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CHEMISTRY
DEPARTMENT

E. H. Lover

THE
JOURNAL
OF *E. G. Lowe*
GAS LIGHTING,
WATER SUPPLY,
AND
SANITARY IMPROVEMENT.

VOL. XXXV.
January to June, 1880.

LONDON :
WALTER KING,
11, BOLT COURT, FLEET STREET, E.C.

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TO SUBSCRIBERS.

The JOURNAL is supplied direct from the Office to any part of the United Kingdom, at the rate of 21s. per annum, payable in advance. If credit be taken, the charge is 25s.

Subscribers who desire to avail themselves of the reduction in subscription by paying in advance for the year 1880, are reminded that this can only be done during the present month.

Covers for binding the Volume (No. XXXIV., July to December, 1879) may be had, on order, from any bookseller, or direct from the office—price 2s. 6d. each.

Post Orders to be made payable at the Chief District Office, St. Martin's-le-Grand, London, to Walter King, 11, Bolt Court, Fleet Street, E.C.

TO CORRESPONDENTS.

G. SIMMONDS (Reigate), and R. P. THOMAS (Ware) are thanked for their letters on the subject of Frozen Lamp Services.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 6, 1880.

Circular to Gas Companies.

THE advent of a new year naturally causes one to cast a retrospective glance over the events of that which has just passed away. Time is, of course, continuous, but it is convenient that divisions should be made, and among these the most important is that which marks the close of what it is customary to call one year and the commencement of another. Looking back over the occurrences of the past twelve months, we find that, as respects Metropolitan Gas Companies, the most important has been the inauguration of a system of amalgamation among the Companies south of the Thames. At the beginning of the year it was rumoured that overtures had been made which, had they resulted in success, would have brought some of the Southern Companies into union with the great combination on the north; but the negotiations—if anything that could be called negotiation took place—fell through, leaving the Southern Companies exactly as they were. But the idea of amalgamation could not be allowed to drop, and it was soon found that the South Metropolitan Company were negotiating in earnest for a

union with the Surrey Consumers Company. The case presented some difficulties, but a scheme sanctioning the combination was eventually approved by the Board of Trade, and subsequently confirmed by the Privy Council. It took effect from the 1st of July last, but the combined working did not, we believe, commence till October. We have said that the case presented some difficulties, which it required all the sagacity of Mr. George Livesey, the Secretary and Engineer of the South Metropolitan Company, to surmount. Two Companies had united, one of which was charging 3s. per thousand feet for their gas, while the other charged 3s. 9d. It was clear, then, that Companies with such differential rates to consumers could hardly hang together, so the bold proceeding was taken of reducing the price in the late Surrey Company's district to 3s. We may stop here for a moment to pay a meed of praise to the magnanimity of the Directors of the South Metropolitan Company, who, we dare say not without due calculation, have conferred this great benefit upon the gas consumers in the district of the late Surrey Company.

Although this was the only amalgamation consummated during the past year, progress was made with another which we regard as of a more important character. We refer to the projected union of the Phoenix Company with the South Metropolitan, a scheme to effect which is now before the Board of Trade, and in the modified form in which it was last presented will, we have no doubt, in a few days receive the sanction of the Board. The capital arrangements, which have already been described, we expect have now been settled to the satisfaction of every one; but in this case again the question of price to be charged for gas will crop up. At the present time the Phoenix Company charge 3s. 4d. per thousand feet, and at this rate make little more than their statutory dividends. When becoming a part of the South Metropolitan Company, the price will eventually be reduced to a level, and 3s. will be charged over the whole district. This drop will necessarily make a considerable difference in the profits of the amalgamated Company. But perhaps we are here rather prospecting than reviewing past results. We may safely leave the combined undertakings to the management of those into whose hands they will fall, satisfied that due care will be taken alike of shareholders and consumers.

Last year we commenced our retrospect with a notice of the electric light, which in the year then past had just come into somewhat limited use in this country. In the course of the past year the employment of the light for public illumination has considerably increased, and to a certain extent for the lighting up of shops; but, so far, nothing has been done to prove that it can be made a means of domestic illumination. The one invention which seems to have taken a strong hold in the Metropolis is that of M. Jablochkoff, which is patronized by the Metropolitan Board of Works. By means of this system we have now a considerable portion of the Thames Embankment and Waterloo Bridge illuminated. Recently an important experiment was made, which bears on the possibility of the use of electricity for public lighting in future. A wire starting from Charing Cross was carried to the Victoria Station of the Metropolitan District Railway, about two miles distant—a much greater length than was required being interposed. The station was said to have been satisfactorily lighted, but the experiment has not been continued. Of course, the one thing necessary to know, when we are considering street lighting, is the number of lights that might have been interposed between what we may call the two termini. From the experiments made on the Embankment and Waterloo Bridge, it would seem that the lights might be multiplied almost indefinitely, sufficient initial power being supplied at one central station; but on this point we shall presently have more specific information.

It is curious to remark that of all the systems of electric lighting which have been introduced, that of M. Jablochkoff has proved the best. The Rapiéff finds a limited use in *The Times* office, but the Lontin no longer shines outside the Gaiety Theatre. The Werdermann system, of which we expected most, seems to have dropped out of recognition, leaving M. Jablochkoff complete master of the field. The inventions of the genius of Menlo Park, U.S.A., still remain upon paper. They may prove of importance some day, but at present the promise is small. We should here also refer to what is going on at Liverpool, where the Corporation, having obtained power to spend £50,000 out of public moneys—and, we imagine, whatever sum they please out of their own private property—have gone in for experiments to demonstrate, if possible, the utility of the light for public and interior illumination. Bound down, as they are, not to make any profit by the supply of the light to such establish-

ments as railway stations, hotels, theatres, music halls, &c., the experiments, we imagine, are being carried on in a manner which is not, perhaps, likely to ensure success. Still, the passing of the Liverpool Lighting Act last year marks an era in the history of public illumination, and we wait with some curiosity for the results which will be obtained. Last year there was a rage among Gas Companies to obtain power for supplying the electric light; but inasmuch as little was known about the economic conditions under which it could be provided, a Select Committee of the House of Commons was appointed to report on the matter. Their decision was that the time was not yet ripe for legislation on the question, and thereupon all applications of Gas Companies fell through. We do not expect that any similar attempts on the part of the Companies will be made in the coming session.

During the past year Metropolitan gas shares have undergone some rather, for them, violent fluctuations in value, and it would be idle to ascribe this to anything but the influence of fear of the ultimate predominance of the electric light. No doubt in these scares a few shares change hands, but we take it that, as a rule, they fall into the holding of astute persons, who, after waiting a short time, put them quietly into the market again, and realize what we call normal prices. For example, a few weeks ago, Metropolitan gas shares were somewhat depreciated in value, but they have now gone back to their usual price.

One good result of the use of the electric light in our public thoroughfares has been to stimulate invention in the improvement of burners and lanterns for public use, and great success has been obtained in this direction. A number of Sugg's admirable lamps were set up in Waterloo Place and in the Waterloo Road, and gave universal satisfaction, so long as the gas consumed was furnished gratis by the Gas Companies. But increased illumination can only be obtained by an increased consumption of gas, and when the Vestries found that they would have to pay more for improved light, the experiments were countermanded. Mr. Wigham's lights at the western end of the Embankment excited general admiration; but these, too, have gone the way of all attempts to improve street illumination by means of gas. Expectation is on tiptoe as to the future use of the electric light, and no Local Authority will now, if they can avoid it, add to their gas bills.

Improved methods of lighting railway carriages have been devised by Messrs. Pintsch and Co., whose inventions have been noticed in our columns; while another invention has more recently come before us, in which coal gas, to which has been added a small amount of petroleum oil, is compressed into cylinders that are carried along the roofs of the carriages, and from this convenient situation supply gas to the lanterns beneath. The invention, so far, has proved eminently successful, and the future contest for lighting railway carriages will, we anticipate, be between these two systems.

To speak the truth, there is little to be said about new inventions. Their number, we may almost say, is legion; but until any or some are established in general use, it is impossible for us to notice them. All our Gas Managers Associations held highly successful meetings in the course of the year, and many ingenious ideas were thrown out, and some processes described which, when thoroughly worked out, will no doubt tend greatly to the improvement of our manufacturing art. It is, however, so difficult to appraise the value of inventions without having had some practical experience of their working, that we always hesitate to express an opinion, the more so as we notice that gas managers almost invariably contradict each other when new processes and apparatus are under discussion. We welcome, however, the rapid increase in the number of members of these Associations, which must in the long run tend to the advancement of our industry. At the present moment the subject which seems to create the greatest interest is the mode of heating retort-settings, and regenerative furnaces are in the ascendant. That of Dr. Siemens has been used with much success on a limited scale in this country. Those of MM. Oechelhäuser and Liegel have had a larger application with success on the Continent. In America, also, they have been applied to the satisfaction of all who have used them. We look forward to a day when these furnaces will receive a large application in this country, to the advantage of gas-makers and all concerned in undertakings.

Nothing further occurred than was noticed above of the dealings of Parliament with Gas Companies during last year. Entirely new Companies who applied for parliamentary powers, of course, escaped auction clauses and sliding scale; but, in general, established Companies who went for incorporation were made subject to both. In like manner statutory Companies who applied for further powers had to submit

to recent legislation. One object of the Legislature seems to have been to secure, as far as possible, reductions in the price of gas. The initial prices under the sliding scale have always been made low—too low, in our opinion, considering the possible future of the undertakings concerned. But Gas Companies, even those not under the sliding scale, have of their own mere motion reduced prices, and it may be said that at the present time the gas-consuming interest is of paramount consideration. How far it may be possible to make further reductions in the future remains to be seen. We have before referred to the revival of trade and the general rise of prices. Everything connected with the manufacture of gas shares in the general elevation of price, and we are looking forward to see, at no distant date, something like a revival of the condition of things which obtained in 1873-4. The sliding scale now bars any applications for a revision of price, such as were made in former times, and the Companies must take the goods the gods send them, and be thankful for whatever dividend they may receive.

While, therefore, heartily congratulating Gas Companies on their success during the past year, we cannot help calling attention to rocks ahead. At present there would appear to be but slight danger in these, and we have little doubt that the able steersmen who guide the Companies affairs will safely take them through the dangers with which they may be beset. We may conclude this short retrospect by wishing all our readers a prosperous New Year.

Every step in the direction of economizing the cost of purification is a gain to Gas Companies. Over oxide we have now full control. With proper treatment it may be made to last for ever, whilst everything it takes out of the gas is a marketable product. So much cannot be said for lime, which, when spent, has up to recent times been considered purely a waste material. A small use has been made of it in agriculture, and some is used in the works. Still, the money obtained for spent lime bears no proportion to the original cost of the stone. Thus every process which pretends to revivify the spent material must be of great interest to gas-makers, especially to those who are situated in districts where lime has to be fetched from a distance. Several processes for this revivification have been published in our columns, and to-day we give another. The compression of the spent lime into bricks before it is placed in the revivifying furnace is a very good idea; and the heating arrangements, as described by a correspondent, appear to be excellent. But one thing seems to us to be deficient. Spent lime, as it comes from the purifiers, is, we rather think, according to Graham's analysis, mainly a mixture of carbonate, sulphite, and sulphate of lime, the two latter forming about twenty per cent. of the spent material. Now, these compounds cannot be changed back into caustic lime by means of the process described by our correspondent. The carbonate of lime, which constitutes about fifty per cent., will, of course, be reduced to caustic lime, and be available for purification; but the sulphur compounds must necessarily increase with every repetition of the revivifying process. Hence we should have thought that three or four, instead of forty re-burnings, would have reduced the substance to a material too inert for purification.

The Corporation of Dublin and the Gas Company are still at variance as to the terms on which the public lights shall be supplied. The Company very properly adhere to the terms which they have offered, and which were reported in our columns a fortnight ago. It seems to escape the notice of the Company's opponents that every case must be judged on its own merits. The conditions of gas supply in Belfast and Dublin cannot be compared. In the one case there is a corporate undertaking, well situated for the production and sale of gas; in the case of Dublin, we have an instance of a company undertaking less favourably situated for the manufacture of gas, and moreover with a comparatively limited sale for private consumption. Notwithstanding this, however, the price of gas in Dublin has been reduced as far as it can be, leaving the Shareholders of the Company their statutory rights, while making provision for depreciation, renewals, &c., which must be provided for out of profits. No one would think of saying that the Company do not make more than ten per cent.; but should this case of public lighting go to arbitration—which it possibly may, but we do not think will—we feel satisfied that the Directors of the Company will have no difficulty in demonstrating that they are only availing themselves of the powers which the Legislature has very properly given them. It is pleasant to see that with a multitude of enemies in the Council, the Gas Company have some energetic defenders. The High Sheriff, in a vigorous speech at a recent meeting, showed that, taking all things into consi-

deration, the gas consumers of Dublin are as well served as those in most large cities in the kingdom. The gas distributed is of high quality, and if the price has not been reduced, more than an equivalent has been given by raising the quality. We need hardly repeat that gas of what is called sixteen-candle power, tested by a flat-flame burner, is furnished, such gas being equal to eighteen candles at least if tested by the burner used in Belfast. Now, as one candle is considered equal in money value to threepence, it follows that there is little or no difference in the price of gas in Dublin and Belfast.

Water and Sanitary Notes.

THE history of water affairs during the past year presents few points of importance. The Metropolitan Companies, we may say, have kept on the even tenor of their way, in every case improving their works, and, as it might be, extending them to meet the increased requirements. They have gone farther, and done what will always redound to their credit—namely, extended a system of constant supply and a service of hydrants, in neither of which enterprises were they at all assisted by the Local Authorities, except, indeed, in so far as hydrants were concerned. The Corporation of the City of London early took up the matter of hydrants, and at their own expense distributed them all over the City. Some of the Water Companies, at all events, seem at last to have been aroused to the situation in which circumstances, which they might have controlled, have placed them. The Southwark and Vauxhall Company, for example, have given notice of a Bill which would have empowered them to amalgamate with the other Metropolitan Companies; but, as will be seen below, it is now all too late. What was possible, and what might have been effected, if our advice had been taken two years ago, is at the present moment unattainable. The Metropolitan Water Companies, as commercial undertakings, may be said to have passed away. Their future is vague and indefinite, and all we can hope is that the Shareholders will not suffer from any change of proprietorship.

It would appear that the water undertakings of the Metropolis are fairly lost to the Companies. Mr. Cross, to carry out the promise he made to Parliament last session, has appointed Messrs. Smiths and Gore, of Whitehall Place, to conduct the various negotiations necessary for the purchase by the Government of the London Water Companies. Two, it is reported, have already acceded to the terms which have been offered, and it is expected that the rest will fall in quick succession. We take this statement, which we believe to be substantially correct, for what it is worth, and then wish to inquire what the Government, having purchased the water undertakings, intend to do with them. Surely they do not mean to retain and manage them, carrying to the Consolidated Fund whatever profits they may yield. The question of the London Water Supply is not a national one; it is a purely local matter. The Metropolitan water undertakings, if they do not belong to the Companies, are, it may be said, the property of the ratepayers, and should be managed for their general benefit. But possibly we are not doing Mr. Cross justice. It may be his intention, when he has acquired the undertakings, to hand them over to a Water Trust, who shall manage them for the good of the Metropolis at large. If so, well; but, in any case, do not let the London water consumer be misled. He will not get water cheaper or better. In the course of years, fresh sources of supply may be introduced; but for the present, and for a long time to come, he will have to be content with the much-abused Thames and Lea supplies. For half a century or more he will only be able to receive a mixture of the deep-well and river supplies, except in certain districts, in which the deep-well water may be accessible. These changes, however, will necessitate a great outlay. By what means is this to be met? There is but one answer to the question. The necessary extensions will be made with borrowed money, the interest on which will have to be paid by the Metropolitan ratepayer. No doubt money for the purpose will be lent at about four per cent., which is a different thing to paying Shareholders in Water Companies an average of seven and a half per cent. Still, it must be remembered that the water-works have to be paid for, and this leads us to consider at what rate the payment must be made. Mr. Cross's notion, that the shares should be bought up at the value they possessed last July, all, we think, will agree to be inadmissible. Nearly every Metropolitan Company has increased in worth since that date. Messrs. Smiths and Gore have, no doubt, found this out, and, we hope, have made due recognition of the fact, which we may be certain has been forced upon

their attention by the Companies. Speaking generally and in round numbers, we may say that the shares in the Water Companies last July were worth nearly double their nominal value. If it be intended to pay off the Companies in lump sums, the above would be about the price to which the Shareholders will be entitled; but if payment be made by way of annuities, we suspect that these will be estimated according to a three years average of the dividends. In some cases, and one in particular, this would be manifestly unfair. The Southwark and Vauxhall Company were for some years under a cloud, and have only just recovered what we may call their normal position so far as regards finances. It would therefore be altogether unjust to buy them up at an average of the years preceding 1878. At their last division they paid six per cent. per annum, and there would be every prospect of their continuing the same dividend for years to come. As for the New River Company, their value it is impossible to assess. We leave this difficult nut for Messrs. Smiths and Gore to crack. Before the week is out we shall probably have further information as to the alleged purchases, of which at present we possess only rumours. This much we may say, however, that if the Water Companies feel themselves aggrieved by the action of the Government, they have only themselves to thank for it. For years we have pressed upon their attention the policy of amalgamation, which, if it had been carried out, would have saved them from the Government clutches. The *cui bono* of the transfer of the undertakings we shall have to discuss at some future time.

The working man is the pet of the day. For him large portions of the Metropolis are converted for a time into deserts, and on these, as may be convenient to some parties or other, huge barracks are built to house the unfortunate people who have been displaced to create the desert. In the meantime, the displaced working men have housed themselves, not perhaps to their complete satisfaction, and certainly not to the satisfaction of those on whom some charges result from overcrowding. However, the Metropolitan ratepayer must pay for something, and Mr. Cross now seems to insist that he shall be let in for a good round sum for what are called street improvements and "improved dwellings for the "working classes." The Metropolitan Board of Works started gaily enough on their schemes for improvements. They bought land, hovels, and tenements at such prices as they could obtain them, and afterwards sold some of the sites at a ruinous loss. This, we may suppose, discouraged the Board in their efforts to improve the domestic circumstances of the working classes. They are now strongly urged by the Home Secretary to make another effort. He authorizes them, under the Streets Improvements Act, to find sites in substitution of those already acquired, it being always understood that inhabitants displaced shall be provided for before the tenements they occupy are demolished. But we are not told who is to erect the new buildings. The Metropolitan Board of Works acting as building speculators would be scarcely compatible with their present functions. They may, of course, offer to sell or to lease the lands. Supposing no one came to purchase or take the lands off their hands, then who is to provide the improved dwellings? The terms asked by the Board would certainly be high, and ordinary speculators would be frightened from entering into negotiations. The Peabody Trust are not for the moment prepared to enter upon further ventures, and the Labourers Dwellings Company are, we imagine, disinclined to build everywhere. Mr. Cross, however, insists that the Board shall go to work with energy; but in what direction their energy is to be exerted must be settled by the Works and General Purposes Committee, to whom the Home Secretary's letter has been referred. One passage in the letter gives us much satisfaction. It is that in which he directs that no building erected upon the new sites shall be more than five storeys high. We have often pitied the unfortunate labouring man who, after a hard day's work, had to toil up six flights of stairs to arrive at his lodgings, but have been consoled by the reflection that when once he had reached his home he would stay there, and not come down again to go to the public-house.

DEATH OF MR. A. F. JACKSON.—It is with much regret that we announce the death, at Putney, on the 26th ult., of Mr. Albert F. Jackson, who was so widely known as the able and courteous Secretary of the Imperial Continental Gas Association, from which position he retired last June, after 13 years service.

We have received from Mr. Samuel Hunter, A. Inst. C.E., the Engineer of the Salford Corporation Gas-Works, two excellent framed photographs of the works. One shows the engine-house at the No. 2 station, with the tower scrubbers and the patent condenser (described in Vol. I. of our "Treatise on Coal Gas," p. 313) in the background. The other is a photograph of the double-lift holder in course of construction, according to the plans alluded to in Vol. II. of the "Treatise," p. 143. Both are exceedingly well executed, and make a handsome pair of pictures.

URBAN WATER SUPPLY.

IN the JOURNAL of the 25th of November last we directed attention to a Blue-book issued about that date, the object of which was to show the means whereby water is supplied in the various Urban Sanitary Districts in England and Wales; and we have since endeavoured to obtain from the information that is there given some general results that may be useful to our readers.

We observe, in the first place, that the returns are very imperfect—important towns being altogether omitted, and many districts included, the population of which does not reach five hundred. Thus, to take only the towns in the Basin of the Thames, we fail to find any account of Abbots-Langley, Amersham, Barking, Berkhamstead, Broxbourne, Chertsey, Dorking, Egham, Eltham, Ewell, Faringdon, Great Marlow, Hatfield, Hemel Hempstead, Hendon, High Wycombe, Hungerford, Kingsclere, Leatherhead, Rickmansworth, Shoreham, Walton-on-Thames, Wendover, Woking, and Woodstock. It is thus evident that the return must not be regarded as complete with regard to the Thames; and the same remark might be applied, and similar illustrations given, with regard to the other great drainage areas. It must also be stated that they are by no means brought up to the latest date. The Acts passed, not only in the last session of Parliament, but several years ago, are unnoticed, and the present state of works is rarely indicated. As the order for the return was made in May, 1878, and the return bears date July, 1879, more than a year was occupied in the preparation, and it is to be regretted that more care was not taken to give a correct account of the facts, and also to include all towns of importance.

There are in England and Wales certainly more than twelve hundred towns and urban districts, the population of which exceeds a thousand, and the returns are published for only nine hundred and forty-four, or about three-fourths of the whole number; these returns, moreover, including a considerable number of districts the population of which is much under a thousand. The arrangement is alphabetical with respect to counties, the counties being grouped as in the Census returns. No reference whatever is made to drainage areas. We must further add that the information as to sources is eminently barren and unsatisfactory. A large number of the replies to the queries as to sources give no further information than is obtained from the words "wells" and "springs." Now, it is clear that "wells" may be the worst or the best source; and unless there is some way of distinguishing them, the reply is of no value whatever. As to the word "springs," it is evidently used in many senses, and often applies to wells. In some replies we find the sources described as "land springs;" in many the wells are alluded to as "private;" and in many more the wells referred to are evidently supplementary to a regular supply from some established source. There is throughout a tendency to depreciate the value of the supply when afforded by a Company.

Notwithstanding these shortcomings—which are very real, and which require for their remedy a much more intelligent and careful system of replies to queries than those afforded by the Local Authorities in the cases where replies have been given—there is a great fund of information in the Blue-book before us; and, by combining it with other facts on record, we have obtained some valuable statistics. We have for this purpose made use of an essay by Professor Ansted, published with a map and several appendices, in the Report of the Annual Conference on National Water Supply, Sewage, and Health, held at the rooms of the Society of Arts, in May, 1879, pp. 43-64; and, assuming the districts there suggested, with some modification, we think a few valuable generalizations on the subject of water supply may be obtained. In the present article we limit ourselves to the Basin of the Thames, proposing afterwards to give similar statements with reference to the other great river basins of England—the Severn, the Trent, the Ouse, and some others less important. Our readers will do well to refer to the account of the Basin of the Thames on page 45 of the report alluded to, which appeared also in the *Journal of the Society of Arts* for the 25th of July last, where the physical facts relating to the basins and their statistics are given in some detail.

The Basin of the Thames is very clearly and naturally divided into two parts where the chalk hills cross its course between Wallingford and Reading. It is convenient to subdivide the part below Wallingford into two, the dividing line crossing the river near Teddington, where the tidal influence ceases. The whole water supply for the Metropolis being taken a little above this point, near Hampton, this division is especially useful for our purpose. Regarding the basin as a drainage area, it comprises (exclusive of the Medway system)

5425 square miles, and within it are nearly two hundred urban districts and towns of populations exceeding one thousand, of which the aggregate population a little exceeds five and a half millions. Averaging the urban population of the whole basin, there would seem to be one thousand human beings to every square mile; but, put in this light, the statement is eminently misleading. There can be no doubt that, if the population were equally distributed, and the sewage of all the towns carried into the river in equal proportions throughout its length, the Thames would at all times be in such a state as to be unfit for habitation on its banks; but the exact contrary of this is well known to be the case. We have not to deal with any generalization of this kind. The three divisions of the river, not very unequal in extent, are very unequal indeed in population, and especially in urban population. Thus, in the Upper Thames Valley there are only four towns on about 83 miles of river course, and 24 in the sub-drainage area of ten tributaries; and, the total urban population of this division being little more than 130,000, the average here is about nine acres to every human being. The only large town on the river is Oxford, which is supplied with water from a lake formed by excavations in gravel, the water being naturally filtered from the gravel. The sewage of Oxford is passed over land. Banbury, near the source of the Cherwell, is the largest of the towns on the tributaries, and it is also supplied with filtered river water. Swindon, at the source of the Cole, is supplied by springs. Of the other 22 towns, all smaller, we have only nine referred to in the returns, and they are all supplied by wells, some of which are deep, but others shallow.

In the district of the Middle Thames, which receives a large body of water, and through which the river flows for 51 miles, there are 21 towns on the main stream, and 44 on nine tributaries, the total population being, however, only 316,620. The drainage area is 1850 square miles, showing an average area of four acres to every individual. The extreme thinness of this population so near the Metropolis, and in a country so crowded as England, is exceedingly remarkable, and deserves careful consideration in reference to the use of the river water. The only large town on this part of the river is Reading, supplied with water from the River Kennet, and the largest town on the nine tributaries is Reigate, whose 16,000 inhabitants are supplied by wells. Of the towns on the river, only 13, including Reading, are alluded to in the returns, and all except those which take their supply from the London Water Companies (Hampton Wick, Surbiton, Kingston, Ham, and Teddington) are supplied by wells, some deep, but many of them superficial, and some very bad. Of the towns on the tributaries, 21 only are to be found named in the returns, and all of them (except Malden and Wimbledon in the Metropolitan supply) depending upon wells. The information with regard to almost all these towns is excessively meagre, and of 22 towns there is no record whatever.

In the Lower Basin of the Thames there are about 30 towns situated upon the river, and about 70 upon nine tributaries. The total urban population exceeds five millions, and the drainage area is 1675 square miles, thus showing a population of nearly five persons to an acre. Of course, the greater part are crowded into the 40 or 50 square miles that include the Metropolis and its suburbs; but the number of other towns situated on the river course (which amounts in all to 70 miles) and on the tributaries, especially the Lea, is very large. The Lea alone contains half the population on the tributaries. Of the towns on the river not supplied by the Metropolitan system, six out of eight are supplied from wells in the chalk. The others are not referred to. Of the towns on the tributaries, we find 34 named in the returns, and nearly as many not named. Upwards of 20 of those in the list are supplied by wells, and some of the rest by the Metropolitan Water Companies.

It will be seen by the above brief notes that the water supply of almost all the places within the Thames drainage area, mentioned in the returns, is obtained from wells of which there cannot be a doubt that a large number, if not a large proportion, are shallow, and obtain only the water draining from the surface into gravel. Such wells are all dangerous, and gradually become more so as the population increases. We must submit that a more searching investigation is needed than has been obtained by a few perfunctory replies to official questions, and that some account is due not only of the places from which replies have been vouchsafed, but from those numerous others to which no questions were sent or from which no answers were received.

One word more before we conclude. It is satisfactory to know, as a matter of fact, that so very small a proportion of the population of the Thames drainage area can have any

influence on the water supplied by the Companies from Hampton. It is also important, however, to bear in mind that, besides the sewage sent into the Thames by the Metropolitan sewage system at Barking, the river also receives that of a population of at least half a million from the various tributaries that enter it near and below London. We fancy this has sometimes been forgotten, in estimating the source of those sewage indications met with in the bed of the stream near London, and attributed to the conveyance of a part of the solid sewage back by the incoming tides. The Brent and the Wandle pass many towns, and the Ravensbourne and the Lea many more, all of which must help in the deposit of sewage mud on the Thames banks and bottom.

BERLIN MUNICIPAL GAS SUPPLY.

We have been favoured with a copy of the report on the working of the gas undertaking of the Berlin Municipality, for the twelve months from April 1, 1878, to April 1, 1879. From it we learn that the period of depression which has prevailed since 1873 has had great influence on the gas lighting of the city, in at least one direction. The consumption of gas increased yearly with the progressive development of commerce up to 1872, and in the period from 1873 to 1878 there was still a positive though diminished increase in the demand; but the past year showed, for the first time, a decrease in the total consumption. Taking into consideration the fact that during this period a good number of new services were laid, such decrease can only be ascribed to the slackness of trade, which has affected even the smaller manufacturers and shopkeepers, who have everywhere aimed at economy, manifested by the limiting of their gas consumption, or, in some cases, by the substitution of petroleum for gas. The actual decrease in the consumption was, however, very small, so that it had no influence on the financial position. Coals were cheaper, and the working results having turned out better than last year, the surplus realized was far in excess of the estimate.

During the working year, 1878-9, the production of gas at the four stations was as follows:—

	Cubic Mètres.
Stralauerplatz	7,705,000
Gitschinerstrasse	18,285,000
Müllerstrasse	19,282,000
Greifswalderstrasse	15,924,000
Total	61,196,000

The preceding year's production was 61,306,400 cubic mètres (2,160,830,760 cubic feet), thus showing a decrease in that of the past year of 110,400 cubic mètres, or 0·18 per cent.

The stock of gas in the holders on April 1, 1879, was 20,000 cubic mètres more than on April 1, 1878, so that the net production was—

For the year 1877-8	61,304,000 cubic mètres.
For the year 1878-9	61,176,000 "

The quantity of gas sent out during the past year was therefore 128,000 cubic mètres, or 0·21 per cent. less than during the preceding year. The year 1877-8 showed an increase of 3·675 per cent. as against the preceding year.

On April 1, 1879, the city gas-works supplied 11,717 public street-lamps, as against 11,479 on April 1, 1878, thus showing an increase of 238 lamps, or 2·07 per cent. for the year. The precise number of private burners in use was also counted, and a number of lights, the further use of which was doubtful, were struck out of the record. The number of burners in use on March 31, 1879, was thus found to be 614,133, as against 644,742 entered on April 1, 1878, showing a decrease of 30,609 burners, or 4·74 per cent. The total number of lights supplied by all the stations was therefore 625,850 on April 1, 1879, as against 656,221 on the corresponding day of the previous year, the net decrease being 30,371, or 4·63 per cent.

The gas consumed was applied as follows:—

	Cubic Mètres.	Per Cent.
Public lighting	8,301,631 or	14·828
Works and offices	607,625 "	1·085
Private consumption	47,074,946 "	84·087
Total	55,984,102 "	100·000

The total unaccounted-for gas, condensation, leakage, &c., was therefore 5,191,898 cubic mètres, or 8·487 per cent.

The proportion of gas used in public lighting shows an increase over that of the preceding year—viz., 14·828 and 14·266 per cent.—while the proportion of private consumption has decreased from 84·536 per cent. to 84·087 per cent. The reason of this is that the consumption of street-burners remains constant, the apparent differences from year to year being really caused by the addition of fresh burners at various times during the year; but there are many circumstances which influence the consumption of a private burner. Taking the time during which a street-burner is alight at 3675 hours yearly, with an hourly rate of 0·195 cubic metre consumption, a public lamp will consume 716·625 cubic mètres in the year; but on account of the increase in the number of burners after April 1, 1878, the average yearly consumption of each appears to be 714·846 cubic mètres. The average consumption of each private burner during the year 1878-9 was 75·702 cubic mètres, which is below that of former years, as will be observed by the following table:—

1874-5	91·158 cubic mètres.
1875-6	85·201 "
1876-7	78·632 "
1878-9	75·702 "

The working period for 1877-8, which was only nine months, is not reckoned. The unaccounted-for gas, as before stated, amounted to 8·487 per cent. of the total production for the year, as against 8·696 per cent. in 1877-8, and 8·252 per cent. in 1876-7. The proportion has, therefore, remained almost stationary for three years, showing the care with which the alterations and extensions of the distributing plant have been carried on.

The maximum daily consumption, which usually occurs just before Christmas, was on the 5th of December, when there were general illuminations on the occasion of the return of the Emperor to Berlin. On that day 294,200 cubic mètres of gas were made at the four works; while the next greatest production, in the ordinary way, was on Dec. 17, 1878, and amounted to 289,800 cubic mètres. The maximum daily production in the preceding year was 299,800 cubic mètres on Dec. 21, 1877; the maximum of the past year was, therefore, less by 10,000 cubic mètres. The smallest daily production was on June 28, 1878, when 68,000 cubic mètres were made at the four stations. The maximum daily consumption was on Dec. 5, 1878, the day of the illuminations, when 322,000 cubic mètres were sent out. Leaving this day out of consideration, on account of the exceptional circumstances, the next heaviest consumption was on the 21st of the same month, when 305,000 cubic mètres were sent out, which is 2900 cubic mètres less than the maximum day's consumption of 1877. The maximum seven days consumption in 1878-9 was 2,065,300 cubic mètres, or a decrease of 1600 cubic mètres as compared with the corresponding figure of the preceding year, which was 2,066,900 cubic mètres. The maximum hour's delivery was between seven and eight p.m. on Dec. 5, 1878, during which time 38,800 cubic mètres were used; the next greatest being 37,250 cubic mètres, which was consumed between five and six p.m. on Dec. 31, 1878, or 1050 cubic mètres less than the preceding year's hourly maximum. The smallest consumption on any one day occurred on June 23, 1878, when 65,300 cubic mètres were sent out, as against a corresponding figure of 67,200 cubic mètres for the preceding year, or a drop of 1900 cubic mètres. The following proportions have thus been determined, omitting the illumination day:—The minimum daily consumption was to the maximum consumption as 1 : 4·67 (preceding year as 1 : 4·582); the maximum daily consumption was to the yearly consumption as 1 : 200 (preceding year as 1 : 199); the maximum hourly delivery was to the maximum daily consumption as 1 : 8·18 (preceding year as 1 : 8·04).

The coal carbonized in producing the 61,196,000 cubic mètres of gas in 1878-9 was 216,058·2 tons (of 1000 kilos), which makes an average of 283·24 cubic mètres (10,001·2 cubic feet) per ton. As, in the preceding year, only 279·71 cubic mètres of gas per ton were obtained, there is an increased rate of 3·53 cubic mètres (124·6 cubic feet) per ton. This favourable result is to be attributable partly to the improved quality of the coals, which are now better screened than formerly, and partly to the extended use of heating by carbonic oxide, which produces a more uniform heat in the retorts. It may also be mentioned that the amount of work done per head of the workmen employed is considerably increased, and also that the fire-bricks used have answered the heavy demands of generator stoking better than before. For the same reason the production of each retort in use has considerably increased, the yearly average per retort daily being as follows:—

Year.	Cubic Mètres.	Cubic Feet.
1875-6	201·0 or	7095
1876-7	220·5 "	7783
1877-8	230·2 "	8126
1878-9	242·2 "	8549

The favourable results of working have also permitted much economy in wages and fuel. The number of retorts in use (calculated for one day) was 252,677, with 1,420,317 charges. The duration of the charges was with generator furnaces about 4 hours; with other furnaces generally 4·8 hours. The greatest number of settings in use at all the stations in one day was 174, with 1226 retorts, on Dec. 5, 1878, with 7132 charges, as against 191 with 1309 retorts and 7119 charges in the preceding year. Of the total 252,677 retort working days, 117,676, or 46·6 per cent., were with retorts fired by generator furnaces, and 135,001 working days for retorts fired in the old way with grate furnaces. *In view of the favourable results obtained from generator firing, the system will be applied to all settings which have to be renewed, as far as other circumstances will permit.*

The quality of the gas has been almost uniform throughout the year, as shown by the photometrical observations taken at the works and at the testing-station in the centre of the city. The gas was always free from sulphuretted hydrogen, and the quantity of carbonic acid and ammonia was always trifling. The average illuminating power, as found by Professor Rüdorf at the central testing-station, was 17·2 candles; the minimum on three occasions was 16·5 candles, and the maximum was 17·5 candles on eleven occasions. No interruption of the manufacture took place at any of the stations during the year, the working having in all cases been perfectly regular.

The following new works and extensions have been made at the various works:—

Gitschinerstrasse Station.—Rebuilding 16 settings with generator furnaces; erection of a travelling crane for unloading materials.

Müllerstrasse Station.—Completion of gasholder of 31,500 cubic mètres (1,111,950 cubic feet) capacity; completion of residence, &c., in Sellerstrasse; gasholder yard partly enclosed and roads made; No. 2 purifying-house enlarged by an extra floor for revivifying space; additional 20 settings, with generator furnaces, erected in No. 3 retort-house; clearing for additional office room.

Greifswalderstrasse Station.—Additional twelve settings, with

generator furnaces, erected in No. 2 retort-house; erection of three scrubbers and two cast-iron tanks for condensation products; water-pumps fitted.

A great deal of extension and relaying of mains was done in the distributing department.

The following are the accounts for the year ending April 1, 1879:—

WORKING ACCOUNT.					
		Year 1878-9.		Per 1000 C. M. of Gas.	
		Marks.*	Marks.	1878-9.	1877-8.
To Coal	—	4,081,601	66.75	74.60	
Fuel	—	575,842	9.41	10.19	
Total	—	4,660,443	76.16	84.79	
By Coke, breeze, and ashes	2,422,540	—	39.59	42.14	
Tar	433,507	—	7.08	7.31	
Ammoniacal liquor . .	122,186	—	2.00	1.93	
Sundry products . . .	55,551	3,033,784	0.91	0.55	
Net cost of coal . . .	—	1,626,659	26.58	32.86	
To Purifying material . .	—	23,386	0.38	0.22	
Wages	—	376,811	6.16	6.60	
Total cost of manu- facture	—	2,026,859	33.12	39.68	
Land charges	—	5,985	0.10	0.06	
Oven renewals	—	152,471	2.49	3.17	
Repairs of buildings and apparatus	—	85,320	1.39	1.67	
Repairs of plant	—	35,447	0.58	0.60	
Taxes and insurance . .	—	111,119	1.82	1.18	
Other working expenses .	—	182,029	2.93	2.83	
Management	—	541,073	8.84	6.74	
Pensions	—	4,594	0.08	0.16	
Expenses of private lighting	—	35,552	0.58	0.42	
Public lighting	—	168,407	2.75	2.32	
Bad debts	—	26,225	0.43	0.35	
Total expenses	—	3,375,281	55.16	59.18	
By Gas sold— Public lighting	1,106,871	—	—	—	
Private ditto	7,615,674	8,722,545	142.54	142.31	
Balance	—	5,347,264	87.33	83.15	
Balance of meter-rents .	—	163,171	2.67	2.50	
Total balance	—	5,510,435	90.05	85.65	
To Amortization	690,856	—	11.29	8.41	
Amount deducted . . .	1,099,338	—	17.97	15.63	
Total	—	1,790,194	29.26	24.04	
Balance	—	3,720,241	60.79	61.61	
Interest	—	1,089,227	17.80	18.36	
Net balance	—	2,631,014	42.99	43.25	

GENERAL BALANCE-SHEET.					
		March, 1878.	April 1, 1878-9.	March, 1879.	
		Marks.	Increase. Marks.	Decrease. Marks.	Marks.
<i>Assets.</i>					
Land account	5,338,296	32,580	—	5,370,876	
Meters on hire	1,096,407	19,620	—	1,115,027	
Apparatus	28,360,232	608,535	—	28,968,767	
Stores	390,299	—	19,339	370,960	
Goods	329,977	365,685	—	695,662	
Products	460,768	—	208,154	252,614	
Bad debts	3	—	—	3	
Debtors	2,133,765	—	51,805	2,081,960	
Bills of exchange, &c.	645,334	—	239,240	406,094	
Cash	105,729	—	65,675	40,054	
Reserve	90,350	153,797	—	244,147	
		1,180,217	584,213		
Total	38,950,160	596,004	—	39,546,164	
<i>Liabilities.</i>					
Credit of account	699,000	—	699,000	—	
Credit of 1846	2,288,670	—	218,356	2,070,314	
" 1869	5,181,000	—	159,000	5,022,000	
" 1875	8,300,000	—	313,500	7,986,500	
Coal insurance	96,599	—	96,599	—	
Fire, &c., insu- rance	152,089	117,075	—	269,164	
Renewals	9,409,757	1,099,338	256,160	10,252,935	
Capital	9,309,000	—	—	9,309,000	
Amortization	2,072,176	690,856	—	2,763,032	
Caution-money	187,017	55,188	—	242,205	
City Treasurer (separate acct.).	1,254,852	2,631,014	2,254,852	1,631,014	
		4,593,471	3,997,467		
Total	38,950,160	596,004	—	39,546,164	

HULL GAS SUPPLY.—Mr. James Baynes, jun., F.I.C., F.C.S., F.R.M.S., County and Borough Analyst, Hull, reports the following as the results of all his tests, during 1879, of the gas supplied in the East District of Hull, by the Sutton, Southcoats, and Drypool Gas Company:—

	Max.	Min.	Mean.
Illuminating power, standard sperm candles	16.53	15.71	16.00
Grains of sulphur per 100 cubic feet	20.37	11.00	16.09
Grains of ammonia per 100 cubic feet	19.76	6.43	10.53

Mean barometer and temperature in experiment-room: Barometer, 29.79; temperature, 58.28°.

* The value of the mark is about 1s. English.

Communicated Article.

THE HYDRAULIC MAIN.

By Mr. R. H. PATTERSON, F.S.S.

The Hydraulic Main was one of the earliest improvements in gas manufacture; and it is hard to conceive how the work was at first carried on without it. It is in universal use at the present day, although with various modifications; and its advantages are obvious, while its defects are not so. One of its great merits is held to be that it maintains a "seal" upon the retorts without any action or attention upon the part of the workmen—an invaluable advantage in country gas-works, where there is not such a supply of trained workmen as there is in London and the other large towns. On the other hand, it must be said that, even in new gas-works or retort-houses, it is almost impossible to fit each and all of the dip-pipes with such accuracy as to have a perfectly even or equal seal upon every one of them; and in retort-houses which are not newly erected, the Hydraulic Main itself has to be looked after, to see that no derangement of its level occurs from "settling" or accident. Indeed, I should think that in every large retort-house there are several dip-pipes which vary from the average and desired setting to the extent of an inch or even more. "An inch or more" is rightly held an important matter in the working of the Exhausters, yet such a difference is unavoidable as regards those Dip-pipes which are out of the proper levels. Further, when there are Exhausters, as is the case in all large gas-works now-a-days, the great advantage attributed to the Hydraulic Seal, of being self-acting, almost disappears. Most valuable and beneficial as Exhausters are, it must be remembered that they place the "seal" almost as much at the mercy of workmen as if there were no Hydraulic Main at all—as if the retorts were sealed or closed by some other arrangement which has to be regularly attended to by the workmen. The only difference is, that whereas in the one case (that is, when there is no Hydraulic Seal, and valves have to be opened or closed by manual labour) the want of attention has to be guarded against in the retort-house; in the other case (that is, when the hydraulic seal is employed), the want of attention has to be guarded against in the exhauster-house. Thus, since Exhausters came into use, it is hardly correct to speak of the Hydraulic Main or seal as a self-acting apparatus. It requires constant vigilance in the Exhauster-house before the hydraulic seal can be worked properly.

But the chief object of this article is not to deal with the Hydraulic Main from a mechanical point of view, but rather to carry further the facts and principles of my previous articles "On the Effects of the Contact of Tar with Coal Gas." I think I may say correctly, that the damaging effect of this contact, as it ordinarily takes place, upon the illuminating power of the gas, is now pretty generally recognized; and that the former idea, so much in vogue, of prolonging the contact between the tar and gas during the cooling or "condensing" process, is now seen to be erroneous. But what about the Hydraulic Main itself?

This question presents itself under two different aspects; and one of these has engaged the attention of gas managers for several years past. I allude to the "Anti-Dip" movement, and the invention of several kinds of apparatus for abolishing the Hydraulic Seal. The object of these inventions had nothing to do with the evil effects of the Tar-seal upon the illuminating power of the gas. Although Mr. Bowditch had clearly set forth chemical facts and principles which necessarily led to this inference, his doctrines had been entirely forgotten—or rather, I may say, they had never been noticed or appreciated at all. The Anti-Dip movement excited attention at the very time when the maxim in vogue was to keep the gas and tar in contact as much as possible, even during the cooling process; and the object of the inventions for abolishing the hydraulic seal was solely with the view of lessening the "pressure" or resistance to the flow of gas from the retorts, and thereby lessening the deposits of carbon within the retorts.

The Anti-Dip system, not merely as a proposal or as an experiment, but as actually adopted in large gas-works, is really of old standing. I found it in use at the Fulham works of the Imperial Company when I first visited them in 1868, at which time it was an unusual practice; and Mr. Kirkham tells me he first adopted it in 1851. Except during the drawing and charging of the retorts, the Hydraulic Main was inactive, and the gas was allowed to issue without passing through a hydraulic seal; and as no self-acting apparatus had then been invented, the opening and shutting of the valve was done by manual labour. It is a noteworthy fact that this Anti-dip apparatus of Mr. Kirkham's happens to be, to this day, perhaps the very best as regards lessening the contact between the gas and the tar—although, as already said, no one paid the least attention to the effects of this contact in those days, and the sole object of the invention was to lessen the back-pressure and the formation of deposits in the retorts.

Carbon-Deposits in the Retorts.

Upon this point I adhere to the opinion which I expressed during the controversy, or at least correspondence, which took place in the JOURNAL in 1875—namely, that the carbon-deposits in retorts are not formed, to any appreciable extent, from the elements of permanent gas, but of the very heaviest portion of the tarry vapours; which, if not deposited within the retorts, would inevitably find its way into the tar-well. It will hardly be questioned that the hydrocarbons which form the permanent and saleable portion of the gas, and which exist as chemical compounds, are the portion of the gas which will be deposited last—in other words, which will longest resist condensation; and as regards the tarry vapours, the quantity

of them which escapes from the retorts is so vast, compared with the carbon deposited within the retorts—in other words, there is no much of this most readily depositable portion of the hydrocarbons which escapes being deposited, that it is not reasonable to suppose that the carbon-deposits in the retorts consist in any appreciable degree of the chemical compounds which form permanent gas, and which are far less readily deposited. I speak, of course, of ordinary gas-works where Exhausters are employed; and I confidently believe that there is no appreciable loss of saleable gas produced by the carbon-deposits in retorts. In other respects these deposits are quite as pernicious as they are held to be. They are tar deposited in the wrong place—indeed, in the very worst place where such deposits can occur. If these remarks be correct, we must look to some other cause than the slight decrease of these carbon-deposits for an explanation of the gain—or, at all events, the alleged gain—of illuminating gas from the abolition of the Dip; and that gain I believe to be attributable to the gas not being washed with tar, as takes place where the Dip or Hydraulic Seal is maintained.

Pulsations of the Gas.

The formation of carbon-deposits within the retorts has recently been attributed by that ingenious and thoughtful investigator, Mr. Young, of Clippens, to the oscillations or pulsations of the gas. The gas has to make its way through the Hydraulic Seal in rushes or gulps; for the gas does not percolate through the water or tar, but has to force its way by successive displacements, the seal being alternately opened and then closing again. And Mr. Young holds that the carbon-deposits are almost entirely due to the pulsations thus produced in the gas; in other words, not so much to the back-pressure as to the manner in which it operates. I only venture to speak conjecturally on this point, but I cannot agree with Mr. Young. First of all, it should be remembered that such deposits will occur to some extent without any back-pressure at all, and owing to the mere fact that a portion of the gas must come in contact with the glowing sides of the retorts, whereby a portion of the constituent carbon tends to be solidified and deposited. Secondly, the longer this contact endures, the greater will be the deposits; always supposing that the heat of the retorts and the smoothness or roughness of their inner surface are the same. And as back-pressure tends to retain the gas in the retorts, the greater the back-pressure the larger will be the deposit of carbon. But the part which "pulsation" plays is very little, or, as I am disposed to think, none at all. For example, suppose that instead of passing a 3-inch seal, the gas had to escape through a pipe so small as to produce a back-pressure equal to 3 inches. Under such circumstances, I think the deposits in the retorts would be no more in the former case than in the latter. With a 3-inch seal, the back-pressure from the seal cannot exceed 3 inches at its maximum—that is, at one point of the oscillation; while at the other point the back-pressure almost disappears, because the seal is for the moment broken, and the gas rushes through. It seems to me, therefore, that the common opinion, which regards the formation of these deposits as dependent on the amount of the back-pressure, is the right one, and that the mere manner in which that back-pressure works (*viz.*, by producing pulsations in the gas) is of very little effect.

But I am inclined to go further than this. It is held that these pulsations of the gas exist within the retort as well as beyond it. I do not think that such is the fact. Take a cistern, or any open vessel, and allow the water to rush out by alternately opening or shutting the outlet. You will see plainly that, beyond the outlet of the cistern, the water moves along the pipe or channel in rushes or pulsations; but you will not find such pulsations in the mass of water within the cistern. Each time the outlet is opened there will be a movement of water towards the outlet, but there is no back-flow. The water that has issued is gone, and the water which has been moving towards the outlet simply fills the place of the water which has escaped, and then comes to rest. Of course, as gas is being constantly generated, each time the outlet is closed there will be an increase of pressure within the retort—just as water will accumulate, and the level of the cistern will rise, if water continues to flow into it; but there will be no pulsation *similar* to what occurs in the pipes beyond the cistern. No doubt, when a flow either of gas or water is checked, there is a slight *internal* compression of the particles, greatest in front; but this is quite a different thing, and a bagatelle in comparison with the pulsations of the gas in the Hydraulic Main, where these pulsations are really waves or rushes produced by *external* pressure (*viz.*, the outrush of gas from the mouths of the Dip-pipes), and which gradually die away in their onward progress.

Is all Back-Pressure Bad?

There is one aspect in which back-pressure in the retorts has not been sufficiently considered, and which I must plead in mitigation (not reversal) of the unanimous judgment that *per se* (that is, irrespective of its use in sealing the retorts) all back-pressure is bad. The chief object in constructing and working the retorts is to conduct the distillation of the coal at a very high temperature. The substitution of clay retorts for iron ones is held to have done even more good in this way than by the saving in the retorts themselves. It is not always an easy matter to get as high a heat as is desirable, and I could mention a very large gas-works of recent date where for several years the gas-make was far below the average, owing to the imperfect structure of the retort-benches, which prevented the retorts being heated to the proper point. Also, if one looks at the various new processes of gas-making, proposed or actually adopted, it will be found that, in one way or other, the real improvement is owing to a higher and a brisker heat during distillation. For example, look at Malam's process, which consists in making the gas, after

being generated, pass through a mass of glowing coal heaped up at one end of each retort. This arrangement reduces by one-fourth the entire gas-making space in the retorts; yet the result is said to be to produce a larger quantity of gas (or, at least, of illuminating power) than before. Plainly, whatever gain there is in the employment of this process must proceed simply from the *higher temperature* to which the gas is exposed. The permanent mass of glowing coal must prevent the reduction of temperature during the early part of each charge, owing to the drawing and charging of the retort with cold coal; and, secondly, the gas-vapours, when produced, being passed through a mass of glowing coal, are subjected to a higher heat than gas which is withdrawn from the retort in the ordinary way—that is, by passing unchecked to the outlet between the top of the coal and the roof or sides of the retort.

Back-pressure will tend to produce much the same effect, by *keeping the gas longer subjected to the high temperature within the retorts*. In so far as greater heat converts a larger portion of the gas-vapours into permanent gas, this result will be promoted by a certain amount of back-pressure, and without using more fuel in the furnaces or any special arrangement within the retorts.

I make these remarks not from any doubt as to the extreme value of Exhausters, or as to the great loss which would attend a heavy back-pressure. But I think it important that this particular effect of back-pressure (*viz.*, in subjecting the gas-vapours to a higher heat) should not be overlooked, especially seeing that, as already remarked, all the new or proposed modes of distillation appear to me to owe their good results to the single point of obtaining and employing a higher temperature.

Choking of the Dip-Pipes.

Another matter connected with the Hydraulic Main which has engaged the attention of gas-managers is the frequent choking of the dip-pipes in consequence of some portion of the tar in the Hydraulic Main being converted into pitch. It has generally been assumed that this formation of pitch is occasioned by the heat given out by the retort-bench; but Mr. G. Livesey has recently come to the conclusion (which manifestly is the correct one) that the real cause is the heat of the gas itself in the Hydraulic Main; for the heat of the entering gas is unquestionably greater than any which reaches and acts upon the Main from without. The remedy most commonly proposed is to increase the distance between the Main and the retort-benches, in order to lessen the heat; or else to attain the same object by thickening the walls of the retort-benches at the parts nearest to the Hydraulic Main. In regard to this latter proposal, it has often occurred to me whether it would not be more economical and otherwise advantageous to *thicken the entire external walls of the retort-benches*. The heat at present radiated from them detracts from the high temperature at which it is held desirable to conduct the process of distillation; and also, although this escape and loss of heat by radiation may be insignificant at any particular moment, it must swell to an enormous and very wasteful amount in the course of years. Look at a lime-kiln—how dense are its walls! And the action of a retort-bench is just like a kiln.

Mr. Livesey's remedy for choked dip-pipes does not lie in reducing the heat in the Hydraulic Main—which, as already said, he regards as necessarily produced in the main by the gas itself—but simply to diminish the depth of tar or liquor in the main—to make the main only deep enough for the purpose of maintaining the "seal," while allowing a free exit to the gas from the dip-pipes. By so doing, there are no corners or depths left where the tar may remain stagnant; the whole mass of fluid is kept in motion; and this simple change he finds sufficient to put an end to the grievous embarrassment of choked dip-pipes.

Contact between the Gas and Tar.

Another, and I think a most important matter connected with the Hydraulic Main, which has now begun to engage attention—in consequence of the recognition of the damage which may be done to gas from its contact with tar—is the speedy and constant withdrawal of the tar from the main, and keeping the liquor in the main to as great an extent as possible in the form of water. About six years ago, from considerations of my own as to the evil effects of tar upon the illuminating power of gas, I ventured to recommend "that every pains should be taken to keep the liquid in the Hydraulic Main as nearly as possible in the form of water, by drawing off the tar, and supplying water when needed. By this means," I said, "the bad effects of the tar-washing on the illuminating power would be reduced; and also another and wholly different advantage would be gained, because the pressure on the retorts would likewise be diminished." I had not at that time read Mr. Bowditch's book—which I have quoted largely, and made the *text* for my recent series of articles on the contact of tar with gas—nor, indeed, I should think, had gas managers read the book, or else they must have wondrously failed to appreciate it. But there was recently an interesting correspondence in the JOURNAL as to when, and by whom, an apparatus for drawing off the tar from the Hydraulic Main was first devised; and this much is clear, that this procedure was adopted merely for the purpose of preventing the tar from becoming too thick or pitchy for commercial use. As stated by Mr. Hall, of St. Andrew's (see JOURNAL for Dec. 16, 1879), who appears to have been one of the first to devise an apparatus for withdrawing tar from the Hydraulic Main, it was in order to prevent its stagnation, the pitching of the Main, and the damage done to the commercial value of the tar. In short, neither the drawing off of the tar, nor the movement for abolishing the dip, nor any other change which has been made or proposed in the Hydraulic Main, had anything to do with the object which is now rising into prominent attention—*viz.*, the reduction or abolition of

the contact between the gas and the tar; while the method for preventing choked dip-pipes, by lowering the temperature of the Hydraulic Main, is diametrically opposed to that object, for it would necessarily aggravate the evil action of the tar upon the gas.

But, whatever may have been the motives for which these various changes upon the Hydraulic Main have been devised, let us see *where we are now going to*.

(To be continued.)

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

SAFETY LAMPS IN PURIFYING-HOUSES.

SIR,—Although I cannot pretend to say that the Engineer of the Bradford Corporation Gas-Works is in error, I can help to comfort "W." by giving my experience with safety-lamps, both old and new. When I joined the City of London Gas Company (Jan. 6, 1840), safety-lamps were in general use at their works in Dorset Street, Fleet Street, and had been, I presume, from 1825—the date, I think, of an order given by what was then called the Committee of Management, that no other moveable lights should be used upon the works. These commands were painted boldly on boards let into the walls at conspicuous points, and preserved by restoration to the end; consequently, we were never without the judicious warning, nor the safety-lamps either.

The old lamps were all that could be wished for as far as safety was concerned. They gave but little light, however, and therefore a lamp that would give more was sought for and found, the safety of which I never had reason to question. Mr. Armstrong, who made the first, has, to my mind, during the many years since gone by, produced the best forms that I have any knowledge of for the purposes of gas-works. I say forms, because I consider that more than one sort is required, and for this reason: A gas-works should be furnished with as few fixed lights as possible, therefore those men who have to get about much should be provided with lamps so glazed as to diffuse the light, whilst those whose business it is to inspect gauges, thermometers, registering apparatus, &c., should carry lamps that, when so directed, throw a strong light on any particular spot. With such a lamp one man can send the light in the direction of danger, whilst another advances to see what is the matter, thereby gaining the advantage of a good light with the augmentation of safety.

There were three accidents in my time, two of which, one by day and the other by night, would not have happened if the order referred to had not been disregarded. The third must for ever remain a mystery, as the only man who was near the spot did not survive the injury received at the time. This also was by day.

The most severe test that I am prepared to mention occurred one winter's evening, about six o'clock, when the make was over 100,000 cubic feet per hour. The valve-man came to me in great haste to say that something was wrong, because both meters had stopped. I immediately went to the purifying-house, at the door of which I met the man whose business it was to attend to that portion of the work, with his safety-lamp, he also having heard that something was amiss. This man, without a moment's hesitation, entered the building, and proceeded to stop the mischief by bye-passing and shutting the inlet and outlet of a vessel, the pressure in which had blown the water out of the seal-cup. It is true we were not long exposed to danger, as the operation just mentioned was simply opening one valve and shutting two others; therefore, whether our escape was due to mere coincidence, or to the fact that a properly constructed and properly found lamp was the cause, is not for me to enter into now. I merely give my own experience.

W. MANN.

Jan. 2, 1880.

SIR,—In reply to your correspondent "W.," in your issue of last week, I have to support Mr. Swallow, the Engineer of the Bradford Corporation Gas-Works, in his assertion that "safety-lamps are no safeguard against explosions;" but I could scarcely go so far as to say "it would be dangerous to approach the purifying-house with a safety-lamp," unless I prefix the words, *under certain circumstances*.

I give this opinion from the experience of several fires, and narrow escapes therefrom, through the use of Davy safety-lamps in the purifier-house. Under certain circumstances, it would be highly dangerous to have a safety-lamp in such a place.

WILLIAM KEY.

Gas-Works, Tradeston, Glasgow, Dec. 31, 1879.

THE REVIVIFICATION OF SPENT LIME.

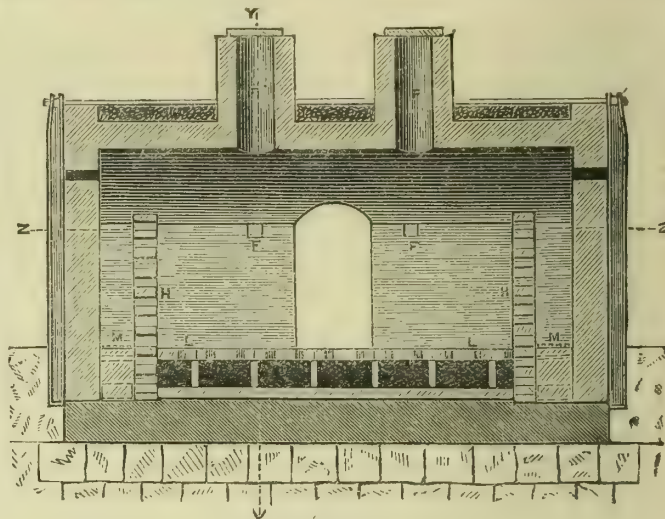
SIR,—When we consider what a vast amount of the lime used for the purification of coal gas is, by the sulphur compounds, converted into a most noxious ingredient, and by the carbonic acid into an article which, though inodorous, is of great bulk, without any useful property or value, it is obvious that every plan devised for the restoration of its exhausted function must be a step towards economy and order in connection with the manufacture of gas, and therefore should not be lost sight of whilst there appears room for any improvement. Hence the reason for what follows.

The lime having been fouled by exposure to impure gas, must, in order to change it back again to what it was before use, be submitted to certain degrees of heat, the last of which must be intense, and so applied as to permeate the mass. Now, how to bring this sulphuretted and carbonated mixture to the fire, and how best to apply the heat to its re-quickening, at the least cost, and without creating a nuisance during removal from the purifying vessels to the fire, and during the firing process, is what has to be well provided for in any plan that the deviser may hope to be considered equal to the elimination of the difficulty involved in the using of lime only once, and then having to deal with it as a waste product.

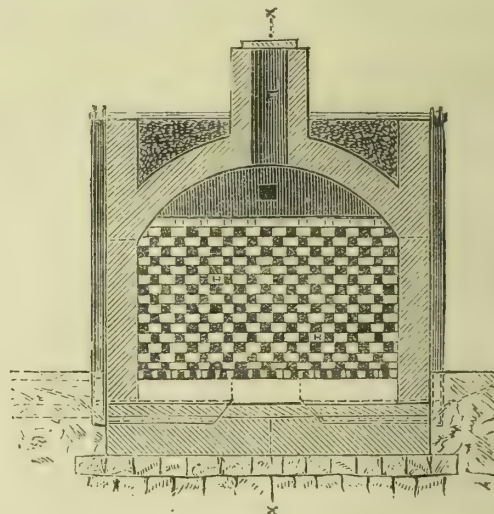
As regards Mr. Hislop's method of converting into quicklime the spent lime of gas-works, all the readers of the JOURNAL are pretty well informed. The simplicity of the arrangement cannot be doubted,

and the cost of the operation is given by men whom we have no reason to question; but the sanitary character of the works using such a plan on a large scale is debatable, and, consequently, the whether or no must be left for practice to decide. The invention patented by Messrs. Hislop and Young (see JOURNAL for Nov. 18 last) can hardly be pronounced as a simple arrangement, there being too much of the millwright's art about it; but still, as the fire is inside and the gear out, more may perhaps be accomplished by the device than at first sight appears. This being admitted, it is an improvement on what has been before proposed for the purpose, and time will speak as to its possible duration.

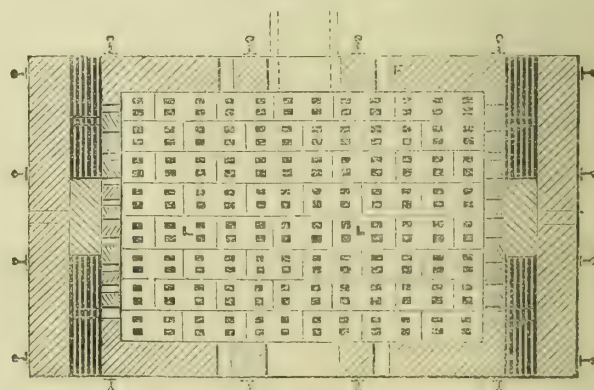
My object in writing is to call attention to an invention of Mr. ASA W. Williamson, of New York City, in the specification of whose English patent (No. 2576, dated June 24, 1878) it is stated that "the difficulty heretofore experienced in re-burning lime of this character [i.e., lime which in purifying gas has absorbed moisture, ammonia, carbonic acid, and sulphur] has arisen from the powdery character of the lime preventing the flames from permeating the mass, which action is necessary in order to drive off the substances named. By pressing the lime into bricks this difficulty is avoided."



LONGITUDINAL SECTION AT X.



CROSS SECTION AT Y.



PLAN ON LINE Z.

The following is the procedure at the New York Mutual Gas Company's works, where the patent is in practical operation, and the accompanying illustrations show the apparatus:—The spent lime is carted to a large room, where it is pressed into the form of blocks 6 in. by 6 in. by 12 in., by means of a brick-making machine of suitable construction. From this room the bricks are taken to the oven or kiln. This is an arched chamber with furnaces in each end 16 in. by 4 ft. 8 in. The furnaces, M M, are divided from the oven by perforated walls, H H, 6 feet in height. The kiln is 10 feet wide in the clear, 8 feet high,

and 1-4 feet long between the perforated walls, H H. The floor, L L, is perforated, and overlies a chamber into which the products of combustion and "burning" descend prior to their passage to the chimney by the main flue. The kiln is entered for charging and discharging through doorways, one on each side. For cooling the contents of the kiln there are two vertical ventilating flues, and two small openings just below the springing of the arch, all of which are marked F F, provided with dampers as well as the main flue. The blocks or bricks, when formed by the machine, are piled up with ample spaces between them for the circulation of heat, as is customary in "piling clay bricks in the kiln."

The patentee says "the bricks will shrink in size as they lose carbonic acid, sulphur, and the like, and from such shrinkage it can be ascertained about when the kiln is burned. From 20 to 36 hours should be sufficient to accomplish the object. By adopting this process the lime may be used an indefinite number of times, as by each burning it is converted into caustic lime, only requiring slaking to convert it into the hydrate, and fit it for the purifying-boxes again, or for other purposes for which caustic lime is used."

At the works of the Mutual Gaslight Company, New York, the same lime has been used more than forty times, and the cost of reburning is reported to be about one-half of the first cost of the lime. W. M.

FROZEN LAMP SERVICES.

SIR,—Observing in last JOURNAL your request as to remedies for frozen lamp services, I have pleasure in giving my experience in the matter. When the weather is severe, and the lamp services become frozen in large numbers, the gas manager's position is a most unenviable one. The dark streets provoke criticism even more severe than the weather, and for the time being the gas company and their manager are extremely unpopular.

For several winters this has been my position, and although many experiments have been made, they resulted only in failure, until within the last month, when a plan was hit upon which has proved most effectual.

Four drachms (or thereby) of hydrochloric acid into the frozen pipe, and immediately after this fill up the pipe with hot water. In five minutes or so, a complete clearance will be effected. A pint or two of hot water should then be poured down the pipe, to "kill" or dilute the acid, and this will find its way to the nearest syphon.

Care must be taken to thoroughly cleanse the pipe of all traces of the acid, as a quiet but certain process of corrosion might set in, which would be most destructive.

I hope my cure may be of some service to the afflicted.

Gas-Works, Bury St. Edmund's, Jan. 1, 1880.

JOHN M'CRAE.

THE PORTER-CLARK PROCESS FOR PURIFYING AND SOFTENING WATER.

SIR,—Your own comment at the foot of my letter published in your issue of the 23rd of December, and Professor Ansted's friendly letter in your last, appear to invite some response from me upon the question of the cost of the Porter-Clark process if applied upon the large scale of town supplies. I therefore send for your information a paragraph or two upon that point, taken from a little pamphlet printed in May, 1878, and circulated at the Society of Arts Congress on National Water Supply. I enclose a copy of the pamphlet, which is descriptive of what was being prepared, and has since been in operation, for the town supply of Swindon:—

"It is expected that the interest upon the cost of the plant and buildings, and the cost of working, will amount to about 1d. per 1000 gallons upon 280,000 gallons treated daily.

"Where the quantity amounted to 1 million gallons daily, comparatively slight increase in the proportions of the apparatus would admit, relatively, of considerable reduction of cost in wages, in the plant and machinery generally, and in the building; so that the patentee names from 0.5 of a penny to 0.6 of a penny per 1000 gallons as the maximum, to be yet further reduced as the quantity to be dealt with increased."

In a priced list I have issued recently I have put the cost of the plant (exclusive of building) for 100,000 gallons per hour at £5500; the space occupied at 5000 square feet; and the weekly expenses of working at £10. I do not seek, Sir, to advertise my affairs gratuitously, but I wish to show that I am very far from being shy of announcing the cost.

Now, it is true that my friends of the London Water Companies smile good-naturedly at my simplicity in suggesting 4d. per 1000 gallons in addition to, or even in lieu of their present charges for filtration; and, like yourself and Professor Ansted, they say that no particular benefit would result to the consumers generally from water thus softened and filtered. I will not seek to occupy your space by a parade of more or less distinguished names in opposition to your views; but for myself and my own household, consuming for all purposes, possibly, 100 gallons of water daily, for which I pay the Lambeth Water Company at the rate of something over 2s. per 1000 gallons, I certainly would gladly pay 36½ farthings, or even pence, per annum in addition, for the comfort, cleanliness, and economy I should derive from using water of 3.5° of hardness, instead of that which now gives me, instead of soft lather, curds of lime-soap, neither agreeable to see nor to carry about in the pores of my skin, and solidified in my shirts and under-garments.

The valuable little work on "Water Analysis," by Messrs. Wanklyn and Chapman, to which Professor Ansted refers in his own work on "Water and Water Supply," explains that "the more lime or magnesia in the sample of water, the more soap a given volume of the water will decompose so as to give insoluble oleate, palmitate, and stearate of lime or magnesia, and consequently the more soap must be added to a gallon of water in order that the necessary quantity of soap may remain in solution, so as to give rise to the phenomenon called 'lathering.'" And, as Mr. Jarman, F.C.S., in his lectures at the Society of Arts, puts it, "The insoluble soap so formed cannot be washed out of the wool or fabric, to which it attaches itself with great tenacity. . . . Even during the rinsing or washing of the wool or fabric where soap has been used, the mischief is increased by the fresh water acting

upon the excess of soap which has to be used to obtain a scour. This excess is also converted into insoluble soap, and is added to that already formed."

On this point Professor Ansted remarks that the softened chalk water at Banstead is not used in the laundry there. That is so; for, having many acres of clean slated roofs, the architect excavated an enormous reservoir for the storage of rain water for laundry purposes, the softened water being designed for the use of steam-boilers and heating apparatus, and this is the purpose which the magistrates certify it has "satisfactorily answered." In saying that, they could hardly have ignored the question of economy—on the contrary.

In relation to manufacturing and industrial uses—to which, indeed, the specification of my first patent particularly points—I venture to add the following figures from another paper I have issued, for I have reason to know that this has a special interest for water companies in certain localities:—

"Taking the total cost at 2d. per 1000 gallons, and applying it to 100,000 gallons per day, we have 18s. 8d. To evaporate 100,000 gallons, or 448 tons of water, in boilers encrusted, as they commonly are, by hard water, 56 tons of coal would be consumed; whereas, with water deprived of its lime by this process, 50 tons would serve. The 6 tons at 10s. per ton, less the cost of the softening, gives £2 3s. 4d. as the daily saving—in round figures, £600 a year. Mr. Duncan has paid £500 a year for removing incrustation from boilers thrown off work; the pipes of his costly 'Economizers' became choked, so that the value of that source of heat was lost; but, with the Porter-Clark process, he is putting in new 'Economizers.'"

JOHN H. PORTER.

Tudor Street, Blackfriars, London, Jan. 1, 1880.

Legal Intelligence.

PONTYPOOL POLICE COURT.—SATURDAY, DEC. 27.

(Before Colonel BYRDE, Chairman; the Rev. J. C. LLEWELLYN, and Mr. E. J. PHILLIPS.)

WILLIAMS v. THE PONTYPOOL GAS AND WATER COMPANY.

In this case, the Pontypool Gas and Water Company were charged, at the instance of Mr. John Williams, an innkeeper, with failing to comply with one of the provisions of their Act of 1873—viz., the construction, within 2½ years of the passing of the Act, of a reservoir for the supply of water.

Mr. A. J. DAVID appeared in support of the information; and Mr. A. T. LAWRENCE represented the Company.

Mr. DAVID, in stating the case, said it was an information laid by a Mr. John Williams, against the Pontypool Gas and Water Company, under the following circumstances. The Company, in May, 1873, obtained an Act of Parliament giving them certain powers, and enforcing upon them certain conditions which they would have to fulfil in consideration of the granting of the Act. Among the provisions contained in the Act there was one for the making of a reservoir at Nant-y-Mailor, for the supply of water, and which should be made capable of holding 4½ million gallons of water. Section 47 of the Act enacted as follows:—

The Company shall within two years and six months after the passing of this Act complete to the satisfaction of the Board of Trade the existing reservoir on the stream or brook called Nant-y-Mailor, so that the same shall be capable of holding not less than four million five hundred thousand gallons; and if the Company fail within the period aforesaid so to complete the said reservoir, then the Company shall be liable to a penalty of twenty pounds a week for every week after the expiration of the period so limited until the said reservoir is completed as aforesaid.

The Act was passed on May 26, 1873, and up to the present time the Company had not constructed the reservoir, which meant that from Nov. 26, 1875, up to Dec. 2, 1879, they had failed to comply with the Act. This did not concern him or his client alone, but the public generally. He (Mr. David) contended that on the face of it the Act had not been complied with, and the Company were now liable to penalties amounting to £4200. It might be argued that the penalty should have been applied for within six months of the commission of the offence—namely, on Nov. 26, 1875; but his argument was that it was not a separate or divided offence, but a continuing one, for which the Company would be liable to penalties after the expiration of the date for completion of the reservoir. Mr. Williams was a man who had good cause of complaint. He was a tradesman in the town, and in the course of his business, as a publican, had been prevented from following out his intentions on account of the deficiency of water. Within the last two years—within two or three weeks—there had not been a sufficiency of water in consequence of the want of this reservoir, and in some places in Pontypool there had been no water at all.

Mr. LAWRENCE said that Mr. Williams was merely a public informer.

Mr. DAVID said at the same time his client was entitled to take these proceedings, and the law sanctioned it. It was quite enough to show that the Act had not been complied with, in order that the penalty which was stated in the Act could be recovered. The way in which the penalty was recoverable was according to section 136 of the Lands Clauses Consolidation Act, 1845, which was as follows:—

Every penalty or forfeiture imposed by this or the special Act, or by any bye-law made in pursuance thereof, the recovery of which is not otherwise provided for, may be recovered by summary proceeding before two justices; and on complaint being made to any justice, he shall issue a summons requiring the party complained against to appear before two justices at a time and place to be named in such summons; . . . and upon proof of the offence . . . it shall be lawful for such justices to convict the offender, and upon such conviction to adjudge the offender to pay the penalty or forfeiture incurred, as well as such costs attending the conviction as such justices shall think fit.

The Company had committed an offence under their private Act which rendered them liable to a penalty of £20 a week for 210 weeks, or an aggregate of £4200. The offence for which the Company were indicted was not a separate or divided one, but was a continuous one; and therefore the six months under which an order should be made for enforcing the penalty did not apply. Was it to be said that this six months barred jurisdiction when it was a continuous offence? He thought not, and held that the Company were liable.

Mr. LAWRENCE said he would at present only proceed to urge the objection which his learned friend had said would be taken—viz., that the proceedings were out of date. Mr. David had called attention to the section for the recovery of forfeits, but he (Mr. Lawrence) would in return direct attention to the 142nd section of the Lands Clauses Consolidation Act, which imposed a limit of six months for the recovery of penalties, and which especially applied to the clause under which this case rested. It was as follows:—

No person shall be liable to the payment of any penalty or forfeiture imposed by virtue of this or the special Act, or any Act incorporated therewith, for any offence made cognizable before a justice, unless the complaint respecting such offence shall have been made before such justice within six months next after the commission of such offence.

He then proceeded to quote several cases in which it was declared that proceedings must be taken before the expiration of this period, and if such notice was not given in the time it could not be given at any other. For

neglecting to construct the reservoir it was contended that the Company were liable to certain penalties. They, no doubt, were liable, had notice been taken of the matter before the time fixed by law for such proceedings. The 142nd section of the Lands Clauses Consolidation Act said that proceedings must be taken before the expiration of six months next after the commission of the offence. He was not aware of any case—in fact, he might take upon himself to say that there was no case—which was like the present. He had consulted many authorities, and they showed that the section limiting the time of notice to six months was a most imperative one. The grounds upon which the proceedings were taken were of the most trivial nature. For the satisfaction of the Board of Trade, an Inspector was sent down after the period had elapsed for carrying out the improvements of any private Act, and if in this case the reservoir had been a public want, it would have been insisted upon. Because a common informer came forward, not only all the Shareholders in a concern, but their families, might be literally ruined. It was a very wise provision of the Legislature, which prevented lurking people going about for no purpose, and inflicting incalculable harm upon others. He said nothing about whether good, bad, or indifferent reasons existed for these proceedings. He believed—in fact, he was instructed to say—that there was no complaint about the supply of water in Pontypool, which was as pure and good as any in England. They were simply brought to a poor question of law, and he believed there could be no doubt that it was the universal custom to consider the words of any Act of Parliament as applying literally. No doubt the offence was an existing one in September, 1875, but he was at a loss to conceive how these six months should have lasted until December, 1879.

Mr. DAVID said all he would ask the Court to do was to amend the information by adding the words, “and to such offence continuing to this day,” that is, the date of issuing the summons. He did not pretend to say that between September, 1875, and December, 1879, more than six months had not passed, but he claimed that the offence was one of a continuous nature.

Mr. PHILLIPS remarked that the law was clear—it distinctly said the six months “next” after the offence. He thought the complainant ought to have given notice within this period of the commission of the offence, and the objection taken by Mr. Lawrence was fatal.

Mr. DAVID said the only thing was the question whether this was a continuous offence. It might be that they were entitled to recover penalties after the expiration of the six months in which notice might have been given. If they had moved at the appointed time, they would have been entitled to six months penalties, and nothing more, but they would have been entitled to come again. Justice Mellor said the limitation of six months did not apply where a continuous offence existed. This was the nearest authority he had been enabled to lay his hand upon. It was a matter open to debate, he was perfectly aware, and it was hardly to be expected that his learned friend and himself would agree upon the construction of the law.

Mr. LAWRENCE said he did not pretend to say that he found a case upon this question. He might take it upon himself to say there was no case upon it, but in similar cases it had always been held that the six months limitation was imperative. He then proceeded to quote several cases, and read the decisions of Justices Blackburn and Lush, who maintained that such a contention was a *reductio ad absurdum*. They had decided that inasmuch as the order was not made within the six months, proceedings would not stand afterwards. These authorities went to show that common sense alone would prove the hardship of such an application as the present one being made, as well as its inconsistency. It was perfectly clear that if these proceedings had been taken within the limitation period, the Company would have been liable to a penalty of £20 a week. As it was, it was of no use taking up the time of the Bench.

Mr. DAVID said he could simply refer to what evidently must have been the intention of the Legislature at the time the Company's Act was passed, and he thought the Bench would be guided by that. The Legislature could have made the penalty a lump sum, but they said, “If the Company do not do the work within a certain specified time, they shall be liable to a weekly penalty;” and, therefore, he contended this was a continuous offence. They were, therefore, entitled to recover all these penalties. If they were entitled to six months penalties, they were entitled to all.

The Bench retired. After a brief absence, they returned into court, and the CHAIRMAN said that when the Company's Act was passed there was no doubt, the Magistrates thought, that it was intended to compel the completion of work in the specified time, and it was reasonable to conclude that, in default of taking proper measures to complete the work within the reasonable time which the Legislature had fixed, the Company were open to penalties. It had not been proved that any damage had been sustained, but they agreed that the Company would have been liable if proceedings had been taken within the specified time. The Bench, however, were of opinion that the provision in the Act had not been complied with, that the word “next” was fully applicable in this case, and the summons would therefore be dismissed.

Mr. DAVID asked for a case for the consideration of the Court above. The CHAIRMAN said that although, so far as the Bench were concerned, it would be difficult to state, they were prepared for such an application, and as the matter was one of great importance they would grant a case.

Mr. DAVID asked the Bench that, as this was a case for the Court above on a technical point, they would not dismiss the summons.

Mr. LAWRENCE said he should offer no material objection, for, if the Court above were of opinion that the limitation did not apply, the case would be sent down to this Court for hearing.

The complainant then entered into recognizances, and the case so far terminated.

REDUCTION IN THE PRICE OF GAS AT STOURBRIDGE.—At the meeting of the Stourbridge Commissioners on the 29th ult., it was announced that from and after the 1st inst. the price of gas would be reduced 2d. per 1000 feet.

In reference to the paragraph which appeared in the JOURNAL of the 23rd ult., announcing that Mr. Robert Fish, of Bucharest, had been decorated with the Order of Chevalier of the Star of Roumania, for conspicuous services in maintaining the lighting of the city during the period of the late war, the Bucharest *Curierul Financiar* says that the general impression prevailing in Bucharest is that no reward was better merited, for at the time when the navigation of the Danube was interrupted, and communication with England was impossible, Mr. Fish maintained the lighting of the city for several months with very little coal, and produced his gas from other materials. With a less able man at the head of the gas-works, Bucharest would most assuredly during that period have remained in darkness, and the Company been compelled to spend very large sums of money in the substitution of candles or petroleum for the public lighting. Beyond professional ability of a high order, Mr. Fish possesses a thorough desire to fulfil his duties conscientiously, and to give satisfaction to, and gain the respect of those among whom he has taken up his abode—qualities which are the more appreciated for their rarity in most of those who visit Roumania.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health on the Composition and Quality of the Metropolitan Waters in December, 1879:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitro- gen. — As Ni- trates, &c.	Ammonia.		Hardness (Clark's Scale).	
				Sa- line.	Or- ganic.	Before Boil- ing.	After Boil- ing.
<i>Thames Water Companies.</i>							
Grand Junction	22.50	0.060	0.195	0.000	0.008	15.4	4.2
West Middlesex	22.90	0.056	0.210	0.000	0.008	15.4	4.2
Southwark and Vauxhall	23.10	0.049	0.180	0.000	0.008	14.8	4.2
Chelsea	21.10	0.052	0.180	0.000	0.008	14.3	4.2
Lambeth	22.10	0.052	0.180	0.000	0.008	14.3	4.2
<i>Other Companies.</i>							
Kent	31.10	0.012	0.450	0.000	0.004	21.2	7.0
New River	21.90	0.023	0.200	0.000	0.007	18.7	3.7
East London	23.50	0.073	0.195	0.000	0.008	14.8	4.6

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours.

The water was found to be clear and nearly colourless in all cases.
C. MEYMOTT TIDY, M.B.

THE PUBLIC LIGHTING OF DUBLIN.

At an Adjourned Meeting of the Municipal Council of Dublin on Monday, the 29th ult.—the HIGH SHERIFF (Alderman H. Tarpey, J.P.) in the chair—the question of the lighting of the city was under consideration, in consequence of the action taken at the previous meeting of the Corporation, on the 15th ult., when a letter was read from the Town Clerk, stating that the Committee nominated to consider the terms of a new contract for the public lighting of the city had on Dec. 2 addressed a letter to the Alliance and Dublin Gas Company, requesting information as to the terms on which they would contract for the supply of gas. The reply of the Company proposed to contract for three years at the ordinary price charged for gas within the city, and with a charge the same as at present (of 4s. 6d. per lamp per annum) to cover the cost of repairs, painting, and meter-rents. The Committee thereupon reported to the Council their opinion, “arrived at after careful consideration, that the price of gas should not exceed 3s. 6d. per 1000 feet in Dublin, and that the proposal of the Company is most unsatisfactory to the citizens, as not containing any intimation of a substantial reduction of price in the immediate future, having also in view the now established prosperous circumstances of the undertaking.” They also recommended “that if an equitable arrangement can be effected with the present Gas Company, it should embody an agreement entitling the citizens to a discount on the public lighting account, in view of the large consumption, seeing that the Company have recognized this principle in their dealings with the other large consumers.” The Council then resolved to refer the Company's letter back to the Committee with instructions to communicate with the Company with a view to getting better terms.

The TOWN CLERK now read the following letter, which had been addressed to him by Mr. W. F. Cotton, the Secretary and Manager of the Company:—

Dear Sir,—I am directed to acknowledge the receipt of your letter of the 16th inst., and in reply to state that my Directors regret the Committee nominated to consider the terms of a new contract for the public lighting of the city did not feel justified in recommending the Municipal Council to accept the terms named in my letter of the 10th inst. The terms offered by the Company would enable the Corporation to carry out the public lighting of the city at a cost per lamp per annum not exceeding the price paid in London—a fact which must be apparent to the Committee who have procured a return of the cost in London and other places.

The Committee are aware that in London and other large cities and towns the Local Authorities provide the whole of the public lighting plant, whereas in Dublin the Company have expended a large amount of capital in providing similar plant, the Corporation having the use of same free of charge, not even paying the interest upon the capital invested.

My Directors are most anxious to be in a position to reduce the price of gas. They have done so voluntarily on several occasions during the past five years, and although they cannot do so at present in the face of nearly all materials used by gas companies advancing in price, they will take the first opportunity for making a reduction, not alone to the Corporation, but also to the consumers in general.

In conclusion, I am to state that should the Committee consider the Company's terms unreasonable, they can take advantage of the law which governs such cases throughout the kingdom, and go to arbitration to fix the price, thereby affording an opportunity, before an impartial tribunal, of either proving or disproving the statements which have been made in the Municipal Council.

Dec. 24, 1879. (Signed) W. F. COTTON.

Mr. MAYNE (Chairman of the Gas Committee) said they were in the position that almost at the eleventh hour they found the Company refused to make any concession whatever. The Committee would have to approach them again, but it was almost too late to hope for much. In the meantime, some arrangement should be made for the ensuing twelve months.

Mr. M'Evoy said the Council must do something. The Act of Parliament referred to in Mr. Cotton's letter was the Gas-Works Clauses Act of 1871, the 24th section of which provided for an arbitration as to the prices local authorities were to be charged for gas. He knew that private consumers in Dublin were getting gas at 3s. 11d. per 1000 feet, and he did not think any arbitrator would award a higher payment than this for the public lights. There was no alternative but to have a legal notice served on the Company, calling on them to supply gas to the city for one year, and apprising them that the Corporation were prepared to go to an arbitration as to the amount to be paid. If the Council should think fit to suspend the Standing Orders, he would move a resolution to that effect.

Mr. GILL asked Mr. M'Evoy if he knew at what times the private consumers, to whom the price of gas was brought down by a discount to 3s. 11d. per 1000 feet, paid the Company; also, did he know that the Company had not been paid a penny by the Corporation since last April.

Mr. GRAY, M.P., said the proposal of Mr. M'Evoy was a very serious one, and would require a little more consideration. No doubt the Corporation would be able, before an arbitrator, to make out a case for compelling the Company to supply them with gas at as low a rate as they supplied it to private consumers—namely, 3s. 11d. per 1000 feet; but, on the other hand, the Company could advance a claim to be paid for the lamps, &c., and might, in this way, succeed in running up their charge even to more than 4s. 3d. per 1000 feet. The question required careful consideration before they rushed into it; though he himself thought they ought to have an arbitration and a full public investigation of the whole matter. Even if the arbitration did not give them so large a pecuniary result as they might expect, it would bring the whole facts authoritatively before the public, and in this way would do good.

The Company might think they were only charging a fair rate, and, if so, they could have no objection to going to arbitration. But another consideration was that it would be unfair to take the matter out of the hands of the Committee to whom the Council had referred it. What he suggested was that they should ask the Company to continue the supply of gas for the present, pending the report of the Committee, which they would have in a fortnight; and if this report recommended that the Council should go to arbitration, the notices could be served.

The High Sheriff said he agreed with the Lord Mayor Elect (Mr. Gray) that this was the proper course to pursue. Though he had not intended to take part in the discussion, he could not refrain from denying statements that had been made in the Council Chamber upon a recent occasion. He promised the Council that if the question were to go to arbitration the Company would get out of it with clean hands, and would show the public that, under the circumstances of the case, gas was sold considerably better in Dublin than in any other city in the United Kingdom. It had been stated that gas was sold in Belfast at 3s. 6d. per 1000 feet. True, and he was not at all surprised at it, considering that the Corporation of Belfast had borrowed money at 4 per cent. He was only sorry that the Corporation of Dublin had not pursued the same course when they had an opportunity, and purchased the gas-works; but to say that under present circumstances their gas could be compared with the gas in Belfast, was one of the most ridiculous ideas that ever emanated from the mind of any respectable man. As to London, they never could compare Dublin with London. For instance, freight was 5s. a ton higher from Newcastle (where the Company got their coal) to Dublin than to London. It had further been stated that no reduction in the charge for gas had been made in Dublin for the last 12 or 14 years, except one of 3d. per 1000 feet; but it was forgotten that the illuminating power of the Dublin gas had been greatly increased. He recollected gas being sold, at the old price, having the illuminating power of 10 or 12 candles; and every candle added to the illuminating power was worth 3d. Assuming that the gas in 1866 was 12-candle gas, it was now 16-candle gas with a flat-flame burner, and this in reality made it equal to 18-candle London gas, so that there was a concession of at least 1s. in quality if not in price. There was no body of men in existence more anxious to look after the interests of the consumers than the Gas Company, but they certainly would not be driven into making a reduction in this manner; and if ever a reduction took place Mr. Mayne would not get the credit of it—it would come spontaneously from the Company themselves. It would be much better for Mr. Mayne to let the Gas Company mind their own business, and he assured the Council they were as anxious to do well for the consumers as Mr. Mayne was. In London the public lamps cost for lighting, &c., from 3s. 9d. to 4s. 5d. each, besides the plant being owned by the Local Authorities. In Dublin the charge was 8s. 8d. per lamp without any charge for plant, upon which the Company had expended thousands of pounds. All these things would come out on arbitration, if the Council demanded it.

After some remarks from Messrs. MULLIGAN and HODGSON, and from Alderman HARRIS, the Standing Orders were suspended, and

Mr. M'Evoy said he was prepared to yield to the objection that the Council had not time to consider the probable consequences of going to arbitration, and he moved instead—"That the letter be referred to the Gas Committee, with special instructions to report on the subject of arbitration, and that in the meantime the Gas Company be requested to continue the public lighting, on the present terms, for three months."

Mr. GRAY seconded the resolution.

Alderman GREGG deprecated anything like an attempt to threaten or coerce the Directors of the Gas Company, who were business men of the highest respectability and integrity.

Mr. MAYNE pointed out that the arbitration clause referred to by Mr. M'Evoy had been repealed by a clause in the Company's Act of 1874, which provided, he said, that they were to have power to increase the price unlimitedly on satisfying an arbitrator that the cost of manufacture had increased, but the consumers could obtain no reduction unless they were prepared to take a worse quality of gas. The only point which he considered the High Sheriff made in favour of the Company was as to the quality of gas in Belfast. They were bound in Belfast to supply gas of exactly the same quality as in Dublin, and, in fact, they never let their gas go below 17 candles, while the average in Dublin was 16 candles. As to the freight from Newcastle to Dublin and Belfast being the same, the Belfast Corporation did not go to Newcastle for their coals, but made their gas out of Wigan coal. Therefore the comparison of Newcastle freights was altogether outside the question; as, if the Dublin Company chose to make their gas from Wigan coal they could do so on the same terms as at Belfast.

Alderman HARRIS: What is the capital of the Belfast Corporation Gas-Works?

Mr. MAYNE: The capital invested in plant at present is £350,000. The area of Belfast is nearly 7000 acres, nearly twice as large as the city of Dublin; and there are 170 miles of mains.

Mr. BROOKS, M.P., said the question they had to consider was whether the Company were getting undue profits. He reminded the Council that the Shareholders of the Company were for many a day without any dividend at all. They were at present making hay while the sun shone—getting a moderate and not unreasonable profit of 10 per cent. on the capital they had invested. To-morrow or next day some process of lighting might be found which would sweep away every vestige of this 10 per cent., capital and all. There appeared, on the face of it, to be some unreasonable charge on the part of the Company, but if the thing were considered with fair regard to the risk of the Shareholders who had invested money in it, it would be apparent to the mind of every man that 10 per cent. was not an unreasonable return for people who sank their money in the manufacture of gas. The Legislature had duly considered this subject. It had been debated before hundreds of Select Committees whether 10 per cent. was a reasonable profit, and nothing less than a complete reversal of the legislation of the last ten years would enable the Corporation to reduce the Company's profits below that figure. What they had to consider was not whether the price of gas was too high or too low, but whether the Company were exceeding their statutory powers, or getting any unreasonable dividend for the risks they ran in the manufacture of gas.

Alderman HARRIS said it was quite true that the Shareholders in the Gas Company did not receive any dividend for a very long time; but he remembered perfectly that at the time some of the present Directors published a pamphlet, in which they showed that it was through the mismanagement and incapacity of the former Directors that no dividend had been paid, and not in consequence of the unprofitable nature of the business in which they were engaged. He quite agreed with Mr. Brooks that, considering the risk, 10 per cent. would be a fair profit; but what the Committee found was this—that, besides the question of the 10 per cent. dividend, the Company were renovating the whole of their works at the expense of the citizens, and putting by a substantial reserve-fund of £35,000 besides. He therefore said they were making much more than 10 per cent., and that if an arbitration took place it would be found that they were making 20 per cent. Public lighting now cost £2000 a year more than it did in 1873 or 1874. At that time they had 20-candle gas, and he remembered well Mr. Cotton proving at the time that, at the price they were

then charging, coal being at famine price, they had ample profit to enable them to provide 20-candle gas. Unfortunately, the Corporation had since then lost the services of Mr. Cotton, and the Gas Company had gained them.

Mr. GILL said a vast number of the present Shareholders had not received 10 per cent., nor more than 6 per cent.

The resolution referring the letter to the Gas Committee for report was then agreed to.

A report from the General Purposes Committee, in reference to the pressure at which gas is supplied, next came up for confirmation.

The Lord Mayor suggested that it should be taken as adopted; but

Alderman HARRIS, Chairman of the Committee, objected to this course. He said that one of the evils in the Council was that when gentlemen took a great deal of trouble with a report it did not meet with the attention it deserved. He therefore moved that it be referred to the Committee to whom the gas question had already been entrusted.

This was seconded and agreed to, and the other business of the Corporation was proceeded with.

At the Meeting of the Municipal Council last Thursday, the following letter, addressed to the Lord Mayor, was read and referred to the Gas Committee:—

Alliance and Consumers Gas Company, Jan. 1, 1880.

My Lord,—My Directors having considered the letter from the Committee nominated to arrange the terms for a new contract for the public lighting of the city, dated Dec. 31, 1879, regret that they are not in a position to reduce the price of gas at present. I am therefore to request your lordship will be so good as to remind the Corporation, at the meeting to be held this day, that the contract between that body and this Company for the public lighting of the city will expire on the 5th of January next, when my Directors, being desirous to meet the views of the Corporation, will be prepared to continue the supply of gas to the public lamps for one year on the terms stated in my letter of the 10th ult.

In the absence of an intimation from the Corporation to the contrary on or before that date, or should the Corporation continue the lighting of the public lamps, my Directors will take same as conclusive evidence that said terms have been accepted for the period named. (Signed) W. F. CORROD.

THE PAYMENT OF BACK DIVIDENDS BY THE CAMBRIDGE GAS COMPANY.

It may be remembered that, at the last half-yearly meeting of the Cambridge University and Town Gaslight Company, on the 31st of July, the report of the Directors—after recommending the usual maximum dividends on the consolidated stock and new shares, and announcing a reduction in the price of gas (from Midsummer) of 8d. per 1000 feet—stated that, "considering the present condition of the Company's affairs, the Directors feel it to be their duty, in the interest of the Shareholders, to recommend a further payment of 10 per cent. on the consolidated stock, on account of the deficiency in dividends in previous years." On the motion for the adoption of the report, an amendment was proposed, "that this meeting does not approve of the part of the report recommending the payment of an additional 10 per cent. on the consolidated stock;" but was lost. It was also suggested by one of the speakers that all action in reference to the matter be suspended until Counsel's opinion on the question, which had been sought by the Improvement Commissioners, had been obtained. The Chairman of the Company (the Rev. Dr. Phelps), however, said that they had been advised by Counsel as to the legality of the transaction; and this view has been upheld by the legal gentleman consulted by the Improvement Commissioners. At their last meeting the Clerk read the questions and replies in the case submitted by the Parliamentary Committee of the Board of Commissioners.

It should be mentioned that the Company obtained an Act of Parliament in 1867 which repealed, with certain provisions, the original Act of the Company—4 Will. IV., c. 24—the special clauses in question being the 32nd and 33rd, which are as follows:—

XXXII.—And be it further enacted, that the said Company, at any general meeting or special general meeting, shall have full power from time to time to call for and examine all or any of the accounts of the said Company; and at every annual general meeting, or some adjournment thereof, a dividend or dividends shall be made out of the interests, profits, and advantages of the undertaking (unless such meeting shall declare otherwise), and such dividend or dividends shall be at and after the rate of such a sum per centum upon or for every share in the said undertaking as such meeting or meetings shall think fit to order and determine, but no dividend shall be made whereby the capital of the said Company shall be reduced, nor shall any dividend be paid in respect of any share or shares after a day appointed for the payment of any call for money in respect thereof by virtue of this Act, until such call shall have been paid.

XXXIII.—Provided always, and be it further enacted, that from and after the twenty-fourth day of June which will be in the year One thousand eight hundred and forty, the said Company of Proprietors shall not be entitled to receive out of the clear profits arising from the said undertaking more than the sum of five pounds per annum upon each share of fifty pounds, in estimating which clear profits no interest on the original capital of thirty thousand pounds advanced in and upon the said undertaking shall be deducted or allowed; and in order to ascertain the amount of the clear profits of the said undertaking, the said Company shall and they are hereby required, from the said twenty-fourth day of June, One thousand eight hundred and forty, to cause a true, exact, and particular account to be kept and annually made up and balanced to the said twenty-fourth day of June in every succeeding year, of the money collected or received by them or for their use by virtue of this Act, and of the charges and expenses attending the supporting, maintaining, and using of the said works; and if the clear profits of the said undertaking shall at any time thereafter amount to a larger sum of money than shall be sufficient to make a distribution among the said Proprietors of five pounds per annum for every such share of fifty pounds, to be computed and take place from the said twenty-fourth day of June, One thousand eight hundred and forty, then and in such case the excess or surplus which shall be more than sufficient for the purposes aforesaid shall from time to time be placed in the hands of such person or persons, or on such Government or other security or securities, to answer any deficiencies that may happen in the next or any succeeding year or years, as the said Company shall for that purpose order or direct, until such excess or surplus shall amount to the sum of three thousand pounds; and the interest or dividends of such sum or sums so to be invested shall be paid and applied in like manner as the moneys to be received by or for the use of the said Company by virtue of this Act are to be paid or applied; and the total amount of every such annual account as aforesaid, certified in writing as just and true, under the hand of the Chairman for the time being of the Committee of Management, or their Superintendent, or any other officer of the said Company, together with an account of the dividends and interest to be from time to time received on all such moneys so to be placed out as aforesaid, shall within fourteen days next after the making up of every such annual account so to be made up as aforesaid, be laid before the Vice-Chancellor of the said University of Cambridge, the Mayor of the town of Cambridge, and three of the Commissioners acting in execution of the hereinbefore recited Acts of the twenty-eighth and thirty-fourth years of the reign of his said late Majesty King George the Third (not being either of them personally interested in the said undertaking), and one at least of such three Commissioners being a University Commissioner (which said three Commissioners shall be nominated and appointed at any of the general meetings of the Commissioners under the said recited Acts), and for the authentication of which account the said Company shall (if required) produce all their books, bills, receipts, vouchers, papers, and writings to the said Vice-Chancellor, Mayor, and said Commissioners, and if it shall appear from the accounts to be respectively made up on and from the said twenty-fourth day of June, One thousand eight hundred and forty-three, that the clear profits of the said undertaking, after such sum shall have been so invested, including the said dividend and interest, shall, upon an average of three years then next preceding, have exceeded the rate of five pounds per annum upon every such share of fifty pounds, then and in every such case the said Company of Proprietors shall pay such surplus of the said clear profits, dividends, and interest to the said Commissioners for paying, cleansing, and lighting the said town of Cambridge, or their Treasurer, to be by them applied and disposed of towards and in aid of any rate or assessment, rates or assessments, made or to be made under the said Acts, anything in this Act to the contrary notwithstanding; and if the said Company shall

refuse or wilfully neglect to deliver or to lay before the said Vice-Chancellor, Mayor, and said Commissioners, or any one of them on behalf of the others of them, the said accounts, or other books, bills, receipts, vouchers, papers, and writings hereinbefore mentioned, for the space of seven days after being required so to do in writing by the said Vice-Chancellor, Mayor, and said Commissioners, or any three of them, the said Company shall forfeit and pay the sum of fifty pounds for every such refusal or wilful neglect, and the further sum of five pounds for every day such refusal or wilful neglect shall continue after the expiration of the said seven days; such respective penalties to be recovered by any person who may sue for the same, with full costs of suit, by action of debt, or on the case, in any of His Majesty's Courts of Record at Westminster.

The four questions addressed to Counsel, and his replies thereto, were as follows:—

QUESTION 1.—Whether, by the new Act of the Company, sections 32 and 33 of their original Act are repealed.

Opinion.—The new Act of the Company repeals the old one, except so far as its express provisions operate to prevent the repeal. There is no express provision saving any rights of the Commissioners. I am of opinion, therefore, that section 33, so far as it gives any right to the Commissioners, is repealed. On the other hand, section 25 of the new Act limits the amount of dividend that may be made by the Company in any year only by providing that it shall not be larger or other than the Company might have made if the old Act had not been repealed. This provision keeps alive the limitation contained in section 33 of the old Act, which, in my opinion, so far as it imposes a limitation, is not repealed. I am of opinion, however, that the only limitation in section 33 of the old Act is in effect that the Company shall not receive out of profits more than 10 per cent. on the capital authorized by the old Act, and that the 10 per cent. is to be reckoned from June 24, 1840, so that no limitation is in force until the dividends declared on the old capital amount together to 10 per cent. from June, 1840, on the £30,000 original capital, and a like percentage on the additional capital created under the old Act from the time of its becoming entitled to receive dividends. I am of opinion that section 32 of the original Act is repealed, but that its repeal does not affect any question before me.

QUESTION 2.—If Counsel should be of opinion that sections 32 and 33 of the original Act are not repealed, he will please advise whether the Company have any power to pay dividends or bonuses on capital raised previous to the passing of the new Act, and whether all profits realized above £10 per cent. per annum ought not to be handed over to the Commissioners under the original Act.

Opinion.—I am of opinion that the Company have power to make dividends or bonuses on capital raised previously to the passing of the new Act until all deficiencies in dividends already declared by which such dividends fall short of 10 per cent. are made up.

QUESTION 3.—If the Commissioners are entitled to surplus after payment of 10 per cent., what proceedings should be taken to recover the same?

Opinion.—I am of opinion that the Commissioners have no right in any event to surplus profits, the provisions of the Gas-Works Clauses Act, 1847, and the special provisions contained in section 71 (as to maximum charge) and in section 83 (as to transmitting accounts) being substituted for the corresponding provisions of the old Act.

QUESTION 4.—If the Commissioners are not entitled to the whole surplus, are they or the gas ratepayers entitled to an account of the profits made on the new and old capital respectively, so as to distinguish and exclude the profits earned by the new capital and to give the right to require that after the prescribed dividend of 7 per cent., under section 25 of the new Act, is provided for, the surplus profits on that part of the capital shall be dealt with in accordance with clauses 31 to 35 of the Gas-Works Clauses Act, 1847, directing investment for a guarantee-fund and ultimate reduction of the price of gas.

Reply.—Neither of the Commissioners nor the ratepayers are, in my opinion, entitled to have any distinction made between profits earned by new capital and those earned by the old capital. The whole profits of the Company are to be dealt with and accounted for as prescribed by the Gas-Works Clauses Act, 7 per cent. being the prescribed rate on new capital within the meaning of the Act, and 10 per cent., including arrears, on old capital, standing for the prescribed rate as to the old capital, and the gas ratepayers (but not the Commissioners) are entitled to such remedies as are given by section 35 of the Gas-Works Clauses Act, and to no others.

11, New Square, Lincoln's Inn. (Signed) JOHN RIGBY.

THE GENERAL GAS LIGHTING AND HEATING COMPANY OF BRUSSELS.

The Annual General Meeting of this Company was held in Brussels on Dec. 20, 1879, when the Board of Direction presented their report on the operations of the Company, together with statements of account, for the twelve months ending Aug. 31. The report stated that the year had been marked by one very important feature for the Company—namely, the sale of their two stations at Chemnitz, in Saxony, the contract for the lighting of which town was originally to terminate in May, 1884. For some time past the Company had been in negotiation with the Municipality, with the view either of obtaining a renewal of the contract or of disposing of their works, the latter alternative being at length the only one under discussion, as the Municipality had resolved to undertake themselves the public and private lighting of the town. The Company's offer to sell having been accepted, the works were handed over to the Authorities as and from the 1st of July last, for the sum of 2,833,600 frs., or £113,344, that being the amount agreed upon after considerable negotiation. In this sum was included the value of the concession for the lighting of Schlosschemnitz. The value of the Chemnitz works on July 1 last being estimated at 3,470,000 frs., or £138,800, there was consequent upon this sale a difference of 694,767 frs., or £27,790, in the item of "General expenses of first establishment." This amount had, therefore, been deducted from the sinking-fund. One satisfactory result of the transaction was to considerably alter the financial position of the Company. From and after July 1, 1879, the Municipality were to pay every half year, on the 1st of January and the 1st of July, 5 per cent. per annum interest on the sale price of the works, one instalment of which, to the amount of £15,000, was payable on Dec. 31, 1879; the balance not to be handed over until six months notice had been given by either party, such privilege to date from Jan. 1, 1880, in the case of the Municipality, and from July 1, 1880, in the case of the Company. In payment of the purchase-money the Company had received five bonds, one of which was payable on Dec. 31, 1879, and the other four on the conditions above mentioned. The Directors, therefore, had in hand the funds necessary for carrying out whatever extensions might be called for by the improvement of their business for many years to come.

The better financial position of the Company had enabled them still further to reduce their bond debt, which stood at 11,260,000 frs., or £450,400, as against 11,677,500 frs., or £467,100, at the corresponding period of the previous year. This had been effected by paying off 999 bonds, of which 164 were re-issued previous to the sale of the Chemnitz works.

The net profit produced by the working at the several stations of the Company during the year had increased by the very substantial sum of 1,996,352 frs., or £79,873, being an advance of 82,564 frs., or about £3300,

on the profit of the preceding year, although the former sum was, of course, *minus* the profit that would have been made at the Chemnitz works in the months of July and August. This increase, which was principally the result of better working consequent upon the improvements and extensions carried out at the several stations, was very much more satisfactory, inasmuch as something like 150,000 frs., or £6000, of the profits had been expended on maintenance of works during the year. To the sinking-fund had been added the sum of 500,000 frs., or £20,000, which the Directors believed would be amply sufficient to represent the depreciation in the value of the Company's plant and buildings, and the shortened period of their concessions.

With regard to the effect of the sale of the Chemnitz works on the profits of next year, the Directors hoped that by the abolition of certain expenses, together with the interest on the amount realized by the sale and the improved revenue that would in all probability be earned at their other stations, which had every year shown progress, no sensible diminution would be felt.

There had been little to report in the way of outlay on works of first establishment during the year. The work done had consisted principally of extensions of mains at the several stations, the replacement of inadequate apparatus at St. Omer, and the completion of the works at Tournai, which had been in operation since August. The original works had been pulled down, and the old materials sold or utilized. The total outlay on works of first establishment had been 637,661 frs., or £25,506, in which was included the balance of the purchase-money of the land required for new works to be erected next year at Prague, and the gross sum had been apportioned as follows:—

	Francs.	Sterling.
Land	103,352	£4,134
Buildings	104,622	4,185
Plant and machinery	203,776	8,151
Mains	225,911	9,036
Total	637,661	£25,506

There had been but a slight increase in the sale of gas, owing to the long-continued stagnation in trade. The profits had, nevertheless, tended upwards. The Company had sold 18,267,043 cubic metres, or about 644½ million cubic feet, against 17,943,668 cubic metres, or 633½ million cubic feet in the year 1877-8; but as the former figure did not include the sale of gas for July and August, 1879, at the Chemnitz works, it would be necessary, in order to make a just comparison of the two years, to deduct from the latter figure the quantity of gas sold in those months of 1878, thus bringing it down to 17,756,790 cubic metres, or 636 million cubic feet, which would then show an increase of 510,253 cubic metres, or 2'87 per cent., in the consumption.

On the 31st of August, 1879, the total number of public lamps supplied was 212,855, against 205,856 on Aug. 31, 1878, being an increase of 6999 lamps. The average consumption of each burner was 87'29 cubic metres, or 3078'30 cubic feet, against 87'16 cubic metres, or 3076'75 cubic feet in 1877-8.

The length of mains laid on the 31st of August, 1879, was 648,497 metres, or 709,024 yards, against 625,366 metres, or 683,735 yards, on the corresponding day in 1878.

For every 100 kilos. of coal carbonized, 28'45 cubic metres of gas were obtained, being at the rate of, as nearly as possible, 10,000 cubic feet to the ton; of coke, 65'10 kilos., or about 18 bushels to the ton; of tar, 4'67 kilos., or about 10 gallons to the ton; of ammoniacal liquor, 10'5 litres, or about 23 gallons to the ton, of the strength of 2'5° Twaddel. These returns had for several years shown constant improvement, as evidenced by the fact that, although the Company carbonized about 1300 tons of coal less in 1878-9 than in the preceding year, 510,000 cubic metres, or about 18 million cubic feet more gas had been sold.

In reference to the price of coal there had been nothing to call for remark, the contracts for the supply of this material having been previously made for two years.

The sale of coke continued to be satisfactory, and the Directors had succeeded in contracting for the disposal of the large stock on hand at Charleroi. At none of the stations was there any great quantity of this residual in store. The original contracts for the tar and ammoniacal liquor were still in force.

The general operations of the Company during the year having been disposed of, the report proceeded to deal with the several items in the accounts. These, however, do not call for special notice, with the exception, perhaps, of the item "Plant, materials, tools, &c.," on which 1,042,250 frs., or £41,690, had been expended. This sum was apportioned as follows:—

	Francs.	Sterling.
Working plant	572,129	£22,865
Meters, &c., on hire	224,588	8,984
Coal	125,081	5,003
Residual products	85,490	3,420
Material	34,962	1,398
Total	1,042,250	£41,690

These figures show a considerable diminution on the amount of this item in the previous year's balance-sheet, owing in part to the sale of the Chemnitz works. On the other side of the account, the reserve-fund had been increased by 656,102 frs., or £26,244, and the sinking-fund reduced by 694,768 frs., or £27,790, the amount lost by the Chemnitz transaction, and the whole of which had been written off; at the same time the item had been increased by 500,000 frs., or £20,000, taken from the profits of the year's working. The item "Sundry creditors," consisted of the amounts owing to the Company's bankers, and other persons together with the sums deposited with the Directors as securities by the principal officers.

The profit and loss account showed a profit of 1,996,353 frs., or £79,874, as against 1,914,288 frs., or £76,572, in the preceding year; to which was to be added the interest due from the Municipality of Chemnitz for the two months of July and August, and the balance brought forward from last account, thus bringing the total up to 2,024,034 frs., or £80,961. When from this were deducted the general expenses, the difference in the issue and redemption prices of the bonds, the bankers commission, the amount placed to the sinking-fund, and the statutory 4 per cent. added to the reserve, there remained the sum of 761,486 frs., which had been thus disposed of:—

	Francs.	Sterling.
First dividend of 25 frs. per share	583,875	£23,355
15 per cent. on balance, added to reserve	26,116	1,045
12 per cent. on ditto, allocated among chief officers	20,892	835
Second dividend of 5 frs. per share (making 6 per cent.)	116,775	4,671
Total	747,658	£29,906

leaving a net balance of 13,828 frs., or £553, to be carried forward.

The Directors report was, as usual, accompanied by that of the Board

of Supervision, who signified their approval of the dividends recommended, and testified to the accuracy of the accounts presented, which were as follows:—

Dr.—Statement of Assets and Liabilities, Aug. 31, 1879.			
	Frances.	Sterling.	
To Share capital (23,355 shares)	11,677,500	£467,100	
Bond ditto (11,260,000 frs.), viz.—			
4316 A bonds (1867)	2,158,000	86,320	
7208 B " (1868)	3,604,000	144,160	
7081 C " (1874)	3,540,500	141,620	
40 D " (1876)	200,000	8,000	
3515 E " (1876)	1,757,500	70,300	
Reserve-fund	713,970	28,559	
Sinking-fund	2,269,943 frs.		
Deduct loss on sale of Chemnitz works	694,768 "		
	1,575,175 frs.		
Add year's proportion of revenue, as per profit and loss account	500,000 "		
	2,075,175	83,007	
Unpaid share coupons	5,023	201	
Unpaid bond ditto	232,850	9,314	
Balance due on Anderlach works	177,297	7,092	
Sundry creditors	478,751	19,150	
Security deposited by chief officers	370,000	14,800	
Bills payable	209,396	8,376	
Dividends = 30 frs. per share	700,650	28,026	
Carried to profit and loss account	13,828	553	
	27,914,440	£1,116,578	

Cr.—Statement of Assets and Liabilities.			
	Frances.	Sterling.	
By General expenses of first establishment	21,620,519	£984,821	
Extensions of works and mains	637,661	25,506	
	25,258,180	£1,010,327	
Deduct first cost of works at Chemnitz	3,470,090	138,804	
	21,788,090	£871,523	
Sundry debtors	589,421	23,337	
Works at Chemnitz taken by Municipality	2,857,272	114,291	
Caution-money deposited at Rimini and Sienna	39,716	1,589	
Difference between the issue and redemption prices of bonds	1,075,391	43,016	
General benefit and relief funds	80,037	3,203	
Bills receivable	43,752	1,750	
Miscellaneous funds, including officers' securities	404,511	16,180	
Plant, materials, tools, &c.	1,042,350	41,690	
	29,914,440	£1,116,578	

Dr.—Profit and Loss Account, Aug. 31, 1879.			
	Frances.	Sterling.	
To General expenses	91,918	£3,677	
Bond coupons, and difference between the issue and redemption prices	614,458	21,578	
Bankers commission and interest, &c.	29,717	1,189	
Sinking-fund on works of first establishment	500,000	20,000	
Dividends = 30 frs. per share	700,650	28,036	
Added to reserve-fund	52,571	2,103	
Share of profits allowed to chief officers	20,892	835	
Balance carried forward	13,828	553	
	2,024,034	£80,961	

Cr.—Profit and Loss Account.			
	Frances.	Sterling.	
By Balance on Sept. 1, 1878	3,509	£140	
Profit on the year's working at the several stations of the Company	1,996,853	79,874	
Interest due from the Municipality of Chemnitz, July and Aug., 1879	23,672	947	
	2,024,034	£80,961	

DERBY GAS COMPANY.

An Extraordinary General Meeting of this Company was held on Monday, the 22nd ult.—Mr. GASCOYNE in the chair—for the purpose of passing a resolution for the raising of further capital under the powers of the Derby Gas Act, 1876, to be expended on the enlargement of works.

The CHAIRMAN said the resolution he proposed to move was simply in furtherance of the decision already arrived at by the Shareholders at a former meeting. In consequence of the necessity of enlarging their works, the Shareholders decided to ask for, and had accepted tenders. The contracts were proceeding somewhat rapidly, and were only delayed for the time by the weather. The works, however, must go on with great rapidity, for in accordance with the terms of the contract they must be completed by Christmas next year. They must be prepared, therefore, from time to time, to pay, and instalments had to be paid every six weeks, so that they would have to raise the money in a tolerably short time. The resolution he had to propose was as follows:—

Resolved, that the sum of £70,000, in addition to the present capital of the Company, be now raised under the powers of the Derby Gas Act of 1876, by the creation and issue of 5600 new ordinary shares of £12 10s. each, and that the sum be apportioned amongst the present holders of the ordinary shares of the Company respectively, in the proportion of one new to one existing share, and be offered to them at par; and that the dividend on the additional share capital to be thus raised be paid at a rate not exceeding 7 per cent., in respect of every £100 of such actually paid up as shall be declared at each half-yearly meeting of the Company.

He might state that the Shareholders passed a resolution to extend the works, and they had now to arrive at a resolution to pay. The Shareholders had very properly committed themselves to the new works; if they had not done so, and the town had been short of gas, they would have been compelled to do so by the Town Council. Their own interest dictated that they should take the step they had done. For 60 years they had had nothing but prosperity, and had paid full statutory dividends, and they were certainly in as good a position now as at any time previously. When this step was taken, there would be ample resources to meet the dividends. Should the electric light ever come into general use, their property would still remain valuable. Had they been present at Nottingham during the recent exhibition of gas appliances there, they would have seen what a grand adaptation could be made of gas for heating and cooking purposes. The shares had been selling for more since the electric light scare than they had ever done before, which showed the confidence the public had in the performance of gas. He (the Chairman) therefore hoped the Directors would have the continued confidence of the Shareholders. Speaking for the other Directors, and not for himself, he was bound to say they were the most attentive Board in England. They were also surrounded by Officers of great ability, and the Shareholders had every reason to be satisfied with their future prospects.

Mr. RICHARDSON seconded the resolution.

In reply to a question, the CHAIRMAN explained that the existing number

of shares was 5600, and the same number of new shares would be allotted, so that each existing Shareholder would be able to take a similar number of shares to that he at present held, if he chose.

Mr. SHEFFIELD asked what was the amount of the contracts for the new works.

The CHAIRMAN replied that they might expect the cost to reach £48,000 or £50,000.

After some further remarks, the resolution was passed unanimously, and the meeting terminated.

BEYROUT WATER-WORKS COMPANY, LIMITED.

The Annual General Meeting of this Company was held at the London Offices on Friday, the 19th ult.—E. EASTON, Esq., in the chair.

The SECRETARY (Mr. Robert M. Young) having read the notice convening the meeting, the following report was presented:—

The Directors herewith submit, for the information of the Shareholders, their sixth annual statement of accounts to the 30th of September last, duly audited.

On the night of the 25th of December last an extraordinary flood occurred, causing the Dog River to rise upwards of 20 feet above its ordinary level. This flood carried away the iron aqueduct (113 feet in length) conveying the Company's water across the river, and caused the destruction and disappearance of a mill of 200 years standing, and very serious damage to the Company's weir and other works. The immediate consequence was that the supply to the town of Beyrout was stopped for upwards of six weeks, and, in the meantime, all revenue lost.

The greatest credit is due to Mr. Cornish, the Company's Engineer, for the efficient and expeditious manner in which the accident was met. Nevertheless, although the works were thus repaired so as to admit of supply to the town, the accident has necessitated a considerable outlay during the whole of the year.

The Directors are led to hope that the present aqueduct, although built of timber, will, with proper precautions, fully answer the purposes required.

They are able to report that the number of contracts for supply of water has increased in a larger ratio than during any corresponding period of former years, and they are advised that the prospects for the future are encouraging.

They regret to state that since the last meeting the Board has suffered the loss of Mr. J. T. Carbonell, by his decease, and of Messrs. W. P. Andrew and A. W. Young, by their resignations. The Shareholders will be asked to appoint new Directors to fill up these vacancies.

Messrs. Moore and Wallis offer themselves for re-election as Auditors of the Company.

The Directors also recommend that Mr. Charles Watkins be re-appointed Auditor of the local accounts at Beyrout for the current year.

ENGINEER'S REPORT.

Beyrout, Nov. 18, 1879.

The audited accounts and balance-sheet for the financial year ending the 30th of September last, and which were forwarded to you on the 4th inst., are, I trust, sufficiently clear in giving you all the necessary information as far as accounts are concerned.

During the year the number of private subscribers has increased 162, of which 142 are new services, and the remainder services which were previously shut off and again renewed. The amount received for surplus water taken by meter has also been much in excess of that of last year, it being 64,735 piastres, against 46,132 piastres during the previous year. As 120 of the new services were put on during the last five months of the financial year ending the 30th of September last, they naturally have not increased the revenue account as much as they will during the succeeding one.

In consequence of the Municipality having lately caused a number of new roads to be opened out, and the desire of many of the inhabitants to take water provided the Company's pipes pass a public square into their houses, I have utilized the old stock of 3 and 2-inch pipes which were lying in our stores, as well as others which you sent out, in extending several of the mains. I am glad to state that the success has been what I anticipated, and that the prospects for the forthcoming year are good. The 1100 pipes which you last sent out are still in stock, and will be laid down during the winter months in such streets where the demand for water is likely to be remunerative. The expense to the Company will be little more than the cost of the pipes, as the work will all be done by our own regular workmen during the slack season.

Besides opening up new roads, the Municipality is now engaged in improving the drainage system in many parts of the town. They are also transforming a public square into a public garden, and are doing their utmost to make arrangements for watering the streets during the summer months; all of which tend to increase the Company's revenue.

The flood which caused the serious accident to the Company's works at the Dog River during last December was without precedent, and has unfortunately cost the Company about £800 to do the necessary repairs, and has caused a loss of revenue of about £600, which are large items to the debit of profit and loss account. The works at the present time are in perfect order, and every precaution has been taken to prevent accidents during the forthcoming winter.

Notwithstanding the several changes in the position of the Company's employees, and the necessity of increasing the staff for special duties, the expense is less by £20 than last year.

Nothing has as yet been settled either as regards railway communication with the interior, or a harbour for Beyrout. His Highness Midhat Pacha has certainly done his utmost to carry out these projects, but without support at Constantinople he is utterly powerless. Although repeated assurances have been expressed by the Sublime Porte that his Highness has full powers to carry out reforms, it is evident to all sensible Europeans resident in the country that his powers have been so much curtailed as to cause him to be looked upon as only a nominal Governor-General. The visit of Her Majesty's Ambassador to Syria has, however, considerably raised the hopes of the inhabitants that something is at last to be done for the country.

Before closing this short report, I must mention that not only are many of the old systems of public water supply to the town destroyed through neglect, but that many of the inhabitants have allowed their wells and cisterns to become useless. Taking these and several other matters into consideration, I most confidently predict that the Company's prospects must rapidly improve. (Signed) JAMES NIXON, Manager.

The CHAIRMAN, in moving the adoption of the report, said he had first to express his extreme regret that he occupied the position he did. Since the Company's last meeting, the Directors had lost by death one of their colleagues—a gentleman who was a Director of one of the London Water Companies, and whose great knowledge of matters of this nature was of essential service to them. He referred to Mr. J. T. Carbonell. They had also to regret the loss, by his resignation, of a gentleman who addressed the Shareholders on the occasion of their last meeting—Mr. W. P. Andrew—who was of the greatest use to his colleagues in all matters requiring sound judgment and careful consideration, and who also explained at these meetings the views of the Board in a manner which was characterized with exceptional clearness. They had further lost the services of Mr. A. W. Young, M.P., who was a most indefatigable Director, but who resigned on being appointed to a seat at the Board of the South-Eastern Railway Company. The consequence was that he (the Chairman) and Mr. Staniforth found themselves alone but the Shareholders would be asked to find this state of things, and to reconstruct the Board so that the Company might be worked more satisfactorily. Being thus left alone, his colleague and he had tried to do the best they could in the Shareholders' interests in the past year, although the prospects at the commencement of it were by no means encouraging to any one, and the effort had been one requiring no small amount of courage. He was, however, glad to say that they did at last see some glimmer of hope on their, he must call it, rather unfortunate Company. On previous occasions the Shareholders had been informed of some of the reasons why the Company had not been so successful as it ought to have been, those reasons chiefly proceeding from local causes; but at last he thought they looked as if they were going to be removed. The report of Mr. Nixon was encouraging—to him especially, as a water-works Engineer, and as having had a good deal of experience in these matters—when he stated that there were so many new subscribers, and especially when he said that the majority of those subscribers had come in within the limited period of five months. The unfortunate accident of last year, which was mentioned in the report, had, of course, thrown the Company back very much. This, however, had now been

remedied, and, as far as could be seen, the works were likely to be as efficient as they were before the mishap. He had also to mention that a certain amount of alteration had been made in the management of the Company in Beyrout. Mr. Cornish, who had been the Company's Engineer out there, and had acted with so much ability, had been offered and had accepted the appointment of Manager of the Alexandria water-works; but they had concluded an arrangement, on very favourable terms, with this gentleman, by which his services would not be altogether lost to the Company so long as they were required; and he (the Chairman) was happy to say that the result of nine or ten months working in Beyrout showed that Mr. Nixon's very efficient management, with the assistance they had arranged for from Mr. Cornish, was carrying on the affairs of the Company quite as well as before, and this was done at less cost. He thought they had reduced the expense of working to the extreme minimum in both places, and now they could only wait for the development of the works, and this at last seemed about to take place. Another letter had been received from Mr. Nixon, later than that of the 18th of November, which showed that they could, by exercising a certain amount of discretion, probably increase the revenue of the Company by allowing the water to be taken at a reduced rate for the irrigation of gardens. There was a large amount of surplus water available, and if the Directors could do what was suggested—dispose of it at even a very small rate—they would do so; anything to increase the revenue of the Company. As far as he could see, the Company would be able next half year to pay as much as they had at last succeeded in paying on their bonds, and perhaps they might do a little more; but the half of the next coupon he thought the Directors could perfectly clearly see their way to. To fill up the vacancies on the Board, and to put them in the condition really of a working Board, they had, after careful consideration and talking about the matter to a number of the Shareholders, come to the following resolution—viz., to ask the Shareholders to appoint the gentlemen he would name. The first was Mr. John Morris, whose name, he need not say, would carry much weight in the City of London, and whose great ability would make it certain that they would have the very best advice whenever they required it. Moreover, that gentleman represented probably the largest section of the Shareholders. Mr. William Western, who was present, was one of the Auditors of the Company, but he (the Chairman) had persuaded that gentleman to retire from the auditorship, and give the Company his services as a Director. That, he might point out, would save them 26 guineas a year; and Mr. Western's knowledge of all the details of the accounts would make him an extremely valuable member of the Board. The third gentleman they proposed was Mr. Young, who was the Secretary, and the reason for doing so was not only because Mr. Young had, through evil and good report, stuck to the business in a manner which showed he had the true British pluck, but also because he would be on the spot. Unfortunately, the quorum of Directors was settled at four, and they could not by a resolution of the Company alter it, as it was one of the conditions approved by the Turkish Government, and an alteration, as the Directors were advised, was impossible. Mr. Staniforth, Mr. Morris, and himself were very much engaged, and could not be sure of being present, and by making this appointment they would have Mr. Young on the spot, and that gentleman probably knew more about the Company than any one else. The Directors would, therefore, for the reasons he had stated, ask the Shareholders to make these appointments.

Mr. J. STANFORTH seconded the motion.

Mr. SANVILLE asked whether the question of supplying water at a cheaper rate was not mooted three or four years ago.

The CHAIRMAN replied in the affirmative, and said perhaps he ought to have stated so in referring to the subject. However, there was never any application for it. He remembered the circumstances perfectly well, but there had never been till now any movement in the direction intimated.

Mr. SANVILLE inquired whether Mr. Nixon anticipated a large number of these applications for water.

The CHAIRMAN said he did. He read the letter referred to of Mr. Nixon, who, in conclusion, said he was of opinion that in two or three years the Company would be able to dispose of the whole of their surplus water, very much to their benefit. The price suggested for the water was 5 centimes per cubic metre, and the opinion was expressed that when once the water was utilized in the manner stated, those who employed it would see so many advantages follow that they would not care to be without it.

Mr. STANFORTH, in reply to a question, said the whole of the present revenue came from private consumers and for the supply to the public fountains. The 120 new services put on during the last five months, as stated by Mr. Nixon, had not come into the present accounts, which were made up to the 30th of September. They would come into the next accounts.

The SECRETARY, in answer to a Shareholder, said the new services would average £4 each—perhaps £5—but they were increasing.

Mr. SANVILLE asked what Midhat Pacha had done for the benefit of the Company. At the last meeting Mr. Andrew stated that he was in correspondence with Midhat Pacha, and he hoped to be able to induce the people to take the water.

The CHAIRMAN said he did not suppose Midhat Pacha had been more successful in that reform than in some of the others he had attempted to introduce.

The motion was then put, and carried unanimously.

Mr. SANVILLE moved, and Colonel EVELEGH seconded, the appointment as Directors of Messrs. John Morris, R. M. Young, and W. T. Western.

The CHAIRMAN said it was right to point out that Mr. Young would practically continue to perform the duties of Secretary, as well as those of a Director, and it was proposed that his present salary be continued.

The motion was unanimously agreed to.

Mr. MACNILLE moved, and Mr. STANFORTH seconded, the re-election as Auditors of Messrs. Moore and Wallis, and the motion was carried unanimously, as was likewise that relating to the re-election as local Auditor of Mr. Charles Watkins.

Mr. WESTERN said that when he was asked to join the Board, instead of being one of the Auditors, he pointed out that the Directors had much better obtain the services of a gentleman who had some local knowledge, as he had never been to Beyrout. However, there seemed no one who had such knowledge, and, therefore, he had consented to join the Board. If, however, they could find any one to join them who had some knowledge of the place—and this was what was wanted—and who would suit them better than himself, his place was quite at their disposal.

On the motion of Mr. SANVILLE, seconded by Colonel EVELEGH, a vote of thanks was unanimously accorded to the Chairman and Mr. Staniforth for the trouble they had taken in connection with the Company's affairs.

The CHAIRMAN expressed the thanks of his colleague and himself for the confidence shown in them. It had not, he said, been a very pleasant business to face what they had had to face in the last year or two, but he hoped the Shareholders would give them credit for having stuck to the ship. They would continue to do so, and with the colleagues who had just been given them he thought they would do as well as they could under the circumstances.

The proceedings then terminated.

DINNER TO THE WORKMEN AT THE TUNBRIDGE WELLS NEW GAS-WORKS.

Last Thursday, at the invitation of Mr. R. P. Spice, the Engineer of the Tunbridge Wells Gas Company, the opening of whose new works we recorded a few weeks since, the workmen employed, numbering more than a hundred, and some others, assembled in the meter-proving and experiment room, and partook of a substantial dinner of beef and pudding, after which tobacco and spirits were put upon the tables, ample justice being done to the whole of the provision. Mr. SPICE took the chair, and was supported by Mr. JOHN READ and Mr. GEORGE SCOTT, the Secretary and Manager respectively of the Company.

The first toast drunk was "Success to the Tunbridge Wells Gas Company," after which Mr. SPICE proposed "The Health of the Workmen," to whom he wished continued good luck and a happy new year. The day was, he said, the first day of the new year, and it happened to be his birthday. He had refused several invitations from personal friends to spend the day, as was his wont, with them, in order that he might spend it with the men connected with the Tunbridge Wells Gas-Works. He had had very much pleasure that afternoon in handing the new works over to Mr. Scott, who would now have the responsibility of conducting a truly modern establishment. If Mr. Scott, with all his northern acuteness, could not make a good job of the works, he did not know who could. He was quite sure Mr. Scott would have the support of the workmen, for whom every accommodation for their comfort and convenience had been provided. They would now have access to a spacious dining-room, lavatories, hot and cold baths, and a retort-house in which they would have ample room, and avoid being cooked, as they too often were in old-fashioned works. The men had the Company to thank for these things, for they readily approved of the plan showing such arrangements.

One of the men, known as TOM SKINNER, was called upon to respond, and he did so with a speech and a laughable song.

Mr. SPICE next proposed the health of Mr. Scott, who, he said, he knew stood well in the estimation of the men, and he was sure the toast would be received with the greatest enthusiasm.

The toast was drunk with musical honours, and

Mr. SCOTT replied that he was very pleased to find such a genial and cordial feeling amongst the men. This had existed ever since he had been amongst them, and he hoped would continue. He believed in a "sweet reasonableness," and that men should feel a responsibility in their work. He had endeavoured to inculcate these principles at the old works, and should enforce them in the new ones, for here he considered he had a great interest at stake. He believed that work done heartily was done in the easiest manner. The men might rely upon his doing whatever he could for their comfort, and in so acting he knew he should be looking to the interest of the Company and all concerned.

Mr. READ next proposed the health of Mr. Spice, the founder of the feast, and the designer of their beautiful gas-works. He said he was sure all would agree with him that a vast amount of pains, a great amount of thought, and an extreme amount of diligence had been exercised by Mr. Spice in achieving such happy results. Mr. Spice had been before the world for a very long time, and no one could point to anything he had done of which he need be ashamed.

The toast having also been drunk with musical honours,

Mr. SPICE, in reply, said with regard to this undertaking he could assure his hearers he had not been lying on any bed of roses for some time past, for very grave difficulties, involving a great amount of anxiety, had had to be overcome. He thought all might now look forward to a satisfactory state of things so far as the interests of the Tunbridge Wells Gas Company and their consumers were concerned. It might be some little time before they would be able to supply gas from their works as cheaply as they should like to do, simply because so much money had necessarily been expended, for which a return could not be immediately realized. It was not their fault that they had spent so much money; he did not think it was anybody's fault. Engineers had to deal with circumstances, as well as to adapt themselves to those circumstances. In this case it so happened that the Company had been compelled to go to Parliament three times, and obtain two Acts, before they could get a footing and a site to build upon. There were differences of opinion among the townspeople as to the first site selected, and the erection of the works upon that site would have been a saving to the Company of £20,000. This sum had been expended in maturing the present works, which would have been saved on the other site, and it was a misfortune for which the Company were in no way responsible. They had been driven to the present site, and it would only be by the most extreme economy of manufacture that satisfactory results could be achieved. That economy would not be brought about by cheeseparing, and imposing extra labour upon the workmen; on the contrary, the labour would be more easily performed, through the introduction of West's plan of drawing and charging retorts, than under what was now called the old system. This was the age of progress, and they would yet have a superior order of things to that which existed in the present day. Let them remember also that they had minds as well as bodies to be taken care of. Having that in view, he had endeavoured to contribute to their stock of knowledge by forming the nucleus of a library at the works. He had brought from his book-shelves in Parliament Street a small selection of works, and he hoped others would contribute to the stock, till by-and-by they would have a library which might favourably compare with any ordinary library in Tunbridge Wells. These books would be placed in the dining-room. Those he had brought included: "The Workshop Companion," "History of the Plague and Fire of London," "Curiosities of Civilization," "The Text-Book of Science," four volumes of the "Leisure Hour," fourteen volumes of "Waverley Novels," "Year-Book of Facts," "British Manufacturing Industries," "Walker's Dictionary," &c. He should add to the list, works by Hugh Miller, Smiles, and other authors of a similar character. He should not be at all surprised if some of them were to become literary men in the course of time. He could not imagine a better field for the exercise of intellect and intellectual pursuits and entertainment than a gas-works. To his mind a gas-works was a paradise for a man who thought, and a man was there bound to think if he only observed that which was going on about him. No man should seek to be lifted from the sphere for which he was fitted, but men should fit themselves for better things to-morrow than they were fitted for to-day. Every man who was the father of a family should aim to become a model father, and every son should aim to become a better man than his father, so to speak; his aim should always be upwards and onwards. In conclusion, he proposed the health of Mr. Read, of whom he said that he knew no one among his circle of friends—and it was a rather extensive one—for whom he had a greater respect. Mr. Read was the exponent, the mouthpiece of the Directors, the controlling power of the undertaking, a man admirably gifted for the duties which he had to discharge. Mr. Read stood between the consumers and the Directors, and discharged his duties with marked fidelity, zeal, and success.

The toast was received with enthusiastic cheering.

Mr. READ, in responding, said he had been a servant of the Tunbridge Wells Gas Company for upwards of a quarter of a century, and he saw present the oldest servant of the Company. When he first entered upon the service

of the Company he found that honoured and respected old man (Moon) in their service, and he most assuredly should be wanting in his duty did he not pay some respect to that man's service. Good servants made good masters, and if Moon had not conducted himself well, he would not be in his present position. He was also quite certain that if the Company had not behaved properly to him, he would have severed his connection long ago. He (Mr. Read) was always anxious to do his duty to the Company, and he was equally desirous that the consumers should have his strongest interests. At the same time, he did not think the men could accuse him of extracting the largest amount of work out of them with any harsh feelings. Of course there were, and would be, times when things would not run so smoothly as one could wish; but then, instead of sitting down with folded hands, how much better it was to meet the difficulties, and endeavour to surmount them. If they met a difficulty with an honest desire to surmount it, it was astonishing how soon it went away. He was glad to see the workmen present, and he was sure they would yield to no one in their endeavour to do their duty. If he saw a man determined to do his duty, he cared not whether he wore fustian or broadcloth, for he generally found that those who prided themselves on their clothes were only drones in the working hive.

Mr. SPICE next proposed the health of John Moon, a man whom he was delighted to honour as the oldest servant of the Tanbridge Wells Gas Company, a man who had done his duty faithfully and honestly for the Company.

Mr. SCOTT desired to bear his testimony and appreciation of the manner in which Moon had at all times conducted himself.

The toast was drunk with musical honours, and Mr. SPICE called upon the workmen to drink in silence better health to Mr. Clements, the Clerk of the Works, who had unfortunately, through accident, lost the sight of one of his eyes, whilst discharging his duty to the Company.

The toast having been drunk in silence, Mr. SPICE proposed the health of Mr. Farrand, a gentleman to whom he felt greatly indebted for supporting him in carrying out some very important duties in connection with the starting of the works, when they were, as he might say, somewhere between wind and water—in the transition period between the old works and the new. The discharge of the duty involved a great amount of practical knowledge and aptitude to meet contingencies. Nothing but experience and intelligence could fit a man for such a work. When he called upon Mr. Farrand to make gas without coal, it was to carry out a scientific problem put to him, the practical solution of which involved almost the sacrifice of his life. This problem had been successfully carried out, in great part through the assistance rendered him by Mr. Farrand, who had succeeded, by adhering to instructions, in accomplishing the making of gas from water. It was Mr. Farrand who assisted him in the delicate operation of clearing the air with which the holders and mains were charged. The transition of the supply of gas from the old to the new works was not a simple one; it required skill and practical knowledge, backed up by experience. The works would that night be handed over to Mr. Scott, and it would now be simply a matter of adjustment, regulation, and order.

Mr. FARRAND having suitably replied, the dinner proceedings closed, and the evening was spent in singing and conviviality.

AMERICAN GASLIGHT ASSOCIATION.

[Abridged from the "Official Report" in the *American Gaslight Journal*.]

(Continued from Vol. XXXIV., p. 944.)

The proceeding on the second day of the meeting of the Association (Thursday, Oct. 16) were commenced by the presentation of a report by the Executive Committee as to the place of meeting next year. On their recommendation, it was resolved to hold it in Chicago.

General Charles Roome, who this year retired from the office of President, was elected an Honorary Member of the Association.

After some conversation as to the investment of the surplus funds in the hands of the Treasurer, the reading of papers was resumed.

Mr. CHARLES H. NETTLETON (Derby, Conn.) read a paper on

SUPPLYING GAS WITHOUT A HOLDER.

Early in June last I had the exceptional experience of supplying gas without a holder, and thinking the details of the work might possibly be of some use and interest to the members of this Association, I have jotted down a few notes relating to it, and trust that I shall present them in intelligible, if not in elegant English.

The circumstances and causes which led me to supply gas without a holder were as follows:—The Company I am connected with have but one holder, of a capacity of 50,000 feet. Owing to defective fastenings, the larger part of the wall plates against which the bottom rollers ran had fallen to the bottom of the tank, and as that gave the holder a great deal of play, it rose and fell very unevenly. It was invariably a foot higher on one side than the other, and sometimes two or three feet. Often the crown pulley got off the guide-rails, and occasionally it freed itself entirely, and fell over on its side. I was fearful that any day it might be so disabled that it would be impossible to use it.

This state of affairs had reached such a pass last winter that, although sending out over 40,000 feet, I did not dare raise it but half way up; and as the consumption was rapidly increasing, it was evident that by some means the holder capacity must be enlarged. The Directors voted to build a new holder; but that meant a debt, and consequently I exceedingly disliked adopting their plan. I knew that a city in Massachusetts had been supplied without a holder, and after paying a visit to the place and interviewing the Manager, from whom I received a great deal of encouragement to repair the holder, I resolved to make the experiment of supplying gas without it.

As a preparatory measure, a circular was sent to all the consumers, stating the fact that certain repairs were necessary, and requesting all to use as little gas as they could, and preparing their minds for a possible failure in the supply. The inlet and outlet of the holder were connected by a 4-inch pipe, the drips filled, and in that way the gas passed directly from the station-meter to the mains. In the ordinary supply only one bench of five retorts is used; but a second was fired up. These were each composed of four retorts 12 by 22 inches, and one 15 by 30 inches, all 9 feet long—giving in all 177 feet of retort floor.

In order to economize time, it was arranged to pump out the tank in the night. The holder was grounded at ten o'clock, and, of course, at the same moment gas was supplied direct from the retorts. For a short time more gas was sent out than was needed, and in consequence the pressure ran up from 1.6 to 3.0 inches; but by slacking lids this was soon reduced. The next day and during the following days it was quite easy to keep the pressure nearly uniform, by charging the retorts often with 50 lb. charges. The day man had instructions to watch the pressure-gauge carefully, and when the pressure had fallen to 0.9 inch, to put in a charge. This would cause it to run up to 1.4 inches, and then in about half an hour the operation would be repeated. In this way an average of 4460 feet was sent out each day, between seven o'clock in the morning and six o'clock in the evening.

For the night work, the following routine was generally observed, and

as it worked well, I give it in full. (It was singular to notice that night after night a certain number of retorts were needed by a certain time, the variation being scarcely more than two minutes.) By half-past six all retorts were empty except one, and that contained a fresh charge of 150 lbs. with the pressure at 1.4 inches. All lids were ready luted, coal in waggons, and everything in readiness to charge when gas was needed. By seven o'clock the pressure would drop to 1.2 inches, and a charge of 300 lbs. was put in. It would then run up to 2.2 inches. By twenty-five minutes past seven it would fall to 1.6 inches, when another retort would be charged, and the pressure would increase to 1.8 inches. After ten minutes the pressure would commence again to drop, and on the slightest indication of this a third retort was charged. From this time on it was generally necessary to charge the remaining retorts as fast as two men could do the work. Once and once only the pressure dropped to 1.4 inches, and remained so for an hour; but otherwise it was maintained steadily, during the hours of a large consumption, at from 1.6 to 1.8 inches. After ten o'clock the pressure would increase so that the lids of one or more retorts were slacked. At twelve some fresh charges were needed; but the consumption was so slight that 100 to 150 lb. charges were sufficient, and at daylight this was reduced to 50 lbs. The average daily consumption was 18,100 feet, Sundays excepted.

In only one thing have I any cause for regret. The coal used during the daytime was so slight in quantity, and the heats so high, that the mains became filled with exceedingly poor gas, and this had to be consumed in the early part of the evening, before the fresh and rich gas reached the burners. As all of my time was spent at the works, I did not know how poor it was until one of the consumers spoke to me about it. If that had been avoided, either by the use of cannon or slacking the lids of the retorts before all the gas had been extracted, the work would have been done to my full satisfaction.

Before starting with this work, it was suggested to me that there would be considerable oscillation in the pressure, caused by the revolutions of the exhauster fans, and that the supply would for that reason be unsatisfactory. Such was not the case, however, as the oscillations in the pressure were generally half a tenth, and never greater than 2-10ths. It was so slight that I could not detect it in an ordinary burner.

From the experience in the city in Massachusetts to which I have referred, and my own, I conclude that for this work one square foot of retort floor is needed for every 100 cubic feet of gas consumed in the 24 hours.

Mr. COGGLESHALL, the Manager of the works in Massachusetts referred to in the paper, said his experience was substantially the same, when supplying gas without a holder, as Mr. Nettleton's.

Mr. CARTWRIGHT said he had had experience, not exactly of furnishing gas without a holder, but somewhat similar. At one time he had to construct a temporary holder, of a capacity of about 6600 cubic feet, and float it on the river. The holder was made of 3 by 4 inch scantling, and the sides were covered with ordinary 1-inch pine boards, overlaid with tin to make it tight. This holder being floated in the river, he was enabled to keep the supply going.

Mr. HARRISON inquired what yield Mr. Nettleton had from his coal at the time he was without a holder; also whether he found that financially it would be profitable to run gas-works without a holder.

Mr. NETTLETON replied that the yield of gas was 4 feet per lb. It was not profitable to run gas-works without a holder; and he would not advise stockholders to try it. It was a matter of economy with them at Derby; they could not afford to build another holder. Of course, during the week the holder was out of use, his expenses for coal were more than they ordinarily were.

Mr. HARRISON said that he had had asimilar experience to Mr. Nettleton's. About 15 years ago their holder was not of sufficient capacity to furnish all the gas demanded, and for a time they supplied direct from the mains. They then were enabled to increase the supply and satisfy all demands.

Mr. M'ILHENNY could see no difficulty in supplying a small town without a holder, provided the manufacturing capacity was equal to the maximum consumption. It would, however, be impossible without holders to supply a large city. Where just such an amount of gas as was required could be made as it was wanted, there would not be any difficulty; but where the manufacturing capacity was less than the maximum consumption, it would be impossible.

Mr. CARTWRIGHT asked if Mr. Nettleton had very many complaints among his consumers during the time he was furnishing gas in the way he had described.

Mr. NETTLETON said that there were some complaints about the quality of the gas, some of the consumers saying it would scarcely light. This was caused by the mains being, in the early part of the evening, filled with poor gas; but, of course, when the fresh gas was sent along, it was of the ordinary quality. This could have been avoided by putting in cannon gas, or by not getting all the gas out of the coal. In fact, if he were to go over the same thing again, he could do better.

Mr. NEAL was disappointed with the conclusions arrived at by Mr. Nettleton after his experiments, as he had had great hopes that the paper would show how the cost of distribution could be reduced very materially by dispensing with holders. The result, however, was that it was found impracticable to dispense with them.

Mr. HELME was a little surprised at the view Mr. Neal took of the paper. He (Mr. Helme) had thought that Mr. Nettleton was simply going to give a little of his experience, in order to enable those who sometimes found themselves in tight places about Christmas week, to get out of them; and he thought it had been done very clearly. He was sure no member of the Association would understand that the paper advocated the running of gas-works without a holder. Any one knew that gas was made the whole day long, to be used up in about four hours; and it was further known that, at times (especially during Christmas week), there was a very large increase in gas consumption, and it certainly was of great importance that it should be known how to get out of the emergency when it presented itself. Mr. Nettleton had shown how he tided over precisely such an emergency as many were likely to find themselves in at certain seasons of the year. By adopting the suggestions he had made, 125,000 or 150,000 feet of gas might be sent out with holders of a capacity of 75,000 or 100,000 feet only. In Atlanta it had been done that very week—they had sent out 91,000 feet of gas with a holder capacity of only 80,000 feet, and they expected to be called upon to do the same thing again.

A vote of thanks was accorded to Mr. Nettleton for his paper.

(To be continued.)

INCREASE OF STOREAGE BY THE CLEVELAND WATER COMPANY.—There has recently been completed, at Skelton, by the above-named Company, a service reservoir capable of holding 750,000 gallons, being an estimated supply of water for three days, for Saltburn and Marske. The revival in the iron trade is causing a large increase in the demand for water for boilers at the mines and at the blast furnaces, and all the Water Companies in the district are materially benefiting by the enlarged demand. The reservoir now completed will, it is expected, materially aid the Cleveland Company in their efforts to enlarge the area of distribution of their water.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

During the past week there has been very little actual business doing. Many of the collieries and iron-works have been closed for several days, either for stock-taking or the holidays, and the market has been little more than nominal; but, so far as there is any business doing, the tendency of prices continues upwards, and in the iron trade especially sellers are very firm.

The Lancashire collieries generally, although there has not been much going away during the last few days, are tolerably well supplied with orders, and upward movements in prices are announced here and there. Some of the firms in the Manchester district have put up their furnace coal 5d. per ton this month, and in slack there is a hardening tendency, although there is no actual advance upon the top prices which have been quoted in the market. The average quotations at the pit mouth may be given about as under:—Good Wigan Arley, 8s. 6d. to 9s.; second qualities, 7s. to 7s. 6d.; Pemberton four-feet, 6s. 6d. to 7s.; common house coal, 5s. 6d. to 6s.; steam and forge coal, 5s. to 5s. 6d.; burg, 3s. 9d. to 4s. 3d.; good slack, 2s. 9d. to 3s. 3d.; and common, 2s. to 2s. 6d. per ton.

The increased demand for coke is causing prices in this class of fuel to harden, and some makers have advanced their quotations this month 10d. per ton.

In the iron trade it is difficult to say what prices are ruling at present, as there is so little iron just now, and particularly forge qualities, offering in the market, and as very few makers can quote at all for anything like reasonable delivery, holders of second-hand parcels are able to command pretty much their own price. Lancashire pig iron continues to advance, and this week quotations for delivery into the Manchester district are given at about 62s. 6d. to 63s. per ton, less 2½ per cent. For Lancashire bars delivered into the Manchester district, £8 10s. per ton has been about the nominal quotation; but as many of the makers have been refusing orders altogether, and a further advance is announced in Staffordshire, there is little doubt that after the holidays higher figures will be asked in this market.

The wages agitation in the coal trade continues; but, so far, the colliery proprietors are holding out against the demands of the men.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

Business has been very much of a holiday character over the last fortnight. The weather, too, has been very unsettled and stormy in the North Sea; coasting steamers having thereby failed to keep their time, and have lost voyages. Last week was a broken one at many of the collieries. Altogether, the shipments of gas coals have been below an average. With regard to the coal trade generally, its prospects are improving every week. With the turn of the new year, collieries of all descriptions are likely to get into full employment; and where the trade has been the weakest over the past three or four years—that is, in the local demand—the second-class and inferior coals which have been a drag upon the values of round coals, are becoming a help. As this class of fuel, with coke, gets down to the lowest point possible for them to reach, without involving the coalowners in irretrievable ruin, so the advance in prices is likely to be the greatest as the improvement in the iron trade becomes further developed. The rise in the price of gas coals seems to have been settled for the first half of 1880, if the contracts which have been made are to be taken as the rule. The figure, stated roundly, is about 6s. 9d. per ton, reckoning the discount usually allowed. The price of second-class gas ranges from 6s. 3d. to 6s. 6d., reckoning discount.

With regard to the prospects of the coasting freights in the first half of 1880, there may be a rise of 3d. per ton; but in respect of business to London, the rate of freight will materially depend upon the manner the north country coalowners and London coal merchants settle existing differences. If the latter continue to declare "war to the knife," as they seem disposed to do, upon the coalowners, and "shunt" as many seaborne house coals out of the market as they can, there will be less steam tonnage employed in the house coal trade, and the gas-works and others will have a better command of steamers to enable them to keep up their supplies of coals.

A class of boat usually employed in the coasting trade is likely to be more extensively engaged this year in carrying the better qualities of iron ore from Spain to the United Kingdom. The Baltic trade, too, looks well for steamers. Small coasting vessels and the ordinary sailing colliers—the latter the common carriers of seaborne coals—of 20 or 40 years ago, continue to undergo a gradual process of extinction. Those afloat are very profitless to their owners, and when these vessels are lost they are never renewed. To some extent small coasting steamers occupy their places. But over the course of the next few years, all concerned in the coal trade to lesser ports of the East Coast, the English Channel, and Ireland will have to reckon upon a considerable diminution in the supply of small sailing tonnage, unless the coasting coal trade is replenished through the introduction of foreign vessels into the market.

The manufactured iron trade is kept busy. Most of the large iron-works and foundries are fully supplied with orders. Prices are well sustained. Lead keeps high. The last sale of superior qualities of Spanish lead realized £19 10s. per ton. The chemical trade improved last week. Prices advanced about 5 per cent. all round. The continental trade has made a good beginning with the New Year.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The great disaster of last Sunday week—namely, the destruction of a large portion of the Tay Bridge, together with the loss of well-nigh 100 lives—which may be regarded as a national calamity, was not unattended with features of melancholy interest to the gas world. Two of the victims were employed in the Corporation Gas-Works, Dundee. They were Alexander and William Robertson, brothers, the sons of Mr. William Robertson, salmon fisher, Abernethy. They had been at home visiting their parents during the day, and were returning to Dundee to be ready for their work on Monday morning. It may be remembered that on the occasion of the annual meeting of the North British Association of Gas Managers, held at St. Andrews, in July, 1878, the members spent part of the second day of the meeting in paying a visit to the bridge only a few weeks after its formal opening. They inspected it with a keen interest, and admired it in no mean degree. Judging by their own experience in the way of roofs blown off, gasholders blown over, boundary walls blown down, a number of the members who took part in that interesting visit will perhaps be able to form some notion of the extraordinary severity of the storm which raged over the Tay on the memorable night of the last Sunday of 1879.

This train of thought leads me to the mention of the fact that on the following night the storm, which still continued, performed some ravages in the West of Scotland. One of them was an accident to the smallest and oldest gasholder at the Paisley Corporation Gas-Works. The mishap was caused by the giving way of some of the guide pulleys, the supposition

being that the storm of Sunday evening, when the holder stood somewhat high, had fractured or damaged the parts that gave way on Monday night, thereby causing the top lift of the holder to tilt over, and to effect considerable damage to the lower one. The amount of the damage is estimated at some hundreds of pounds, but the accident did not in any way affect the gas supply of the town.

In the annual statement of the revenue and expenditure of the various Municipal Trusts of Greenock, just published, the following items are given in reference to the gas affairs of the Board of Police:—Revenue, £38,128 7s.; expenditure, £34,060 4s. 3d.; gross debt, £117,731 16s. 10d. In connection with Greenock gas affairs, I may mention that as the result of 25 experiments officially made in regard to the illuminating power of the gas during the past month, the minimum was 26·47 candles; the maximum, 31·48 candles; and the average, 28·63 candles; the average temperature of the gas while testing being 58° Fahr.

The following figures have just been published in reference to the gas manufactured in Dundee during the last ten years:—

Year.	Gas Made.
1870-71	214,295,100 cubic feet.
1871-72	234,224,000 "
1872-73	252,294,300 "
1873-74	265,994,800 "
1874-75	268,945,000 "
1875-76	285,313,300 "
1876-77	292,604,700 "
1877-78	316,054,900 "
1878-79	322,807,700 "
1879-80	Estimate 325,000,000 "

In its annual review of local affairs, the *Dundee Advertiser* remarks that during the past year endeavours had been made to utilize the electric light in different places in the town; but for ordinary use they had only shown that it was not suitable. It was introduced at Messrs. Cox's works, and at the picture gallery in the Albert Institute, and was found, as hitherto, to be too fitful and glaring for purposes requiring steady and pleasant light. At Messrs. Gourlay's shipbuilding yard it is, however, in constant employment, and for outside work it seems not to be equalled when cost is not a matter of consideration.

With the view of getting at the most perfect system of street illumination, the Municipal Authorities of Aberdeen have recently obtained two of Bray and Co.'s lamps with flat-flame burners, one of 80-candle power and the other equal to 120 candles. The two lamps are said to be the first of their kind erected in Scotland for street illumination.

A correspondent, drawing attention to the question of street lighting in Buchhaven, states that the public meeting of which I spoke in my "Notes" last week, only consisted of 32 persons, of whom 11 voted for the motion and 7 for the amendment, while the remaining 14 declined to vote. He further says that the idea of erecting and maintaining street-lamps by public subscription is only entertained by a few parties, and that the inhabitants are to take a more practical method of getting the streets lighted by-and-by.

The Tay Bridge disaster has resulted in cutting off the supply of water, which was passed over to Newport by a system of pipes laid along the bridge from the Dundee system. As mentioned at a meeting of the Dundee Water Commissioners held last Wednesday, the lamentable accident to the bridge carried away upwards of 1000 yards of piping. The interruption to the supply has been attended with great inconvenience to the people of Newport. It was also stated that the Local Authorities had no claim against the Commissioners for the loss of their water supply, as there was a saving clause in the contract, freeing them from the consequences of any accident. In the meantime, Mr. Watson, the Manager of the water-works, is considering what can be done to lessen the inconvenience complained of.

It seems that the supply of water which the Town Council of Dunfermline are now giving to the town of Inverkeithing will entail on the consumers an assessment of not less than 2s. per £1 of rental.

The Glasgow pig iron warrant market was very strongly excited during the past week. An immense business was done daily, and the eager desire to buy seemed not to be abated. The fresh wave of buying from the United States and Canada has grown in volume, and Germany has also come forward as a buyer. On Friday as high as 68s. 6d. cash was paid, which was 6d. over the price paid during the panic last October; but the close was 68s.

THE PURCHASE OF THE COLCHESTER WATER-WORKS BY THE TOWN COUNCIL.—A special meeting of the Colchester Corporation was held on Wednesday, the 24th ult.—the Mayor (Mr. J. Kent) in the chair—to receive, and, if expedient, to adopt the report from the Water Committee, recommending that, should the vendors of the water-works undertaking not have taken up the award of the Arbitrators, the Council do so; also to deal with the question of the necessary loan. The Town Clerk (Mr. H. Jones) read the report of the Committee, as follows:—"Your Committee beg to report that they have received a notice from the Arbitrators that the award is ready to be delivered over on payment of £563 0s. 2d., and recommend that, should the vendors of the water-works undertaking not have done so, the Council take up the award forthwith. And your Committee are unanimously of opinion that the Council shall deal with the question of the necessary loan at once." He said that Messrs. E. Easton and G. W. Stevenson, the Arbitrators appointed to ascertain the amount of the net annual earnings of the Company and the value of the stock, &c., with a view to determining the amount to be paid by the Corporation for the purchase of the undertaking, had reported that, having gone into all the matters in relation to it, they had arrived at a price which they considered just—namely, £79,813 14s. 2d. They also found that each of the parties to the arbitration should respectively pay their own costs of the valuation. After some discussion, the award was received and entered on the minutes. Mr. Moy then moved—"That the Town Clerk apply to the Local Government Board for their sanction to borrow a sum not exceeding £100,000 for the purchase of the water-works, to be raised by loan on the security of the district-rate." Mr. B. Daniel seconded the resolution, and it was carried.

THE WATER SUPPLY OF SITTINGBOURNE.—On Tuesday, the 23rd ult., Major Tulloch, R.E., one of the Inspectors of the Local Government Board, attended at the Town Hall, Sittingbourne, to confer with the Sittingbourne Local Board, the Milton Improvement Commissioners, and the Milton Union Rural Sanitary Authority, as to the best means of providing the districts with an adequate water supply. His visit was really brought about by a petition which the Rural Sanitary Authority had addressed to the Local Government Board, praying them to issue an order combining the district of the three Authorities for the purpose of providing a common water supply for the united district, constituting a joint board of management, and giving such board power to purchase the water-works of the Sittingbourne Local Board. The result of the conference was that the proposed triple alliance was abandoned, and an arrangement suggested by which Milton will derive its supply of water from the

Sittingbourne works, instead of erecting works of its own. By the new proposal the Milton Commissioners will pay half the cost of erecting the works and laying the main to the point at which the junction with Milton will be effected; in other words, Milton would have to pay a sum of about £2000, and also one-third of the annual working expenses and maintenance. This basis was suggested by Major Tulloch as the only one likely to be mutually acceptable to the Milton Commissioners and the Sittingbourne Local Board. By this arrangement Sittingbourne will have the entire power of managing the works, and will be nominally the sole proprietors; and, on the other hand, the Milton Commissioners, while having the right in perpetuity of receiving all the water they require, without any stipulation as to quantity, and being in all respects on the same footing as Sittingbourne in the case of contingencies arising, will have to pay only one-third of the working expenses, and one-third of the cost of maintenance, while Sittingbourne will be paying two-thirds, which is a very fair set-off to the works still remaining in the hands of the Local Board. The Commissioners and the Local Board both assented to the basis of this agreement, the details only of which have now to be settled.

CONSOLIDATION OF THE BROOKLYN GASLIGHT COMPANIES.—Brooklyn is, says the *New York Plumber and Sanitary Engineer*, on the eve of being the theatre of the largest movement in the consolidation of gas companies ever carried through in that country. Monopoly is a distasteful term to the popular ear; but while the public reap a temporary benefit from the opposition of such interests as those represented in gaslight companies, the benefit is a fictitious and temporary one. The confidence in gas securities in New York is very strong; the old Company has for the first time in 30 years passed its semi-annual dividend, yet its stock has made no commensurate fall. The consolidation of the Brooklyn Companies is certainly interesting, as it will put the manufacture of gas and its sale in the hands of such an immense corporation, and one of such advanced ideas, that many new features in manufactures, experiments, and sale of gas will be developed. It is proposed to adopt, partly or entirely, the water-gas process. This process has become possible of late years, owing to the low price of anthracite and naphtha, and also to the expenditure on it of much engineering talent backed by capital. In Brooklyn, if it be adopted, the two processes will have a chance to run in opposition to each other in the hands of the same Company, so that an impartial comparison of the two methods may be looked for. The misfortune of the profession here has hitherto been that questions like this have been considered from too *ex parte* a point of view. The manufacturer of coal gas supported the economy of his own process, and ran down the naphtha and water-gas engineers, while these latter, up to a late period, for some of the reasons assigned, really did fail to give good evidence of success. Most of our best coal gas engineers do not believe in water gas, and the question in this vicinity is now of the greatest degree of importance it ever has reached. But the water-gas phalanx embraces a number of conservative men who formerly frowned it down. Whatever our personal bias, we must acknowledge that both sides possess good advocates, and for that reason must be glad to see the question in a fair way of being decided within the next few months. Should the consolidation take place, it will be of far more than local interest; it will offer to the country the spectacle of consolidation on the largest scale, and recommend or condemn this solution of similar cases in other cities.

THE PURCHASE OF THE MARGATE WATER-WORKS BY THE TOWN COUNCIL.—At a meeting of the Margate Town Council last Tuesday, the question of the purchase of the water-works by the Council was discussed, the Committee reporting that, with the view to the completion of the purchase, they had examined the accounts furnished by the Company, of the expenditure and receipts since Jan. 1 last year, and they found that the balance due to the Company was £473 10s. 10d., which they recommended should be paid. The Town Clerk (Mr. Foord-Kelcey) stated that the Company had in hand the proceeds of the sale of some Three per Cents., which realized £293 5s. 5d., leaving a balance of £80 5s. 2d. to be made good by the Council to square the account. The parliamentary expenses incurred since Jan. 1 last year had been put into the account—viz., £327 17s. 11d.—and there was redemption of tithes, which amounted to above £70, making nearly £400 on account of extraordinary expenditure during the year. Mr. Bloxham moved that the amount due to the Company be left open for further consideration. He wished to see the works handed over to the Corporation; but he thought certain accounts needed investigation. The Mayor said that could be done. If they did not adopt the report then, the matter must stand over altogether. On Jan. 1 they must pay the balance and take possession, or the purchase must be deferred for another year, and this would involve the loss of the interest on the £60,000. Alderman Chambers objected to the purchase on several grounds, the principal ones being that the price agreed upon—viz., £59,000—was excessive, that a better supply of water could be obtained from the Dane than was now provided by the Company, and that the mains, &c., were not in good condition. Mr. Coleman thought they should have had more time for making the final arrangements, and that several of the items were open to question; but he would be unwilling to cause any delay. Still, he thought the Directors, having made such a good bargain for the Shareholders and themselves, might have met the Council more liberally. He also thought the burgesses had been under a great disadvantage in consequence of the Company being so largely represented on the Council, and that it placed such a gentleman as Alderman Pickering, for instance, in a very unenviable position to have to transact the business, in a large measure, for both the vendors and purchasers. After further discussion, a motion for the adoption of the report and the completion of the purchase of the works was carried by 7 to 2. The works were transferred to the Town Council on the 1st inst., the whole of the purchase-money (£59,000) having been raised by debentures subscribed in the town, and repayable within 60 years.

Register of Patents.

2397.—**LAKE, W. R.**, Southampton Buildings, London, "*Improvements in apparatus for carburetting gas.*" A communication. Provisional protection only obtained. Dated June 15, 1878.

This invention relates to an apparatus or carburetter, divided into two general compartments or sections by a diaphragm, the upper compartment or section forming a tank, and the lower compartment or section forming a generator. Within the generator there are two horizontal shelves or discs arranged one above the other, provided with upwardly turned lips or flanges around their peripheries, and with a series of perforations surrounded with upwardly projecting nipples or guards. Each of the shelves is also provided with a gas-pipe or duct, and is fitted closely in the body of the generator. Between the bottom and lower shelf there is a spiral or evolute gas-duct, composed of a vertically arranged coiled strip of sheet metal, and between the shelf and the upper shelf there is a like coil or duct. The lower shelf rests upon the lower coil, and the other shelf upon the upper one, and between the upper shelf and diaphragm

there is a series of radial partitions provided with lateral openings, and a tube on which the diaphragm rests.

The tube and partitions are provided with small openings near the bottom, but both the partitions and the tube may be omitted if desired; or the partitions may be used on all of the shelves, and also on the bottom, if desired, instead of the spiral ducts, the spaces between being filled with wool, sponge, or other good absorbent; but the spiral ducts are preferable. A float is disposed in a well in the lower part of the generator, this well being provided with a tubular extension reaching above the upper shelf, and surmounted with a parachute or cap, through which the float-rod passes. A screw plug is fitted closely in the diaphragm, and through the centre of this plug there is a vertical opening, in which the stem of the valve works loosely. The upper side of this valve, the diameter of which is nearly as great as that of the cap, is covered or packed with leather, and there is a series of perforations or conduits leading from the tank through a plug to an opening in which the stem works, and thence to the generator below. A valve, concave on its lower side, is provided to receive the upper end of the float rod, and in the upper end of the stem there is a pin to prevent the dropping of the stem too low as the float falls.

The walls of the coils, the lower sides of the shelves and diaphragm, the sides of the partitions and tube, and the interior walls of the generator are to be covered with felt or cloth for absorbing the gasoline or hydrocarbon oil, and thus producing a greater evaporating surface.

2440.—**SUEG, W. T.**, Vincent Street, Westminster, "*Improvements in counterbalances for gasholders.*" A communication. Patent dated June 19, 1878.

This invention has for its object the construction of counterbalances for gasholders in such a manner as to offer great facility for varying their weight in accordance with the pressure it is desired that the holder shall give, and consists in providing as many iron tanks (either galvanized or otherwise) as it is requisite to have counterbalance weights. One of the tanks may be suspended from the holder near each column, or each intermediate column, by a chain which passes over suspension pulleys, the same as when iron weights are employed as counterpoises; or one tank only may be used, having chains fastened to it which pass over appropriate pulleys, and are fixed to the holder at suitable points of suspension. On each side of each column to which these tanks are applied there is a guide-rod or bar rising from the curb of the holder tank to the girders connecting the tops of the columns. These guide-rods or bars pass through eyes attached to each tank, and serve to guide the tank, so as to prevent it from striking against the holder when rising or falling.

For guides, grooved wheels may be substituted instead of eyes, and arranged to roll against the vertical bars.

Near each column, and rising to about the top of the girders, is a water-pipe, curved at the top, so that its mouth and a flexible tube depending therefrom may be over its corresponding tank. When the holder is down and about to be raised by the incoming gas, the tank or tanks will be elevated, and water is then caused to flow from each of the pipes into its tank until the weight of the tanks and the water contained in them counterpoises the holder, or reduces the pressure of it to the requisite extent. When the holder is full and the supply of gas to the district is about to commence, water may be withdrawn from the tanks by suitable pipes and taps until the holder gives the desired pressure. The taps may be so arranged as to be capable of being opened or closed by means of rods, levers, chains, or wire ropes, even when they are at a considerable altitude from the ground, and the water in falling may be directed into the holder tank.

2489.—**REDWOOD, T.**, Lower Clapton, London, "*Improvements in the manufacture of gas for burning.*" Patent dated June 22, 1878.

The improvements comprised in this invention relate to certain modifications of a process for the manufacture of gas, for which the present inventor, in conjunction with T. B. Redwood, obtained a patent, No. 2105, dated May 30, 1877. [See JOURNAL, Vol. XXXII., p. 429.] In that process the removal of dust and the solid and more easily condensable constituents of tar from the crude gas as it issues from the hydraulic main, the introduction of the thus partially purified gas into the part of the apparatus called the converter, together with as much as possible of the volatile hydrocarbon oils usually present in the tar, the dilatation or expansion of the gas by means of an exhauster, and the addition of steam to it during its passage through the converter, are important features of the invention, by the combined influences of which the inventors state they are enabled to apply to the gas and vapours the required degree of heat for increasing the volume of the gas by breaking up the more complex and condensable molecules and converting them into permanent gas, and for otherwise augmenting the value of the gas as a source of light.

In that process the gas is subjected, as it passes through the converter, for a limited time to a temperature of about 1100° Fahr. For effecting this purpose the converter is filled with balls or masses of solid substances arranged so as to break up the current of gas and expose to it a large heated surface. The solid substances used in the converter are most efficacious when they have a porous or spongy texture, and the present inventor states he has found that other substances besides those named in the 1877 patent, if brought into this condition, may be used with effect. Thus glass, slag, brick, or baked clay, and other similar substances, may be used if reduced to powder and afterwards made into a paste by mixing them with some agglutinating and other materials, which, when the paste has been dried and baked, shall cause it to have a porous texture, so that it may be easily permeated by the gas.

The modifications now introduced in the process relate to the materials that may be used in the converter, and the method of preparing such materials so as to increase their efficacy, by causing them to be very porous, and otherwise adapted for the purpose contemplated.

China or other dry clay is used as an agglutinating material, and a mixture of equal parts of powdered alum and bicarbonate of soda is employed for the purpose of causing the required porous texture of the prepared balls or masses. Also iron nails or other small pieces of iron are employed for aiding the conduction of heat into the centres of the porous balls, and through the balls to the centres of the converting cylinders. This method of preparing the balls is applicable to those made with plaster of Paris, which is preferred, and also to those made with the other materials named.

The following example will serve to illustrate the method of preparing the balls:—To 10lbs. of plaster of Paris and 10lbs. of china clay are added 2lbs. of powdered alum and 2lbs. of bicarbonate of soda. Having thoroughly mixed these powders together, sufficient water is used to form a plastic mass, which is divided into balls or masses about the size of an egg. By the mutual reaction of the alum and carbonate of soda, carbonic acid gas is evolved in the paste. This causes the balls to swell and become porous, like the rising of dough in making bread. While the balls are still soft there are introduced into each ball, at different parts of its surface, five or six cast-iron nails long enough to pass from the circumference to near the centre. The balls are afterwards dried and baked, when they retain their porous condition, and are employed in the treatment of the gas in the manner described in respect to the use of plaster of Paris in its natural or usual form in the specification of the 1877 patent.

2516.—MEAD, W., Laurence Pountney Hill, London, "*An improved process for converting into caustic lime spent lime which has been used in the purification of illuminating gas.*" A communication. Patent dated June 24, 1878.

In carrying this invention into practice the spent lime is first pressed into bricks or blocks, the operation being effected by the same means that are employed for forming ordinary bricks. The bricks are then placed in a kiln, and subjected to increasing heat sufficient to drive off the moisture, ammonia, carbonic acid, and sulphur which the lime has absorbed in purifying the gas. An ordinary brick press, which may be operated either by hand or other power, is used. The length of time necessary to carry out the operation depends somewhat upon the size of the kiln and the intensity of the heat; but as the blocks will shrink in size as they lose carbonic acid, sulphur, and the like, it can be ascertained from such shrinkage when the burning is finished. From 20 to 36 hours should be sufficient to accomplish this object.

[An illustrated description of the process to which this patent refers is given in our "Correspondence" columns this week—see ante, p. 16.]

2525.—BOULTON, M. P. W., Tew Park, Oxford, "*Improvements in gas motor engines.*" Provisional protection only obtained. Dated June 25, 1878.

According to these improvements the heat abstracted from the cylinders is used to generate steam to assist in working the engine. The combustible charge is contained in two cylinders and caused to enter a receptacle in the main cylinder of the engine, where they are mixed and undergo combustion. As the charges are expelled from the cylinders, fluid from the receptacle enters behind the charging piston. The fluid works in two cylinders. In the working stroke the fluid passes to the smaller one, expanding therein, and by the difference of the areas the pistons perform their work. A refrigerator and passages governed by valves are provided, so that the fluid can pass from one cylinder to the other, either through the refrigerator or through another passage.

2526.—KIRKHAM, T. N., Abingdon Street, Westminster, and CHANDLER, S., Newington Causeway, "*Improvements in gas-purifiers or scrubbers.*" Provisional protection only obtained. Dated June 25, 1878.

This invention consists in making the layers or strata in gas-scrubbers or washers of non-porous materials, preferably of glass, or of substances coated with a vitreous matter, and of a spheroidal, globular, or oval shape. By the adoption of a uniform regular shape in these scrubbing materials—say the globular—the area of the space of the beds or strata of filtering materials may, the inventors state, be decreased in the ratio of one-third, which effects a great saving in the cost of the scrubbing vessel, and in the cost of the materials used therein. The invention is applicable to the horizontal as well as to the vertical form of washer or scrubber; and when the horizontal form is used the spheroidal scrubbing materials may be placed in a cage or drum, and revolved in a vessel or vessels containing water.

2533.—SHEDLOCK, J. J., Notting Hill, London, "*Improvements in the manufacture and purification of gas, and in apparatus connected therewith.*" Patent dated June 25, 1878.

In carrying this invention into effect, the coal or other solid hydrocarbon is first treated in the ordinary manner for the abstraction of its gases; the liquors condensed from the gas are then treated so as to convert them also into gases, which are combined with those given off from the coal.

For this purpose the tar, as it condenses, is conveyed into a retort charged with coke or other suitable material, and heated to the required temperature. The ammoniacal liquor condensed from the gas, in being conveyed to the retort, is subjected to a certain temperature for the purpose of vaporizing the ammonia, and the remaining water may be either conveyed directly to the retort, or on its passage it may be converted into steam and superheated, in which state it passes through the coke or other material contained in the heated retort, and by which means it is decomposed into its elements. The hydrogen, in its highly-heated state, is brought into contact, in the upper part of the retort, with the nascent gas or vapour produced by the distillation of the tar, and in which condition a combination will take place between the hydrogen and the heavy hydrocarbon gases or vapours. These gases are then conveyed by pipes to the chamber or vessel, where they are intimately mixed with the gases first produced, and with the gaseous ammonia. The combined gases are then conveyed by pipes to the apparatus, in which they are brought into contact in minute quantities with the liquid contained in the apparatus, which will cause a combination to take place between the acid and the alkaline impurities contained in the gas. This liquid may be water, or, if preferred, an alkaline solution for the purpose of neutralizing the acid impurities contained in the gas.

In producing a gas by the distillation of a liquid hydrocarbon, a similar retort and apparatus may be used, omitting the retorts in which the coal or other solid hydrocarbon is treated, and using only that in which the tar is distilled and the water or its vapour is decomposed; but in order that the gas produced may be of uniform quality, it is necessary to carefully regulate the relative qualities of water, or its vapour, and liquid hydrocarbon entering the retort.

2538.—HART, J., SAMPSON, J. L., and COLEBROOK, C. T., London, "*Improvements in the construction of pumping-engines.*" Patent dated June 25, 1878.

In these engines the air-vessel and pump-barrel are made in one or more parts, in such a manner that the pump-barrel, which is made with an open top, is formed within and at the lower part of the air-vessel, and divides it into suction and delivery compartments, each of which is furnished with an air space, and the steam cylinder is placed at the opposite end or top of the air-vessel and bolted thereto. The piston-rod passes direct from the steam cylinder into the air-vessel, and works through a comparatively deep guide. It is packed either with rings, or may pass through suitable packing arranged within the guide.

2575.—PIEPER, C., Dresden, "*An improved water-meter.*" A communication. Patent dated June 26, 1878.

This meter consists of two cylinders provided with pistons, the rods of which act by suitable connecting-rods on a common crank-shaft. The cylinders are either placed at an angle to each other—by preference at a right angle, and in this case the two connecting-rods may operate on a single crank—or they are fixed opposite to each other, which position requires the shaft to be provided with two cranks, arranged so that the one is acted upon by its connecting-rod, while the other passes either of its dead centres. The water passes from the supply-pipe into a chamber, from which it is admitted into either cylinder by a slide-valve. These slide-valves, which will also cause the water to be discharged, are worked by a crank or cranks on the shaft of the apparatus. A counter is connected with the shaft, for registering its number of revolutions; or, what is generally preferred, the number of gallons, cubic feet, &c., dependent upon these revolutions and the contents of the cylinders.

2609.—BOULTON, M. P. W., Tew Park, Oxford, "*Improvements in gas motor engines.*" Provisional protection only obtained. Dated June 29, 1878.

In this engine a vertical cylinder with a piston has at the lower end appa-

ratus for introducing the mixture of gas and air. The upper end of the cylinder contains a steam space, and the piston carries on its upper side a certain quantity of water in contact with the interior surface of the cylinder. The hot gases resulting from the combustion of the mixture as they expand and drive the piston upwards heat the metal of the cylinder; and on the return stroke the piston brings the water in contact with the heated surfaces, when steam is generated in the space above the piston.

2644.—ALSING, G. V., Bradford, Yorks, "*Improvements in the treatment of sewage and other polluted waters and their deposits, and in apparatus employed therein.*" Provisional protection only obtained. Dated July 2, 1878.

According to these improvements, 1 part of sulphuric acid is added to 80 parts of sewage, and the heavy parts allowed to deposit in a catch-pit. It is then screened, and mixed with one ton of clay to every million gallons of sewage. It afterwards passes to a depositing tank, the liquid portion being filtered off through coke, whilst the sludge deposited is removed and used in the manufacture of bricks, drain-pipes, and other purposes for which clay is employed.

2662.—KENYON, H., Warrington, "*Improvements in purifying gas and in the manufacture of ammoniacal salts.*" Provisional protection only obtained. Dated July 3, 1878.

These improvements consist in saturating dried sawdust with about 75 per cent. of chloride of zinc, and the absorbent so produced is put into the purifier in place of lime or oxide of iron, and chloride of ammonium is thus formed, also oxide of zinc. By continuing the operation, part of the oxide of zinc is dissolved by the ammonia, and chloride of ammonium and ammoniate of zinc are retained, along with a little tar and sulphur and any of the oxide of zinc not dissolved. This is washed with water or washings from a previous operation, or with ammonia and water, if it be desired to dissolve all the oxide of zinc, thus obtaining chloride of ammonium and ammoniate of zinc salts in solution.

If oxide of magnesia be required, the chloride of magnesium is dissolved, and dried sawdust is saturated therewith (whilst the chloride is hot, if a strong solution be wanted), containing, say, from 30 to 40 per cent. of chloride of magnesia, and this is used in place of the chloride of zinc absorbent, and thus chloride of ammonium and oxide of magnesia are produced.

Gas may be washed with these salts in any convenient washer without sawdust, the same salts being formed.

2680.—BALL, C. J., Brompton, London, "*Improved apparatus for raising and pumping liquids.*" Patent dated July 4, 1878.

In this apparatus a pipe of suitable size is immersed in the liquid to be raised, and a current of compressed air or other gas is forced into the pipe at a convenient depth, so as to destroy the equilibrium between the outside liquid and that within the pipe, thereby causing an upward current which would draw with it any material that might be in the liquid in which the apparatus is immersed. A current of water under suitable pressure may, however, be used instead of compressed air.

2683.—FOULIS, W., Glasgow, "*New or improved apparatus for governing the flow and pressure of water and other liquids.*" Patent dated July 5, 1878.

This invention is in part based upon the apparatus for regulating the distribution of gaseous bodies described in the specification of a patent granted to the present inventor, dated Sept. 19, 1876, No. 3655. [See JOURNAL, Vol. XXIX, p. 660.]

According to the first modification, the governor consists of a casing with inlet and outlet openings, and wherein is contained a valve having a cylindrical prolongation, the diameter of which is equal to that of the valve. This cylindrical prolongation fits into a corresponding chamber in the casing, and is packed either with a cup leather, asbestos, or with the equivalent thereof. The inlet of the apparatus is on one side of the valve-seat, and the outlet on the other side. The cylindrical chamber is connected by a pipe, either with the inlet side of the governor or with any separate source of liquid supply, which liquid, acting upon the piston of the governor, regulates the extent of opening of the valve, and thereby produces the requisite outlet pressure. On this pipe a regulator may be placed for varying the pressure in that chamber according to the outlet pressure required.

In cases where it is thought desirable to reduce the travel as well as the diameter of the valve of the governor, two valves of equal diameter on a common stem may be used, and where it is desired to maintain a constant ratio between the inlet and outlet pressure, the area of the piston is made less than that of the valve or valves.

For the purpose of controlling the pressure of water in pipes other than main-pipes—such, for example, as in the service-pipes to houses—there is placed on the pipe a double piston-valve loaded by weights, which maintain the valve open until the outlet pressure begins to rise above the desired point, in which case this outlet pressure acting upon the under side of the piston-valve and against the weights, causes the piston to move until it closes the inlet to the required extent for reducing the outlet pressure to the fixed point. The communication between the inlet and outlet may consist of a series of narrow slits or their equivalents, for the purpose of ensuring a gradual action.

The form of apparatus last described may be applied to the pipe communicating with the piston chamber of the governor first described, in which case it is provided with an overflow opening communicating with the outlet or with the drain.

In cases where a limited pressure is available for acting on the piston of the governor first described, the piston may be of larger area than that of the valve.

2686.—COWAN, W., Edinburgh, "*An apparatus for automatically varying the load and pressure in gas governors.*" Patent dated July 5, 1878.

This apparatus—The Automatic Pressure Changer—formed the subject of the two papers read by Mr. Cowan at the last meetings of the British and North British Associations of Gas Managers. [See JOURNAL, Vol. XXXIII, p. 981, and Vol. XXXIV, p. 299.]

APPLICATIONS FOR LETTERS PATENT.

5195.—MAYNARD, H. N., Westminster, "*Improvements in the construction of hydraulic valves for controlling gas and fluids.*" Dec. 19, 1879.

5197.—HADDAN, H. J., Westminster, "*Improvements in the mode of purifying gas.*" A communication. (Complete specification.) Dec. 19, 1879.

5209.—ROSS, A. Q., Cincinnati, U.S.A., "*Improvements in apparatus for charging and discharging the retorts of gas manufactories.*" (Complete specification.) Dec. 20, 1879.

5236.—SALSBURY, H., Long Acre, London, "*Improvements in or applicable to gas-stoves for heating 'soldering irons' or copper bits, parts of which are applicable for other gas-heating purposes.*" Dec. 22, 1879.

5239.—JOHNSON, J. H., Lincoln's Inn Fields, London, "*Improvements in valves for steam, gas, and air engines.*" A communication. Dec. 22, 1879.

- 5256.—NICOLAIDES, A., Constantinople, "Improved means of generating motive force by the combination of water and air, or by the combination of water and gas." Dec. 23, 1879.
- 5267.—SUGG, W. T., Westminster, "Improvements in the construction of gas lamps or lanterns." Dec. 24, 1879.
- 5275.—WILD, J., Huddersfield, Yorks, "Improvements in the method of and apparatus for regulating or controlling the pressure of gas, being also applicable for regulating or checking the pressure of steam, water, or other fluids." Dec. 24, 1879.
- 5283.—SMITH, A. H., Clifton, Gloucester, "Improvements in gas-stoves." Dec. 26, 1879.
- 5310.—BONNEVILLE, H. A., Paris, "Improvements in the manufacture of gas, and in the apparatus used therefor." A communication. (Complete specification.) Dec. 29, 1879.
- 5323.—BULL, H. C., Brooklyn, U.S.A., "Improvements in the manufacture of gas and in apparatus therefor, and for other purposes." Dec. 31, 1879.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 2537.—YOUNG, W., Clippens, N.B., "Improvements in the utilization or employment of certain mineral oil products for the manufacture of illuminating gas." June 25, 1879.
- 2641.—SHONE, I., Wrexham, Denbigh, "Improvements in and relating to apparatus for raising and forcing water or other liquids." June 30, 1879.
- 2685.—HOLMAN, S., Queen Victoria Street, London, "Improvements in apparatus employed in the manufacture of gas." July 2, 1879.
- 2710.—HALLSWORTH, S., Armley, and BAILES, R., Woodhouse Carr, Yorks, "Improvements in treating burnt residue from spent oxide of iron, to be used or employed in purifying coal gas." July 3, 1879.
- 3555.—SIEMENS, F., Dresden, Germany, "Improvements in burners for gas, petroleum, and other lamps or lighting apparatus." Sept. 4, 1879.

- 3747.—COX, J. B., Torquay, Devon, "Improvements in gas regulators or governors for regulating the supply and pressure of gas." Sept. 18, 1879.
- 3848.—GRICE, W., Birmingham, "Improvements in retorts used in the manufacture of coal gas." Sept. 24, 1879.
- 4035.—WILSON, H., Stockton-on-Tees, Durham, "Improvements in apparatus for blowing, exhausting, cooling, heating, purifying, and attenuating air, gas, and fluids." Oct. 6, 1879.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

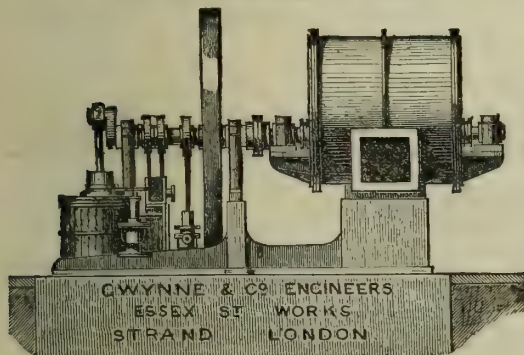
- 4459.—GENT, P., "Improvements in and appertaining to gas-stoves." Nov. 13, 1876.
- 4526.—SYMES, G., "Improvements in apparatus for manufacturing, purifying, and economizing gas, parts of which improvements are applicable for other purposes." Nov. 22, 1876.
- 4563.—KELEN, L. VAN DER, "Improvements in gas-stoves." Nov. 25, 1876.
- 4576.—MATHIESON, C. F., "Improvements in the manufacture of gas." Nov. 25, 1876.
- 4585.—RUSSELL, T., "A new or improved method of charging and drawing gas-retorts." Nov. 27, 1876.
- 4633.—TWENTYMAN, A. C., "Improvements in fire-grates and furnace-grates." Nov. 30, 1876.
- 4675.—HOWARD, E., "Improvements in apparatus for preventing waste of water in water supply to closets, drinking fountains, wash-hand basins, and other water supply appliances." Dec. 2, 1876.
- 4824.—FOULIS, W., "Improvements in drawing retorts, and in the machinery or apparatus employed therefor." Dec. 13, 1876.
- 4830.—BROMLEY, U., CROWE, G., and JAMES, W., "Improvements in and relating to motive-power engines and pumps, applicable also in part to water-meters." Dec. 14, 1876.

Share List of Gas and Water Companies.

(Corrected by Mr. ARTHUR G. PRATER, 23, Cornhill, from the latest Stock Exchange Quotations.)

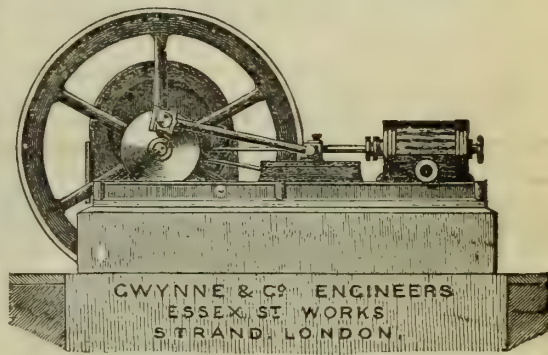
Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.
589392	10	Gas Companies.	£ s. d.	£ s. d.	£	6200	5	Gas Companies.	£ s. d.	£ s. d.	£	12500	5	Gas Companies.	£ s. d.	£ s. d.	£
10000	10	Alliance and Dublin	10 0 0	10 0 0	153-16	300000	100	Georgetown, Guiana	5 0 0	7 0 0	41-47	2000	5	Singapore (Lim.)	5 0 0	7 10 0	53-64
5000	20	Anglo-Romano	20 0 0	10 0 0	21-23	115000	100	Glasgow Corporation	100 0 0	9 0 0	205-210	500000	Sk.	Do., preference	5 0 0	7 10 0	53-64
1500	20	Bahia (Limited)	20 0 0	4 0 0	12-13	7000	100	Do., do.	100 0 0	6 15 0	153-160	..	5	South Metropoli.	100 0 0	11 10 0	198-202
40000	5	Do., 2nd pref.	20 0 0	7 10 0	20-22	5000	100	Grimsby Gas, A.	100 0 0	0 0 0	186-190	..	5	Do., "B"	100 0 0	0 0 0	185-190
10000	5	Bombay (Limited)	5 0 0	7 10 0	57-64	2000000	100	Hampton Court	10 0 0	10 0 0	15-16	1500	10	Tottenham & Ed-	5 0 0	10 0 0	81-83
10000	5	Do., fourth issue.	4 0 0	7 0 0	1-14 pm.	7000	10	Hong Kong (Lim.)	10 0 0	10 0 0	143-154	1500	10	Wandsw. & Putney	10 0 0	10 0 0	143-154
10000	10	Bournemouth	10 0 0	3 0 0	133-144	5000	10	Hornsey	10 0 0	10 0 0	15-16	1500	10	Do.	10 0 0	7 10 0	124-134
229700	..	Brentford	100 0 0	9 0 0	148-53	2000000	100	Imperi. Continental	100 0 0	10 p.c. & 172-175	2 p.c. bonus	4000	10	Do.	10 0 0	7 0 0	114-12
..	20	Do., 5 per cent. pref.	100 0 0	5 0 0	95-100	..	..	Kingston	..	7 0 0	114-124	2400	5	West Ham	5 0 0	10 0 0	82-94
5400	20	Do., C shares	18 0 0	9 0 0	06-8 pm.	..	..	Lea Bridge	..	7 0 0	114-124	..	10	West Kent	10 0 0	10 0 0	14-16
5000	20	Brighton	20 0 0	10 0 0	32-34	..	..	Liverpool United	100 0 0	10 0 0	180-183	..	5	Woolwich, Plumstead, and Charlton	5 0 0	16 0 0	9-10
14000	20	Brighton and Hove	20 0 0	10 0 0	32-34	561000	100	Do., B	100 0 0	7 0 0	125-135	..	..	..	..	..	..
7223	20	British (Limited)	20 0 0	10 0 0	32-34	1691000	100	London	100 0 0	10 0 0	175-178	..	..	..	..	..	..
1500	10	Cagliari (Limited)	10 0 0	5 0 0	9-10	3865000	Sk.	Do., 1st pref.	100 0 0	6 0 0	120-125	..	..	..	..	..	..
550000	Sk.	Colney Hatch	100 0 0	11 0 0	173-178	1500000	Sk.	Do., A shares	25 0 0	6 0 0	29-31	..	..	..	..	..	..
700000	Sk.	Commercial	100 0 0	8 0 0	135-40	7622	25	Do., Debent. stk.	100 0 0	51 & 61	..	..	..	..	..	..	..
20000	20	Do., 7 per cent.	20 0 0	8 0 0	17-18	26692	Sk.	Malta and Mediter-	5 0 0	2 10 0	2-24	..	..	..	..	..	..
20000	20	Continental Union	20 0 0	6 10 0	3-3 dis	15000	5	anean (Limited)	5 0 0	7 10 0	5-54	615000	100	Chelsea	100 0 0	6 10 0	170-174
20000	20	Do., new	14 0 0	6 10 0	22-23	..	..	Do., preference	2 5 0	1 0 0	13-14 dis	1624700	100	East London	100 0 0	6 10 0	173-178
10000	20	Do., preference	20 0 0	7 0 0	118-123	..	..	Mauritius (Limited)	20 0 0	6 0 0	13-14	10798	50	Grand Junction	50 0 0	5 0 0	99-101
750000	Sk.	Crystal Palace Dis-	100 0 0	10 0 0	170-52d.	..	..	Monte Video (Lim.)	20 0 0	5 0 0	63-7	3840	25	Do., 4 shares	25 0 0	5 0 0	49-51
1300000	Sk.	Do., 7 per cent.	100 0 0	7 0 0	118-123	..	..	Niteroy, Brazil	10 0 0	5 0 0	33-44	6160	25	Do., new ditto;	25 0 0	5 0 0	44-48
500000	Sk.	Do., preference	100 0 0	6 0 0	118-123	..	..	(Limited)	10 0 0	9 0 0	63-7	5551800	100	max. div., 7 1/2 p.c.	100 0 0	8 0 0	225-235
25000	6	Do., ordinary 7	1 4 0	7 0 0	4-1	30000	5	Orizaba (Calcutta)	8 10 0	9 0 0	4-14 pm	7818000	100	Kent	100 0 0	6 10 0	172-177
7100	25	Edinburgh	25 0 0	10 0 0	46-48	30000	5	Do., new shares	5 0 0	3 0 0	2-24	3261500	100	Lambeth	100 0 0	6 10 0	173-177
23406	10	European (Limited)	10 0 0	10 0 0	17-15	10000	10	Osman (Limited)	10 0 0	4 10 0	43-51	442	100	Do., max., 7 1/2 p.c.	100 0 0	6 10 0	173-177
12000	10	Do., new shares	5 0 0	10 0 0	2-3 pm.	27000	20	Paris (Limited)	20 0 0	10 0 0	33-35	400000	100	New River	100 0 0	10 0 0	38320-350
35406	10	Do., new shares	5 0 0	10 0 0	2-3 pm.	3600000	100	Phoenix	90 0 0	7 10 0	111-115	4475	100	Do.	85 0 0	10 0 0	101-103
4096300	Sk.	Gaslight & Coke A.	100 0 0	4 0 0	73-77	1440000	Sk.	Do., new max. 7 1/2	100 0 0	5 0 0	95-99	6668000	100	Do., deb. sk., 4 p.c.	100 0 0	4 0 0	162-165
1000000	Sk.	Do., B.	100 0 0	5 0 0	153-164	..	..	Do., capitalized	16 0 0	10 0 0	13-15 pm	3247000	100	Do., D shares.	100 0 0	6 0 0	145-148
50000	10	Do., 5th do.	100 0 0	10 0 0	205-210	..	..	Do., new, 1876.	10 0 0	10 0 0	16-17	700000	100	Do., new ordnry.	100 0 0	4 0 0	..
2000000	Sk.	Do., C 10 p.c. pref.	100 0 0	10 0 0	205-210	..	..	Richmond (Surrey)	10 0 0	10 0 0	16-17	1600	100	Do., new ordnry. No.1	40 0 0	4 0 0	..
3000000	..	Do., D do. do.	100 0 0	10 0 0	205-210	37500	20	Rio de Janeiro	30 0 0	10 0 0	25-26	15073	61	West Middlesex	61 0 0	6 1/2 p.sh.	162-165
1650000	..	Do., E do. do.	100 0 0	10 0 0	205-210	..	..	(Limited)	20 0 0	10 0 0	25-26	..	..	..	..	..	..
300000	..	Do., F 5 do. do.	100 0 0	5 0 0	101-4	1500	324	Shanghai	100 0 0	10 0 0	197-198	..	..	..	..	..	..
300000	..	Do., G 7 1/2 do. do.	100 0 0	7 10 0	150-156	135000	100	Sheffield, A.	100 0 0	10 0 0	193-197
1300000	..	Do., H	100 0 0	7 0 0	125-128	99700	100	Do., C	100 0 0	10 0 0	193-197

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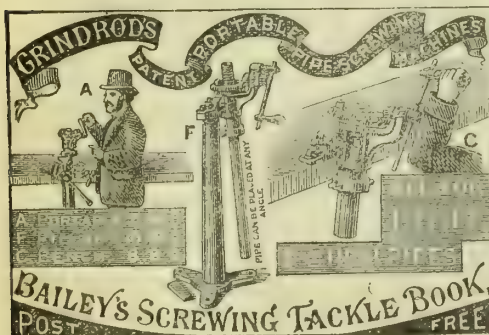
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D 4	8	4	10	3,150	40
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Post Orders to be made payable at the Chief District Office, St. Martin's-le-Grand, London, to Walter King, 11, Bolt Court, Fleet Street, E.C.

TO CORRESPONDENTS.

H. E. C.; A. A. L.—Thanks for letters received.

J. C.—Your letter is noticed below.

A. B.—No date has yet been fixed for the issue of Vol. III of "King's Treatise on Coal Gas;" but several months will elapse before it can be completed. Due notice of its publication will, however, be given in our advertising columns.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 13, 1880.

Circular to Gas Companies.

In the present number we commence our usual abstract of the Gas Bills which will be promoted in the coming session of Parliament. To-day we only give those put forward by Gas Companies in order to obtain incorporation with statutory authority, and those promoted by already incorporated Companies to obtain more extended powers. In general, we may say that, in these Bills, what we may call the established lines of legislation have been followed. We are sorry to see that only two Companies apply for incorporation. There may have been special reason for this, for the dissolution of Parliament, which a short time since seemed probable, would have rendered nugatory the exertions of any Companies to obtain legislative sanction to their Bills. In one of the Bills to which we are now referring, the Company, in deference to Standing Orders, have proposed to adopt auction clauses and the sliding scale; in the other case, the sliding scale is pro-

posed, but no auction clauses. When, however, the latter Bill is before the Chairman of Committees in the House of Commons, the defect, if it be a defect, may be remedied. Similarly, in the majority of the Bills, the Companies who have not yet been subjected to recent legislation have offered to submit to the regulations required by the recent Standing Orders proposed by Earl Redesdale and Mr. Raikes.

We are pleased to observe that every year the number of Companies who have asked for power to supply fittings, and more especially apparatus for the consumption of gas for other than illuminating purposes, increases. We look forward to the time when a gas-stove for cooking and heating will be considered part of the common furniture of every householder. We know of no instance in which such apparatus, having once been adopted, has been given up. The London Company again come forward with their Bill, which we hope will this year meet with the success that it merits. The consumption of gas in the Metropolis would be enormously increased by the use of these appliances. There is room, too, for a large development of the use of gas for the production of motive force. There are so many cases in which the employment of mechanical power is desirable, but in which the use of a steam-engine is inadmissible, that we feel satisfied the gas-engine requires only to be better known to be thoroughly appreciated. Many people complain of the first charge for the engine; but as a larger demand for them springs up, the cost of production will decrease, and they will doubtless be sold at a much lower rate. In the sale of fittings for the use of gas for lighting purposes care and caution will have to be exercised; and Gas Companies must avoid undertaking the fixing of these apparatuses, as this might land them in serious responsibilities. The services of the gas-fitter proper cannot be dispensed with. The rôle of the Company is, after the consumer has made choice of his fittings and decided on the number of lights he will employ, to advise on the size of the pipes and meter required to furnish the quantity of gas needed, and the best burners to use. The superintendence of the Company should commence at the service-pipe, and extend over the house. Such superintendence, intelligently exercised, would prevent nine-tenths of the complaints which now worry Gas Companies. The thick fog which prevailed during the past week severely taxed the energies of gas managers, and complaints have been made as to the quality and quantity of the gas supplied during the periods of darkness. A part of these may perhaps be ascribed to the use of fittings inadequate to carry and consume to advantage the gas, necessarily sent out at a lower pressure than usual.

Among the Bills to be promoted for giving extended powers to Gas Companies, we may particularize that of the Liverpool United Company, who, desirous of raising further money, have elected to borrow in place of issuing new shares. The additional sum they require is not, indeed, large in proportion to the sum they have already raised. It is, in fact, only £70,000, which is wanted for the extension of their Linacre works. It is, we rather think, an entire novelty for a Gas Company to go to Parliament for simple borrowing powers. In this case, however, we regard the policy as sound. It will, in the first place, prevent all opposition on the part of the Corporation, who, for reasons which may be guessed, would strongly object to see any great additions made to the capital of the Company; and then, in any case, the modest proposals of this Bill saves the infliction of legislation which we regard as inimical to the true interest of Shareholders. For these reasons we regard the proposition of the Company with much favour, and have no doubt the Bill will meet with the success it deserves.

The idea of the advantages of amalgamation seems to be spreading into the country, and we notice a Bill which is intended to combine into one undertaking the Dartford, Darenth Vale, and Greenhithe Gas Companies. These undertakings are favourably situated for union, and their combination will, no doubt, prove highly advantageous to the amalgamated Company. When the union is effected, the share capital of the United Company will be divided into three classes, entitled respectively to ten, seven, and five per cent. dividends. The original capital of the Dartford Company will take ten per cent.; while the additional capital, and the capital of the Darenth Vale Company will be entitled to seven per cent.; the Greenhithe Company having seven per cent. on their original capital, and five per cent. on their additional capital.

Writing of amalgamation necessarily brings us to the two most important Bills set down for presentation to Parliament this year—those of the Phoenix and the South Metropolitan Companies. It is hinted in another place that it is doubtful how far the former will be proceeded with. If the

scheme for the amalgamation of the Companies be sanctioned by the Privy Council, the former will most certainly be dropped. Once merged together, the two Companies will proceed under the guidance of established legislation. Supposing the scheme should not be approved, there are certain things that would require alteration; but in many respects it might pass unchallenged; for, as a fact, it does little more than reproduce the provisions of the Chartered Company's Act of 1876, so far as the action of the Referees, the modes of testing, and the method of levying forfeitures for defaults are concerned. There are some points in the Bill which, if there was any probability of its coming before Parliament, we should notice; but as we regard it as already dead, we do not consider further reference necessary.

We turn for a moment to the Bill promoted by the South Metropolitan Company, which is comparatively a simple measure. The Company being already subject to all the most recent Metropolitan gas legislation, there is no necessity to promote such an elaborate measure as the Phoenix Company have done. The Company ask for power to raise a million of money, and half that amount by borrowing. This is done in deference to the commands of the Board of Trade and the wishes of the Metropolitan Authorities, under the impression that consumers are largely benefited by the process. There is, no doubt, much to be said in favour of this view of the case. Companies can borrow at a low rate of interest, and the difference between four and seven per cent. is considerable.

We hear that all the holders of five per cent. stock in the Phoenix Company are not satisfied with the proposed conversion of it into ordinary ten per cent. stock. We cannot deny that they may be a little, but a very little, prejudiced by the change. The five per cent. was a sort of guarantee stock, the holders being entitled to a full dividend until the other shares came down to a common level. Under the re-arrangement, however, the converted stock will share in the benefits of the sliding scale, which we hope and believe will prove to their advantage. In any case, it must be borne in mind that the conversion was not the work of the Directors of the Company, but was insisted upon by the Board of Trade, who were determined that all the capital of the amalgamating Companies should be brought under the action of the sliding scale.

Grumbling is the privilege of all Englishmen. The Reading Gas Company, as our readers will see in another column, are promoting a Bill to enable them to raise further capital, purchase land, and erect new works. The Bill is by no means an extravagant measure. The amount of new capital asked for may seem large, but it is perfectly clear that it does not go beyond the necessities of the case, considering the very rapid growth of the town. It is not wise for a Gas Company to go to Parliament too frequently, the proceedings being expensive, and the results not always satisfactory. Some members of the Reading Corporation think a Gas Company cannot promote Bills too often. They see in the process a means of putting on the screw. We do not anticipate, however, that the Corporation will in this instance offer very strenuous opposition to the measure promoted by the Company. They would like to have fifteen-candle gas instead of fourteen, with power to raise the standard according to their own will and pleasure, it being understood that they are quite willing to pay for an increase of light. The price now charged for gas at Reading is considerably below what the Company's present Act allows, and it was naïvely suggested in the Council that the maximum price might be reduced to something like that now charged. In view of certain possibilities and even probabilities, we cannot recommend the Gas Company to accede to the suggestion. Let them sell gas as cheaply as they can, but at the same time keep a margin for a rise of price if disastrous times should come again. We are bound to say, however, that the Town Council have behaved very well in the matter. They are evidently on good terms with the Company; and they ought to be, for they have been admirably served by them for a number of years. We sincerely hope that nothing will happen to disturb the amicable relations at present existing. As to the idea of purchase, that, we are glad to see, is not entertained; for, without any reference to the electric light "luming," as one of the Councillors said, in the distance, we are quite certain that the margin of profit which the Corporation could make after borrowing money at four or four and a half per cent. would be very small for many years to come.

The works of the United General Gas Company at Limerick have at last been handed over to the Corporation. The transfer took place on the 1st inst., when the purchase-money of £23,000 was paid. We confess we did not expect the Corporation

would be able to raise the money, but their circumstances have doubtlessly of late improved. Limerick hardly requires two gas-works, and we understand it is proposed to combine the original works of the Corporation with those they have just acquired. One will probably be discontinued, which will render necessary a concentration of the manufacturing plant, and an extensive re-arrangement of the mains. To guide them in making these alterations, the Corporation have obtained the services of perhaps the ablest adviser they could consult—Mr. T. Newbigging.

The annual general meeting of the Bilston Gas Company was held on the 5th inst., and the proceedings revealed a tolerably prosperous state of affairs. The profits were not so large as in the previous twelve months, mainly on account of a reduction in the price of gas at the beginning of last year, and a bad sale of coke. Trade is, however, rapidly improving in Staffordshire, and we have no doubt that next year's accounts will show more favourable results. The dividend for the past year was eight per cent.

The rage for the purchase of gas-works by local authorities has extended to Gainsborough, where the small local Gas Company have been threatened. A number of members of the Board have, however, been scared by the electric light, and so propose for the time not to go on with an arrangement into which they could have entered for the purchase of the works for £42,000. The Company met them in a very liberal spirit, and kindly offered to take back the works, and return the purchase-money, if in the course of twelve months the electric light made any progress towards coming into general use.

The report of the Chief Gas Examiner for the Metropolis shows once more how well the Companies keep up the quality of their gas. In only two cases has any deficiency of illuminating power been observed, during the quarter, at the eleven testing-places in the Metropolis. On the contrary, large excesses were frequently noticed, and the average quality has been far above the standard prescribed by Parliament. As regards sulphur impurity, we may mention that the standard fixed by the Referees was well maintained. Ammonia, of course, hardly figures in the report, it being in some cases altogether absent from the gas.

Water and Sanitary Notes.

We have not yet received any specific information as to the progress of the negotiations between the Government and the Metropolitan Water Companies, but rumour has it that considerable advance has been made towards the settlement of the question of purchase. That this is probable seems to be proved by the fact that a good deal of speculation has recently taken place, and that the shares of all the Companies have risen in price. Stock Exchange men are generally very well informed. The most recent view put forward as to the terms which the Companies will ultimately obtain is that the Government will offer in exchange for the existing stocks of the Companies an equivalent in Government stocks at a price to be decided upon. Setting aside recent speculative dealings, there can be little difficulty in assessing the present value in the market of the stock of the water undertakings. But this does not include their whole value. In every case of compulsory purchase, recognition has been made of the principle of paying for prospective value. All the London water undertakings are rapidly improving concerns. They may make from five to seven per cent. only to-day; but, if let alone, from eight to ten per cent. might be paid in a few years. This is a matter which we hope the Directors of the Companies who have had dealings with the Government have taken fully into consideration, for it is a point of vital importance to the interest of the Shareholders. It is rumoured that five of the Companies have now acceded to the terms offered by the Government; but, at the same time, it is thoroughly understood, in influential circles, that there is still room for opposition. The Shareholders of no one Company have as yet been called together to express their opinion on any terms of purchase, which, therefore, cannot be considered as at all arranged. How much of the negotiations is upon paper signed and sealed, and how much consists of a mere verbal understanding between the Agents of the Government and the Directors of the Water Companies, is to us unknown. The whole affair seems at present *in nubibus*, and we must wait for further information.

In the meantime, the great question still remains—What will the Government do with the water undertakings if they should become possessed of them? There is, so far as we can see, but little speculation on this point. There is an idea that the works will be handed over to the management of what

has in some cases, by a figure of speech, been called a Trust. The formation of a body from the most accomplished Directors of the existing Water Companies would, we believe, be hailed with satisfaction by most ratepayers and consumers; but we think there are others who would prefer to see the undertakings under certain *doctrinaire* C.B.'s and engineering quacks. Against the employment of these we shall strongly set our face. Give us honest and capable men, experienced in the management of water undertakings, and we shall be perfectly satisfied that all will go well. In the service of the Water Companies there are Engineers and Secretaries of much eminence in their profession, and from these it would be easy to pick out men who could ably carry on the work of the undertakings. A selection from the Directors of the present Companies would constitute a Board eminently qualified to superintend the Metropolitan Water Supply. Such men, we may say, any Trust must of necessity employ, and it is well for them that they have the immediate advantages of their services. Much of this is, of course, in anticipation. The purchase of the Metropolitan water-works by the Government is still unsettled. We have hinted that influential opposition may possibly arise, and this will certainly come about if the righteous demands of the Shareholders are not satisfied. Messrs. Beal and Watherston may be disappointed, but we can promise them that all negotiations in the matter will fall through unless the just demands of the Proprietors are complied with.

We have repeatedly said that the plans of the Liverpool Corporation, for taking a supply of water from the Vyrnwy and head waters of the Severn, would have to encounter strenuous opposition from towns and cities down the stream. We think, however, we discern evidences that the threatened opposition is fast collapsing. Worcester, as the seat of the Severn Commissioners, might naturally be expected to take the lead in the opposition, and they have done so; but their efforts to stir up strife, so far as we can gather from accounts received, have failed. The Corporation have communicated with Shrewsbury, Bridgenorth, Bewdley, Tewkesbury, Cheltenham, and Gloucester; but no reply has, we believe, yet been received from the Authorities at these towns. Thus, we think, we have very fair reason for assuming that what was expected to be the main opposition to the Liverpool scheme has fallen through. All arrangements for the supply of compensation water at the top of the stream are, we understand, satisfied. The Liverpool Corporation will thus have no difficulty in proving to the Committee of the House of Commons that, while providing for the necessities of their own borough, they have not been unmindful of the interests of those who abstract their water lower down the Severn. In the course of the next week or two we shall have the Water Bill of the Liverpool Corporation before us, with much more information as to the intentions of the cities and local boards on the banks of the river; and, when possessed of this information, we shall probably be enabled to express a more decided opinion as to the prospects of the Corporation Bill.

The Lower Thames Valley Main Sewerage Board have, as our readers have already been informed, applied to the Local Government Board for a Provisional Order to enable them to carry out the scheme which was so promptly rejected by the House of Commons last session. That scheme, it will be remembered, was thrown out without any inquiry. If an inquisition had taken place, we do not know that the result would have been at all different; but, on moral and political grounds, we have a strong objection to the rejection, without inquiry, of any measure submitted to Parliament. We desire to see the scheme fairly considered by a constituted authority competent to decide on the merits of any plan. How far one "Authority" may be competent to decide on a complicated scheme such as is proposed by the Main Sewerage Board, we shall not undertake to say. Recently an engineer of much eminence, sitting as judge, refused to take evidence as to opinions, and would listen only to details of what were considered facts. We believe he was promptly snubbed by a Court of Justice; but our point is that in an inquiry relating to the scheme now propounded, opinions—always supposing them to come from competent authorities—should be listened to as well as the facts on which they are supposed to be founded. We regard, then, as of the utmost importance a searching inquiry, under an Inspector of the Local Government Board, before a Provisional Order is granted. Curiously enough, a deputation from the owners and occupiers in the immediate neighbourhood of the locality in which the Board propose to establish their sewage farm has been to Mr. Slater-Booth to protest against any inquiry being held. They wish the Provisional Order to be refused, just as the Bill was thrown out in the House of

Commons last year. This, however, cannot be allowed, and an inquiry, it is admitted by the Local Government Board, must be held. Not to hold one, would be unprecedented, and might defeat the object for which the Board was expressly constituted. It must be remembered that if the Board succeed in obtaining a Provisional Order, the Order must eventually come before Parliament for revision and confirmation, and without such evidence as might be taken before the Inspector it would run the risk of prompt rejection. Backed by such evidence, it would, in the absence of factious and interested opposition, be sure to succeed.

Captain Shaw's report on the fires which occurred in the Metropolis during the year 1879 was laid before the Metropolitan Board of Works at their last meeting. It states that 1718 fires occurred, only a small proportion of which were of any consequence. The number is larger than in the preceding year, but perhaps not more numerous than might have been anticipated. What concerns us most, however, is the state of the water arrangements for the extinguishing of these fires; and here we may express a decided opinion that the Water Companies did their duty well. In only nine cases out of the 1718 was there a short supply of water. (We ought, by the way, to have been told where these short supplies occurred; for, as it stands in the report, imputation lies upon all the Companies.) In thirty-three cases a late attendance of turncocks is reported, and in eighteen Captain Shaw reports that there was no attendance at all. Seeing the present arrangements, to which the Metropolitan Board have tacitly given their assent by refusing to allow turncocks to reside in the Fire Brigade stations, we can only be astonished that fewer failures of attendance are not reported. It may be, however, that in another two years we shall have to report on the success or non-success of a Water Trust in assisting at the extinction of fires, and we shall be greatly astonished if any greater success attend their efforts than is at present achieved by the Water Companies. We are sorry to see that Captain Shaw makes no remarks upon the success of the hydrant system, which now obtains all over the City, and in a good portion of the East and South-east of London.

FUEL.*

Mr. Robert Galloway, under the title of "A Treatise on Fuel," has published a revised and extended report of a series of lectures on fuel, delivered by him in the Royal College of Science, Dublin. The book is not quite so exhaustive as its title would lead one to expect, but still it contains a considerable amount of information on the subject. The various chapters, too, are not arranged in such strict logical sequence as they might be, and the whole work is rather fragmentary in its character. It abounds in tables, and is moderately sprinkled with formulæ, in reference to which we cannot avoid drawing attention to the confusion wrought through the liberty exercised by every modern scientific writer of adopting at pleasure the metric or common system of weights and measures, and of referring to the Centigrade or Fahrenheit thermometric scale. Mr. Galloway is a rather striking example of this, for he gives his examples of calculations of calorific power and intensity in metric measures, and immediately proceeds to describe in ordinary English measures and scales the apparatus and methods of manipulation by which the data he uses are experimentally obtained. The employment of different standards is immaterial when ratios and constants have to be determined, but the adoption of two conflicting systems in the same book is very troublesome, if not perplexing.

As a manual for use with the various calorimeters, pyrometers, and other analytical apparatus, which are fully illustrated and described in its pages, this little work would doubtless be most useful, for the descriptions of the *modus operandi* in all cases are eminently practical and complete, bearing evidence of having been compiled from actual experience. Sugg's apparatus for testing gas coal is praised for its close approximation to the conditions of ordinary manufacture, and its use is recommended in preference to the method of proximate analysis, which, as the Author says, is the next best means of valuing these varieties of coal. The problems presented by the composition of coal, with respect to the precise conditions under which the elements carbon, hydrogen, oxygen, and nitrogen exist in the combined state, and the uncertain nature of the changes which occur when they are dissociated, are mentioned, and our ignorance of the true state of things is fairly acknowledged, but no hint is given as to the means of arriving at a better understanding. Simple means are shown by which the intensity as well as the power of combustibles may be ascertained and compared, and the reasons why the theoretical power of fuel is never obtained in practice are stated with sufficient clearness.

A complete description, with illustrations, is given of Siemens's Gas Producer and Regenerative Furnace as applied to the manufacture of iron.

On the whole we may recommend the work as useful to the large class of persons whose employment of coal gives them an interest in the experimental treatment of this combustible, to which so large a portion of its contents refers.

* "A Treatise on Fuel, Scientific and Practical." By Robert Galloway, M.R.I.A., F.C.S., &c. London: Trübner and Co. 1880.

THE EDISON ELECTRIC LIGHT.

THE Edison tinder-box is hailed by the *New York Herald* as "the perfected lamp." Mr. W. H. Preece, Electrician to the General Post Office, ridicules it. Professor Proctor admires it. The Count du Moncel, writing to Dr. Cornelius Herz, expresses his astonishment at the excitement created by so dubious an invention. The *Daily News*, ever ready to prophesy against the Gas Companies, is at a loss what to make of this latest device. The *Standard* finds a parallel within the limits of the agricultural interest by comparing the new lamp to "Hodge's scooped turnip with a candle inside." The *Times*, which bade the world long ago "worship the rising sun of electricity," is now a little more cautious in its enthusiasm, contenting itself in the main by quoting the commendations and conclusions of its correspondent who had the felicity of eating his supper at Menlo Park by the light of Mr. Edison's lamp. In the American press, "Mr. Electrician Sawyer," after giving a bold challenge to Mr. Edison to bring forth proof on certain points, finishes by saying, "And I further allege that all Mr. Edison's statements are erroneous." The statements thus challenged have reference to the particular dynamo-electric machine which Mr. Edison has invented, as well as the lamp itself. Mr. Edison has also invented a meter, so that everything is complete. The current is subdivided to any extent, and the amount of light can be regulated as easily as the flame of a gas-burner. The lamp costs a shilling, and the light can be furnished at a rate equivalent to gas at tenpence, or less, for ten thousand feet—that is to say, a penny a thousand, or, as The *Times* puts it, forty times cheaper than gas. In the United States the Edison light would thus be something like a hundred times cheaper than gas; so that if Mr. Edison has really accomplished what is alleged, there ought to be an end to gas altogether. For the present, the most marked effect appears to consist in the inflation of the shares of the Edison Electric Light Company, which are quoted at from twenty to thirty times their par value.

Experience teaches. We have had experience of Mr. Edison, and it teaches us to doubt him. He is a sanguine man, and possibly a tool in the hands of others. He must be invaluable to speculators on "Change." If for some reason the market for gas shares has to be brought down, nothing can answer the purpose better than to trumpet forth some fresh discovery by Mr. Edison. This last invention is perfection itself. It is difficult to see how anything can be cheaper, or better, or more facile. There is positively nothing wanting. Forty times cheaper than gas, and quite as convenient in use, with all sorts of advantages which gas cannot pretend to offer, the new system must carry all before it. Henceforth, instead of the usual vulgar proverb, we shall employ the fair comparison, "Cheap as light." Let us imagine coal at tenpence a ton, or wax candles incomparably cheaper than the present rushlights; let us think of flour at a little more than a farthing a gallon, or Bass's bottled ale at three-halfpence per dozen imperial pints; let us travel forty miles by rail for a penny, and let us outdo in this way the wildest dream of Jack Cade—we shall then get an idea of how cheaply henceforth we are to enjoy the benefit of "bright, clear, mellow, regular, and un-flickering" light. After conjuring up this brilliant prospect, to tell us that "there is a good future before the Gas Companies" is enough to prove that those who make such statements either mean only half what they say, or do not know what they are talking about. If Mr. Edison has accomplished all that is claimed on his behalf, he has set on foot an economic revolution such as the world has never yet seen. He has, in effect as well as in appearance, made platinum as cheap as paper. It is perfectly consistent with all this wild assertion, to be told of "the wizard's by-play," by which he made "a veritable Job" almost well of his sores and rheumatisms in the space of a week. Another piece of by-play at Menlo Park is extracting gold out of the waste sand of the "diggings," so that valueless "tailings" yield from forty to sixty pounds sterling of gold per ton. The *elixir vitæ* and the philosopher's stone are evidently pretty close to Menlo Park.

When outrageous promises are made, there are many people who conceive that, a liberal discount being allowed for exaggeration, there will be found a large residuum of truth. The idea thus very commonly entertained is, as a rule, fallacious. Truth does not commonly adopt the garb of error. There is force in the old proverb, "Too good to be true." The prospect of a splendid fortune is generally a delusion, while the expectation of a modest return may be verified with a little added to it. But we will allow Mr. Edison to be his own judge. We know what he has said in the past, or what he has allowed to be said in his name. Wonderful tidings burst upon the world

a year and more ago. There was the platinum or platinum-iridium lamp, with its gorgeous glow of "mellow" light. In the blaze of this new luminary, gas shares in England fell alarmingly. Now we are told that, after Mr. Edison had been working at platinum and iridium for some months, and getting a "beautiful" light, he discovered that these substances "as now known in commerce are useless for giving 'light by incandescence.'" This is what electricians knew long before Mr. Edison found it out. Unfortunately, the holders of gas shares generally know as little about the electric properties of platinum and iridium as Mr. Edison did at the beginning of his experiments; otherwise they would not have been frightened, as many of them were, into making heavy sacrifices of valuable property.

The tale recited in the *New York Herald* of the 21st ult. as to Mr. Edison's "fifteen months of toil" and his "tireless" experiments with lamps, burners, and generators, is an elaborate apology for the delusion which Mr. Edison has unwittingly practised upon the world. Amid an imposing array of dainty diagrams, we are told of "The First Lamp," "The Second Platinum Lamp," "The Bobbin Lamp," "The First Platinum Vacuum Lamp," "The Paper Light," and at last "The Perfected Lamp." We read of "brilliant results," followed by "a fresh departure." There are "many alterations and improvements," and then it is recorded—"but eventually the apparatus was placed in the 'category of non-successes.'" "Non-success," we presume, is much the same as failure, and what guarantee have we that the "paper light" will not go the same road? As for the generator, Mr. Edison made one long ago which was to excel all predecessors, and now no one condemns it more than himself. We have only to wait a while, and Mr. Edison becomes his own severest critic. But while he is perpetually "rounding" on himself, he always has "the next article" ready wherewith to amuse the public. That he is sincere in his belief from time to time need not be questioned. No man would work so indefatigably unless he had faith in himself. But after wading through the history which covers more than a page of the *New York Herald*, we find that Mr. Edison began to invent before he knew what had been the inventions and discoveries of other men. He has gone over the ground which has been trodden before, and even now he is scarcely abreast of the age in the domain of electric lighting. His "perfected lamp" is but an example of incandescent carbon *in vacuo*. The fact that his carbon is made out of baked paper, constitutes a modification of a very subordinate character. Carbon rendered incandescent in a vacuum is nothing new, and the fragility of the carbon which is to emit the light in the Edison lamp threatens to render the apparatus impracticable in ordinary use. Just as Mr. Edison found platinum, iridium, and osmium, singly or alloyed, to fail under a continuous test, so we may look for failure again, or what is designated "a fresh departure." Mr. Edison is rich in expedients, and fertile in resource. Moreover, he has a wide field before him, where he may ring the changes to the end of time, especially as he can imitate the example of the fashionable *modistes*, who, when the new fashions wear out, fall back on the old.

A long article in *The Times* of yesterday, from "A Correspondent" at New York, states, among other things, that, concerning the apparent success of the new lamp, "the most astonished man is certainly Mr. Edison himself." Further evidence is afforded in this communication of the groundless nature of those announcements which caused so much excitement in the autumn of 1878. The account now given of Mr. Edison's efforts agrees exactly with the criticism which we offered at the time. Concerning all that was done during an entire year subsequent to the first outburst of enthusiasm, we now read: "The experts foresaw failure long before Edison did; and, finally, Edison himself reluctantly 'came to the conclusion last fall that he was on the 'wrong track entirely.'" It is added: "The man wore himself out very nearly, and the disappointment almost sent 'him to his grave.'" It was not until "about two months ago" that Mr. Edison "resolved to test the utility of 'carbon.'" Accordingly, the present lamp is about nine weeks old from the date of its inception, and the epoch of the paper horseshoe is even as recent as the beginning of last month. It was not until "about two weeks" prior to Dec. 30 (the date of the letter from New York) that "experiments began" with the new lamp. At that period, we are told, "a whole crop of new questions sprang into view." All these, it is intimated, have been "promptly solved" by actual experiment, and the working staff at Menlo Park is described as being in a state of intense excitement. "Every man," it is said, "from Mr. Edison down, was first astounded, and then 'exhilarated.'" How much they are astonished may be

inferred from the statement, "They have had so many failures that they can now scarcely believe their senses."

It is satisfactory to find that while the Edisonian staff was thus in a state of semi-delirium, the holders of American gas shares continued sane. The New York correspondent says: "The invention of this new lamp has not produced any very striking effect in regard to gas stocks here yet." Of course such a sensation as we find among the believers in Mr. Edison cannot fail to affect other people in some degree. How readily the votaries of the electric light are stimulated into extravagant expectations is shown by the enormous premiums now demanded for shares in the Edison Electric Lighting Company. The hundred dollar stock fell to twenty dollars last summer, and now it is difficult to set a limit to the prices which some holders are demanding. So far as the facts of the case are concerned, Mr. Edison is adding lamp to lamp at Menlo Park, and intends to go on until he has one hundred and fifty of them burning, "the object being to develop defects." "A few weeks from now," says the writer in *The Times*, "Mr. Edison will be able to formulate a clear opinion about the merits of the invention." There is something commendably modest in the opinion now attributed to the man of many inventions respecting his latest lamp. Holding in suspense his final opinion, "he believes that the new lamp can be distributed over a large area, and houses lighted therewith, for the same price as now paid for gas, possibly less; but of the latter he is not certain." If the prospect of thus underselling American gas is only "possible," and not "certain," there is at present very little to alarm the holders of gas shares in England.

We cannot set bounds to science. But science is not all on the side of the electricians. Gas has its latent capabilities as well as electricity. The electric light has been hovering on the verge of the horizon for a long time, and is still far from the meridian. If the improvement of gas and gas lighting be pursued with as much skill and ardour as the development of the electric light, we shall probably see very marked progress in the application of gas both to lighting and heating. Assuredly the introduction of gas as a means of artificial illumination was never accompanied by such wild figments as have heralded the approach of the electric light. In the early days of gas, the romance was all against it, and imagination was excited in opposition to the new comer. Fancy was found contrary to fact on that occasion, and so it may be now, when we see it exercised still in opposition to gas, by giving extraordinary value to the changing phases of the electric light. At all events, we may leave Mr. Edison to pursue his experiments, if he chooses to continue them, so that he may make his "perfected lamp" more perfect still. If we wish to know the real progress of the electric light, we would rather look away from Menlo Park, and fix our attention on the inventions of Siemens, Jablockhoff, and Brush. If gas is safe in the presence of these, it is not likely to suffer from the achievements of Mr. Edison.

THE GAS-METER DISPUTE AT OVER DARWEN.—It will be remembered that in November last a dispute arose between the Corporations of Blackburn and Over Darwen, in consequence of the seizure by the former Corporation of a number of meters under circumstances which have already been reported in the JOURNAL, the dispute being afterwards settled on the Corporation of Blackburn undertaking to offer an apology for their conduct, and pay the sum of £275. At the meeting of the Darwen Town Council on Monday, the 5th inst., the following letter from the Town Clerk of Blackburn was read:—"Dear Sir,—Enclosed I send you cheque for £275 in settlement of dispute, and I am instructed at the same time to express, on behalf of the Corporation of Blackburn, their great regret for the proceedings which they took in the matter."

THE WATER SUPPLY OF FROME.—At the monthly meeting of the Frome Local Board, on Friday, the 2nd inst., Mr. Tomlinson, the Engineer of the water-works, was present, and made a statement relative to the progress of the works. The chief point he wished to refer to was the deepening of the well, and the consequent increase in the quantity of water. Last year the supply was 300 gallons per minute. The deepening of the well to the extent of 4 feet had resulted in an increase of 268 gallons per minute, making 568 gallons, or 817,920 gallons in the 24 hours. The maximum supply for a population of 10,000 was 250,000 gallons in the 24 hours, or one-third of the supply at the disposal of the Board. The testing had been proceeded with since the 6th of November. The steam-engines would soon be fixed, and he thought they would be ready for pumping into the reservoir by the 1st of February.

PRESENTATION TO MR. H. ROBBS.—On the evening of Thursday, the 1st inst., the members of the Crystal Palace District Gas Company's Workmen's Club presented a very handsome marble clock to Mr. H. Robbs, who for the last 14 years has held the post of foreman at the works. The following, which is the inscription on the gift itself, fully describes the object of the presentation and what led to it:—"Presented by the members of the Crystal Palace District Gas Company's Workmen's Club to Mr. H. Robbs, foreman of the works, as a tribute of gratitude for his generosity and perseverance in founding and assisting them to support a Provident Club for sickness, and his readiness at all times to assist the widows and orphans of the workmen. Jan. 1, 1880." The clock was presented to Mr. Robbs, in the name and in the presence of about 200 of the day workmen, by Mr. C. Gandon, the Engineer, and a very suitable reply was made by Mr. Robbs.

GAS BILLS FOR 1880.

THERE are eighteen measures to be promoted by Gas Companies in the coming session of Parliament. Of these, two only are to confer powers of incorporation on Companies hitherto without statutory authority.

The *Ackworth, Featherstone, Purston, and Sharlston Bill* is to incorporate a Company supplying gas to the places above named, and to others in the vicinity. The Company were formed in 1873, with a capital of £10,000, in £5 shares. No mortgage debt has been incurred. By the Bill the Company seek power to raise an additional £10,000. The original capital will, of course, be entitled to ten per cent. dividend, while the additional is limited to seven per cent., the sliding scale being applied in each case. We need hardly say that the £5 shares are to be registered as half shares. Old and new capital, when fully paid, may be converted into consolidated stock. Borrowing power to the usual extent is prayed in respect of both classes of capital, with the customary restrictions in the case of the additional, it being understood that not more than £2000 of capital is to be issued in any one year. The ordinary arrangements are made for the transfer of the "limited" to the incorporated Company. Gas of fourteen-candle power, tested by the "London" Argand burner, No. 1, is to be supplied at the usual pressures. The initial price is to be 5s. 6d. per thousand feet. Power is asked to form an insurance and reserve fund, and to convert borrowed money into capital at interest not to exceed five per cent. Auction clauses are necessarily inserted.

The *Malton Gas Bill* is to dissolve and re-incorporate the Malton Gaslight and Coke Company, which was formed in 1836, with a nominal capital of £24,000, of which over £5000 remains to be paid up. By the Bill the Company seek power to raise an additional amount of £24,000, on which it is proposed to pay only a five per cent. dividend. The Bill subsequently proposes the sliding scale, but this, we think, must be intended to apply only to the original capital. Power is sought to borrow to the usual extent, and to convert money so borrowed into capital entitled to five per cent. dividend. Gas of fourteen-candle power, tested by the "London" Argand burner, No. 1, is to be supplied at the usual pressures. The initial price is to be 4s. 3d. per thousand feet. Auction clauses are not sought.

There other sixteen Bills are intended to confer additional powers on Companies already incorporated.

The *British Gaslight Company, Limited (Staffordshire Potteries) Bill* is intended to authorize the Company to expend a further sum of £75,000 on their Staffordshire undertaking. Gas of fourteen-candle power is to be supplied in future, tested by the burner now in use.

The *Chester Gas Bill* is intended to authorize the Chester Gas Company to raise additional capital. The Company were incorporated in 1858, and by their Act and another passed in 1870 the Company obtained power to raise the sum of £80,000, and borrow to the extent of £20,000. Nearly all this capital has been called up and expended. By the Act now applied for they seek permission to raise an additional sum of £50,000, carrying the usual borrowing powers. The additional capital is to be entitled to six or seven per cent., according as it is issued as preference or ordinary. The Company restrict themselves to the period of three years for the payment of back dividends.

The *Cork Gas Bill* is to confer additional powers on the Cork Gas Consumers Company. The Company were incorporated in 1868, and their present capital is £150,000, and they have borrowed to the extent of £20,000. By the Bill the Company seek power to raise an additional sum of £25,000, with borrowing powers to the usual extent. Subject to the sliding scale, the dividends on the new capital will be limited to six or seven per cent. New shares are to be sold by auction or tender. The Company propose for the future to make the standard price of gas 4s. 6d. per thousand feet within the district of the Corporation of Cork, and 5s. outside. As might have been expected, they seek power to manufacture, sell, or let on hire all sorts of apparatus for the use of gas for other than illuminating purposes. The Bill further provides that the Corporation of Cork may, if they so desire, purchase the Company's undertaking within three years of the passing of the Act.

The *Dartford Gas Bill* is to authorize the Dartford Gas Company to amalgamate with the Darenth Vale and the Greenhithe Gas Companies, such amalgamation to take effect on the 1st of July of the current year. The share capital of the three Companies is to be divided into three classes, which need not here be particularized. It is proposed to raise additional capital to the amount of £50,000, carrying

the usual borrowing powers. The dividends on the new capital are limited to the customary rates, subject to the sliding scale. The price of gas in Dartford and the immediate neighbourhood is to be 4s. 6d. per thousand feet, and 5s. in the parishes beyond. The new capital is, of course, to be offered by auction or tender.

The *Eastbourne Gas Bill* is to confer further powers on the Eastbourne Gas Company, incorporated in 1868 with a share capital of £50,000, all of which has been raised and expended, and the Company have borrowed on mortgage to the extent of £12,500. By the Bill they seek power to raise an additional sum of £150,000, with power to borrow to the usual extent; it being understood that £9375 may be borrowed for every £37,500 of capital issued with the ordinary restrictions. The new capital is, of course, to be offered by auction or tender. Subject to the sliding scale, it is proposed to limit the dividend to six or seven per cent. Fourteen-candle gas is to be supplied, tested by the customary burner at the usual pressures. The initial price to be charged is 4s. 7d. per thousand feet.

The *Hyde Gas Bill* is to confer additional powers on the Hyde Gas Company, who were incorporated in 1855 with a share capital of £36,000, and power to borrow £9000, the whole of which has been issued and expended. The Company now seek authority to raise a further sum of £56,000, and to borrow to the usual extent. The new capital is, of course, to be offered by auction or tender. The dividends on the new capital are limited to six or seven per cent., according as it is issued as preference or ordinary. Gas of fourteen-candle power is to be supplied, at a maximum price of 5s. 6d. per thousand feet. The test-burner is to be the "London" Argand, No. 1, and the customary pressures are prescribed.

The *Lincoln Gaslight and Coke Company's Bill* is to enable the Company to raise additional capital, and to authorize the re-arrangement of that already issued. The present capital is £112,500, and by the Bill the Company propose to raise an additional sum of £40,000, carrying the usual borrowing powers. The new capital is, of course, to be offered by auction or tender, and is to be entitled to only seven per cent. dividend. The sliding scale is proposed, and the whole capital of the Company, both new and old, is to be converted into consolidated stock, entitled to varying rates of dividend.

The *Liverpool Gas Bill* is to authorize the Liverpool United Gas Company to raise a further sum of money by way of loan. The present capital of the Company is £938,837, and they have borrowed on mortgage £160,000. The Bill we notice is to enable them to borrow a still further sum of £70,000 for the erection of new works.

The *London Gaslight Bill* has been already noticed in our columns. It is simply to authorize the Company to deal in all kinds of apparatus for the consumption and utilization of gas. No capital is asked for.

The *Maidstone Gas Bill* is to enable the Maidstone Gas Company, with a present capital of £50,000, to raise a further sum of £80,000, carrying the usual borrowing powers, for the erection of additional works on lands described in a schedule. The present capital, now bearing different rates of dividend, is to be converted into consolidated stock entitled to interest at seven per cent. Power is also sought to deal in apparatus for the general utilization of gas for other than illuminating purposes. Authority is asked for to sell gas in bulk to local bodies. The new capital is to be offered by auction or by tender, and, subject to the sliding scale, is to be entitled to seven per cent. It is now proposed to supply fourteen-candle gas, tested by the No. 1 "London" Argand burner. The standard prices are to be 4s. per thousand feet within three miles of the Town Hall, and 5s. within the limits of the Company beyond.

The *Phoenix Gaslight and Coke Company's Bill*, the general scope of which has been more than once noticed in our columns, is, first of all, to authorize the Company to amalgamate with any other Gas Company south of the Thames, save and except the Crystal Palace District Gas Company. A scheme has been settled by virtue of which the Phoenix will, in all probability, at once join the South Metropolitan, under powers conferred by this Company's Act of 1876. As a large addition to works is proposed, new land is wanted, and fresh capital of one million sterling is asked for, with borrowing powers to the extent of one-half of that sum. The Company propose to subject themselves to all the most recent Metropolitan gas legislation. An initial price of 3s. 9d. per thousand feet is named in the Bill. We should have mentioned above that, to place the Company on an equality with the South Metropolitan, it is proposed to make the standard dividend on the new capital—subject, of course, to the sliding

scale—ten per cent. Borrowed money is not to bear interest at a higher rate than five per cent.

The *Prescot Gas Bill* is to confer further powers on the Prescot Gas Company, incorporated in 1867 with a nominal capital of £9000, and with borrowing powers to the extent of £2000, all of which has been raised and expended. The Company now propose to raise £16,000 of additional capital, and to borrow to the usual extent of one-fourth. The new capital is to be offered by auction or tender, but no sliding scale is proposed. The illuminating power of the gas is to remain the same as before, but the Company desire to substitute Sugg's "London" Argand burner for that hitherto used.

The *Reading Gas Bill* is to authorize the Company to raise further capital for the purchase of land and the construction of additional works. The present capital of the Company is £80,000, and they may borrow to the extent of £20,000. By the Bill authority is sought to raise new capital to the amount of £120,000, with corresponding borrowing powers. The new capital is to be disposed of by auction or tender, and the dividend on it is to be limited to seven per cent. The Company propose to supply fourteen-candle gas, tested by the "London" Argand burner, No. 1.

The *South Metropolitan Gas Company's Bill* may be said, *mutatis mutandis*, to be a copy of part of the Phoenix Company's Bill above noticed. The same amount of capital is asked for, and the same land is scheduled.

The *Wandsworth and Putney Gas Bill* is promoted to enable the Company to raise further capital. They have at present raised and expended £70,000, and owe on mortgage £16,000. By the Bill they seek to be empowered to issue further capital to the amount of £120,000, carrying the usual borrowing powers. The dividends on this new capital are limited to six or seven per cent., according as it is issued as preference or ordinary.

The *Yeadon and Guiseley Gas Bill* is to empower the Company to raise further capital. The present capital of the Company is £29,325, and they have borrowed to the extent of £7300. By the Bill the Company seek authority to raise an additional sum of £30,000, carrying the usual borrowing powers. The new capital is to be offered by auction or tender, and, subject to the sliding scale, is to be entitled to a dividend of six or seven per cent. The price of gas in the district is fixed in the Company's Act of 1868 at 5s. per thousand.

SOCIETY OF ENGINEERS.—Mr. R. P. Spice, as President of this Society, has issued a circular letter announcing that, in consequence of the resignation of Mr. Graham Smith as Secretary, the Council have appointed to that office Mr. Alfred Elgar, who will enter on his duties immediately. Mr. Spice adds that this gentleman comes to the Society with the highest testimonials for efficiency in regard to his scientific and literary acquirements, and special experience for the work, and not the least is a strong recommendation from the Secretary of the Institution of Naval Architects, whose able assistant he has been.

MR. EDISON'S LAST INVENTION.—The Paris correspondent of the *Standard*, telegraphing last Wednesday, says:—"The news that Mr. Edison has discovered a new lamp for domestic use has produced some sensation here, and some of the papers have made almost as much of it as the American journals. The merits of the invention, however, are disputed by electricians of high standing. The Count du Moncel, who is recognized here as the highest authority on electric science, has addressed a letter on the subject to Dr. Cornelius Herz, which is published in this evening's *Temps*. He expresses astonishment at the excitement caused in the Money Market by the praises bestowed on the lamp, which is called 'a great discovery.' 'Edison,' says the writer, 'is an ingenious and fertile inventor, but is not acquainted with the discoveries made before his time. Neither the idea of the telephone nor the realization of the phonograph belongs to Edison. His first lamp was a modification of the one invented by Changy in 1858. The one now announced is the modification of those of several inventors. In 1875 much noise was made about the incandescent carbon lamp of Korloff, the pretension being that one Alliance machine could feed 15 lamps, and yet no more than two have ever been seen working. Reynier and Werdermann, by adding the voltaic arc to that combination, obtained better results. The new Edison lamp revives the Lodyguine lamp in a different shape. The small carbon needles are replaced by laminated carbon, or carbonized Bristol paper separated by metallic tissues carved into the form of a horseshoe, and joined to the semaphore of the circuit by platinum wires, the whole in vacuum, as in Lodyguine's system. That arrangement may be better than anything previous, but it is not an invention of the importance assigned to it by the American papers. The idea of intercalating metallic bodies in the carbonized mass is not new, for it has been realized by Jablochhoff and Kelmer. It is difficult for the carbon horseshoe, so loose and delicate, not to be deteriorated by prolonged incandescence, on account of the caloric action disintegrating the carbonic particles, and the mechanical action of the current which carries them away and deposits them on the sides of the recipient as in Geissler's tubes. The metallic tissues separating the layers of carbon would be damaged. Experience alone will be able to decide, and it is prudent to wait, in spite of the announcement of 60 or 60 foci fed from a single machine. The same may be said of the dynamo-electric machine, which offers nothing new about which the theories put forth would upset the laws of Ohm and Joule, theories which are at variance with the experiments made with every other machine. Edison has given no account of the maximum effects.' The writer finally protests against the *sans façon* of the Americans with regard to European inventions. 'For them electrical science, which sprang up yesterday, was discovered in America. Many examples might be cited, to which the name of M. Prescott is not foreign, but we prefer to say no more. Let the public be on their guard against the pompous announcements which reach us from the New World.'"

Communicated Article.

THE HYDRAULIC MAIN.

By Mr. R. H. PATTERSON, F.S.S.

PART II.

In considering the part which the Hydraulic Main at present plays in gas manufacture, we must first observe the action of the Exhausters, and the changes which this now old improvement has made in the character and action of the Hydraulic Main. As regards some of the effects of the Exhausters upon the Main, I find conflicting opinions held by engineers of known ability and great experience—opinions, however, which are held hesitatingly, because the exact truth (simple though it may be) has not yet been clearly ascertained. For the present, therefore, I shall avoid these moot points as much as possible.

The Hydraulic Main was adopted in order to prevent a back-flow of gas into the retorts during the time of drawing and recharging—a back-flow which would take place without any back-pressure at all; for the gas would rush down through the ascension-pipes just as the external air rushes into the retorts when the mouthpieces are opened. But of course such a back-flow would take place with greater force when there was a heavy back-pressure, as was the case before Exhausters were employed. But the Hydraulic Main, while thoroughly preventing a back-flow, did so by *permanently adding to the back-pressure*. The pressure of the Seal became added to the back-pressure from the Holders, and also to that produced by the resistance which the gas encounters in passing through the purifying apparatus. Also, the Hydraulic Main allows the gas to saturate itself with moisture, which has the double disadvantage of promoting hydrocarbon deposits along with the condensed aqueous vapour, and of reducing the illuminating power of the gas when burnt.

By-and-by the bad effects of back-pressure became observed. It was found to be the chief cause of the deposits of carbon within the retorts—which in those early times must have been immense, and proportionately injurious. To remedy the back-pressure, Exhausters were adopted. A steam-engine was employed to draw forward the gas from the retorts, and to propel it through the purifying apparatus into the Holders. The Exhausters are always worked to the extent of neutralizing the whole of *this* back-pressure upon the Hydraulic Main. But in some cases this is all, and the back-pressure arising from the Hydraulic Seal is left intact and unaffected by the "Exhaust."

Recently, the practice has been to attack and lighten the seal itself, in order to still further reduce the back-pressure. For this purpose the Exhausters are worked at "a vacuum" (that is, at so many inches beyond what is necessary to neutralize the back-pressure from the Holders, &c., upon the gas in the Hydraulic Main, and thereby to *operate upon the seal itself*). Going still further, some managers prefer to create a vacuum, however slight, *within the Retorts themselves*, in order to withdraw the gas even quicker than its natural lightness would do. In such cases, despite the Hydraulic Main, the Retorts are practically unsealed; but as to how this is done—that is, what is the exact effect of the Exhaust-vacuum upon the liquid in the Main—is a point upon which I find opinions differ. It certainly appears, however, that whatever be the "vacuum" created within the Hydraulic Main, the gas must still bubble up through the liquid. The liquid will be wholly expelled from *within the dip-pipe*, but *outside* it must still stand at its ordinary level in the Main, and the gas, when leaving the dip-pipe, must bubble upwards through the liquid. The internal part of the seal is, of course, removed, but the other part remains. If not, what becomes of it?

The Anti-Dip movement was a great improvement. The Exhausters had removed the original back-pressure (from the gasholders, &c.), and the object of the Anti-Dip is to remove from the retorts the back-pressure occasioned by the *hydraulic seal*. When the retorts are in action the gas is made to pass from the ascension-pipes by a valve-way into the Main without passing through the seal; and this valve or bye-pass is shut when the retorts are being drawn, whereupon the seal is replaced. In short, the gas does not *pass through* the liquid at all, but it traverses its surface throughout the Main. In the most recent forms of the Anti-Dip—since the evil effects of the contact between gas and tar have attracted attention—the gas is not passed into a Hydraulic Main, but travels along a main in which it flows along with the tar which it is depositing.

Speaking roundly, then, since Exhausters came into use, the hydraulic seal has lost its self-acting character—the quality for which it has been most highly esteemed—and is made dependent upon the working of the Exhausters. Secondly, the Exhausters in some cases are worked at a vacuum, so as practically to lessen, or altogether overcome, the seal. Further, by the Anti-Dip apparatus, the seal has been actually abolished, at all events when the retorts are in operation.

Next, there is the new movement referred to in much recent correspondence in the JOURNAL, for withdrawing the tar quickly from the Hydraulic Main, so as to keep the liquid which makes the "seal" as much as possible in the form of water, in order to avoid the contact between the cooling gas and the cooling tar. But this cannot be done thoroughly. And on many grounds I venture to make the suggestion, *Why not abolish the Hydraulic Main altogether?* And also, in such manner as *wholly* to remove the gas from contact with the Tar?

Effects of Tar and Naphtha on the Illuminating Power.

So far as I can see, the actual damage done to the illuminating power of the gas by the tar-washing which it receives in the Hy-

draulic Main has not yet been properly or satisfactorily determined. And really, considering how extensive is the contact between the gas and tar in the present system of gas manufacture, and how serious are the effects attributed to such contact, it is strange that Gas Companies, especially the large ones, do not investigate this question, by instituting carefully conducted experiments. If these experiments are not conducted carefully, and with scientific thoughtfulness, the results arrived at, I make bold to say, may be entirely misleading. For example, there is no fact in this question better known or more clearly ascertained than that a current of gas will lick up naphtha. Bowditch found this, and stated it; Aitken, Young, and others have proclaimed the same thing recently; and, indeed, the whole "carburetted" or carbonating systems proceed upon this fact. Nevertheless, *this is only a part of the truth*, and if accepted as the whole truth, or as true under all circumstances, it will lead to a serious mistake. You may bring naphtha and coal gas together, and yet the result may be the very opposite of what is at present believed; that is to say, instead of the gas licking up or absorbing the naphtha, the naphtha will absorb the hydrocarbons from the gas! As this is a new point, I shall mention the circumstances upon which this statement is made. Several years ago, at the Fulham Gas-Works, a large quantity of cannel had been employed, and consequently a large quantity of the naphthas or light hydrocarbons accumulated in the Tar-well. Seeing this, Mr. Kirkham resolved to employ this naphtha for enriching his gas. Drawing it off from the heavy tar, he employed it in one of his coke scrubbers—the naphtha being allowed to flow down through the scrubber while the gas passed upwards. But the illuminating power of the gas fell off greatly. Mr. Kirkham (as he has told me) at first felt very much puzzled as to the cause of the change. He tried one part of his apparatus after another, never for a moment suspecting that the evil could arise from his carbonating process; but at length, in the course of his investigations, the Naphtha scrubber was turned off, or put out of action, and immediately the gas regained its usual illuminating power! This incident appears to show that the effects of the contact between gas and naphtha depend, *inter alia*, upon the relative proportions in which the gas and tar are brought in contact; and that, although when the gas is in very large quantity compared to the naphtha, the latter substance is absorbed by the former, yet when the naphtha is in large relative quantity the result is the very reverse.

This incident at the Fulham works shows how much we have yet to learn as to the actual effects of contact between gas and the hydrocarbons deposited from it. It is possible that the naphtha used by Mr. Kirkham may have contained some portion of the heavier hydrocarbons, and that it was these and not the naphtha that did the mischief. Still, I think with a fact like this before us, it is evident that there is much to be learnt upon this very important question; that careful investigations are greatly needed, and have been too long delayed; and, lastly, that these investigations must be conducted with scientific thoughtfulness, if they are to bring us to firm ground at last.

Imperfect and unsatisfactory as the present knowledge on the subject is, it can hardly be now questioned that the old, or indeed recent idea of benefit from keeping the gas in contact with the tar in the process of cooling or condensation is wrong, and that the object should be the very opposite. There are many facts which, either directly or inferentially, point to this conclusion, and which I have set forth in former articles. But the advantages claimed for some well-known kinds of apparatus—such as the Exhausters and the Anti-Dip—really go to prove the same fact, especially if (as I have suggested) the gain in illuminating power from these appliances is owing not so much to the reduction of the carbon deposits in the retorts, as to reducing or wholly abolishing the tar-washing of the gas in the hydraulic main. The champions of the "Anti-Dip" claim a considerable increase of illuminating power from their apparatus. And as regards the great improvement achieved by the Exhauster, perhaps one of its greatest advantages has still to be recognized; namely, that by reducing to a vanishing-point the force of the seal, it has proportionately lessened that tar-washing of the gas which seems to me so dangerous to the illuminating quality or commercial value of the gas. I suspect that the great gain of gas (usually reckoned at about 10 per cent.) obtained from the employment of Exhausters, by reducing the back-pressure, is not due wholly to the lessening of the carbon-deposits in the retorts, but largely to the great reduction and almost abolition of the said tar-washing consequent upon the reduction of the seal to zero, or thereabouts. And I make bold to say that if the Anti-Dip movement had arisen in the old times, before Exhausters came into use, its champions would have been at no loss for demonstrative proofs of the advantages of abolishing the dip. Think how severe must have been the tar-washing which the gas had to undergo in the early years of the Hydraulic Main (*i.e.*, before the adoption of Exhausters), when the gas had to force its way out of the retorts, through the seal, under a back-pressure of (say) 20 inches. Now that Exhausters are in use, it is only a very small remnant of this pressure—namely, of the seal itself, and as greatly *lightened* by the "Exhaust"—that the Anti-Dip apparatus has to remove; but it is a valuable further step in the right direction, and (apart from its effect in lessening carbon-deposits within the retorts) must sensibly reduce the bad effects of the contact between the gas and the tar.

Why not Abolish the Hydraulic Main?

Having got so far as we have done—(1) by the action of the Exhausters, (2) by the abolition of the Dip except during the drawing and charging of the retorts, (3) by withdrawing the tar quickly from the Hydraulic Main—I really do not make any very revolutionary proposal when I suggest the abolition of the Hydraulic Main itself.

Of course I know that, except as to the Exhausters, the above mentioned changes are still only beginning to be adopted. The Anti-Dip apparatus is not yet in general use; and the prompt withdrawal of the tar from the Hydraulic Main (although an apparatus, partially for this purpose, may have been devised long ago) is as yet little more than a reasonable and apparently popular proposal. But I feel sure that these changes will make their way; and I venture to think my further proposal will do so too.

So long as the Hydraulic Seal is maintained in any form, it is impossible to prevent the evil action of the tar in attracting and withdrawing from the gas a portion of its illuminating elements. Indeed, even under the most favourable circumstances conceivable, if the Hydraulic Main be retained, the gas must still travel, if not through, at least over, and in closest superficial contact with the condensed tar.

The New Receiving Main.

But suppose the Hydraulic Main be dispensed with,—and also in such manner that no contact is allowed between the gas and the tar which it deposits. Suppose that no liquid seal is maintained at all, and that one or other of the anti-dip appliances (preferably a self-acting one) be adopted—and a large choice of them is to be seen in Part 10 of "King's Treatise on Gas Manufacture"—the state of matters would then be this: There would, of course, be a receiving tube or large pipe to receive the gas from each bench of retorts—in other words, so far as external appearance goes, *something like* the present Hydraulic Main would still exist. But there would be no diaphragms or barriers to keep the constantly condensing tar at a considerable depth in the main. There would be no reservoir of tar or liquid of any kind in the tube or chamber. There would be discharging-pipes from the retorts, but no Dip-pipes. The Receiving Main would be simply a gas-chamber; and, also, from this chamber the condensing tar would be constantly drawn *downwards* and away into the Tar-well, leaving the gas to traverse the tube by itself. The wider the "berth" between the gas and the tar the better. The gas, of course, owing to its lightness, would traverse the upper part of the tube; and the tar should not traverse the tube at all, but at once be allowed to pass downwards and away from the gas.

As simply a rough indication of what might be adopted, suppose that a grating or perforated plate were placed horizontally within the present hydraulic main, at such distance from the top as to give much *more than enough* space for the gas to travel above it; the tar, from its specific gravity, would descend, through the grating, into the lower part of the tube; and this lower part of the tube should be constructed in such a manner as to cause the tar to flow away rapidly, and in a course removed from contact with the gas. This would be the new Receiving Main, which externally would somewhat resemble the Hydraulic Main. It would be the ghost of it—but that is all.

Such an apparatus would have some important collateral advantages. As is well known, the deposit of the valuable light hydrocarbons along with the Tar is owing to the chemical attraction which exists between these substances, and depends to a considerable extent upon the temperature under which the deposit takes place. A high temperature lessens the power of such chemical attraction, and tends to keep the light hydrocarbons volatile and part of the gas. In the Hydraulic Main a high temperature is objectionable—(1) because it tends to thicken the tar, and to convert a portion of it into pitch, whereby the commercial value of the Tar is diminished; (2) because serious embarrassment is frequently produced owing to the clogging or entire stoppage of the Dip-pipes by encrustments of the tar in which they are immersed; and (3) because the higher the heat in the Hydraulic Main, the more largely and disastrously will the gas become saturated with moisture.

In the Receiving Main, no such disadvantages and embarrassments can arise from a high temperature, because there is no Water to be vaporized, while the Tar is at once withdrawn, and also never comes in contact with the Dip-pipes. Accordingly, the Receiving Main can be kept, without disadvantage, at a higher temperature than is practicable with the Hydraulic Main; and by means of this higher temperature the light hydrocarbons can be kept volatile—*i.e., retained in the gas* to a greater extent than is the case at present. Further, to effect this object, the Receiving Main may be heated above its natural temperature by special means and apparatus for the purpose.

But something more requires to be done. It will be no small advantage to minimize the deposit of the light hydrocarbons, and to remove the tar at once from contact with the gas; but there remains the task of *recovering* from the tar such portion of the light hydrocarbons as unavoidably must be carried down along with the condensing tarry vapours. However high the temperature of the Receiving Main may be kept for this purpose, Aitken's "Analyzer," or some such apparatus, should be employed, next after the Receiving Main, and into it the withdrawn tar might be made to flow.

Indeed, for the right and effective use of an Analyzer, a change like that here proposed in the antecedent apparatus is indispensable. To let the gas lose its naphtha in the Hydraulic Main, and then restore the naphtha to the gas in the Analyzer, is obviously a defective arrangement. By means of the Receiving Main, however, the temperature required in the Analyzer can likewise be maintained antecedently; and this, together with the instant and entire removal of tar from the Receiving Main, will certainly tend greatly to retain in the gas those light hydrocarbons which it is the object of the Analyzer to re-volatilize and restore to the gas; but which, obviously, can be more readily kept volatile as part of the gas than re-volatilized when they have become part of the Tar.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE HYDRAULIC MAIN.

SIR,—Having read Mr. Patterson's interesting and instructive article on the Hydraulic Main, and on the effects of "back-pressure" in the retorts, I venture to offer an opinion, founded on experiments, as to the results of subjecting gas to pressure in retorts heated to the degree that clay retorts usually are.

Mr. Patterson quotes Malam's process, whereby he allows the gas to pass through a mass of heated material before leaving the retort, ostensibly for the purpose of re-decomposing any tarry vapours into permanent gas. That this would be effective, to a certain extent, I am prepared to admit; but it would also have another effect—*viz.*, to further decompose some of the permanent hydrocarbons into their constituents—hydrogen and carbon, the former passing away as a non-luminous gas, the latter being deposited in the retorts.

In support of this I may state that a process patented by Dr. Redwood desired to accomplish similar results to Malam's, by generating gas in one retort, and then causing the gas so produced to pass first through a Pelouze and Audouin's condenser, to deposit the lighter hydrocarbons, and then to pass through another retort filled with blocks of plaster of Paris and iron tubing—the result being in most cases a moderate yield of gas, but of very low illuminating value; whilst the iron tubing soon became encrusted with carbon (carbide of iron) deposited from the gas during its transit. Again, when carrying out some experiments, in the direction of Mr. Vernon Harcourt's, for the reduction of the sulphur compounds by passing the gas through heated matter, it was found that the material employed became coated with deposited carbon, and the illuminating power destroyed to the extent of nearly 60 per cent. And again, when experimenting on the production of gas from crude petroleum in the first apparatus employed, the gas was generated in one retort, and then made to traverse a series of three more, heated to bright redness, with the idea that any petroleum vapours would be further decomposed. The result was, however, not satisfactory, for a gas of low illuminating power was produced, and the retorts soon became choked with carbon. On discarding the secondary or superheating retorts, the gas produced from the first or generating retort was, on the average, equal to 60 candles.

These experiments all pointed to the advisability of withdrawing the gas from the retorts as speedily as possible, especially where high heats are employed, and a high illuminating power is to be maintained. If, on the other hand, quantity is required and quality is of no object, then by subjecting the gas to a superheating process a large yield of low illuminating value would be the result.

It is with all due deference to Mr. Patterson that I quote the foregoing, and it would be interesting to hear the opinions of others on a matter of such importance.

B.

SAFETY LAMPS IN GAS-WORKS.

SIR,—My thanks are due to Mr. William Mann for his practical letter on safety lamps.

Mr. Key's letter I do not quite understand. I do not ask whether an explosion *could* be produced by a Davy lamp, as I am quite aware that "under certain circumstances" an explosion *could* be caused thereby. It is quite possible experimentally to produce one, or by neglecting a Davy lamp where an escape of gas is taking place, when, by the ignition of the gas inside the lamp, the wire would become red hot, and eventually cause an explosion.

My question is of a practical, not experimental nature, and I shall still be glad to know if an explosion has ever been caused by a Davy lamp when properly attended to; if so, under what circumstances. If Mr. Key would oblige me by publishing the details of the fires that have taken place, or some of the narrow escapes he refers to, he will greatly assist me to avoid such occurrences on my own works.

Jan. 9, 1880.

W.

THE PRODUCTION OF STEEL FROM CAST IRON.

SIR,—It may seem a singular expression to say that the English people are slaves to liberty, but such is really the fact. To avoid the evils of monopoly, they willingly allow the industry of the country to be shackled and subjected to the misrepresentations of inspectors, testers, referees, and other well-paid busybodies, although the evils in question could be very much better prevented by setting the national industry at liberty, and opening the door to free and fair competition.

I have been induced to make the above remarks because I am in a position to show that the manufacture of coal gas and the production of steel are intimately associated together, and would, no doubt, long since have been united but for the despotic intermeddling policy of a Parliament which is never done talking about liberty. Every gas manufacturer well knows that if he could only employ in a profitable manner the coke he produces, he could almost afford to give the public coal gas for nothing, because the coke forms nearly 70 per cent. of his products, whilst the gas is less than 15 per cent., so that a very small profit upon the coke would enable him to make a very considerable reduction in the price of gas. Indeed, it is my firm conviction that if a large and profitable employment can be found for gas coke, the price of 14-candle gas in all the principal towns of the kingdom need not exceed 1s. per 1000 feet, at which price competition by every other form of artificial lighting would be utterly hopeless; and even as a heating power, gas might not only "rule the roast," but also furnish the fire for steam and other boilers—a "consummation devoutly to be wished," from an atmospheric point of view. It is not, however, in this country that such a change can be developed, because, prior to any alteration, the British gas manufacturer must subject himself to a tedious, highly expensive, and extremely doubtful parliamentary contest. We must, therefore, look for improvement to those countries where liberty is less talked about, and manufacturers enjoy more freedom. A Frenchman said to me not long ago, "You English are strange people, and I am puzzled to know when you are serious and when you are joking. Thus, you go to great expense and take much

trouble to hang a man, and then you call a coroner's jury, with witnesses, and you make them enter into a solemn investigation as to the cause of the man's death! Is this," said he, "done seriously, or is it a joke?" I was unable to answer the Frenchman's question; but it reminded me strongly of what is called the "Gas Act," many parts of which look very like serious jokes.

Turning, however, to the chief object of this letter, I will now endeavour to explain the principles upon which the proposed method of converting cast iron into steel is based, and which method is generally known as the process of crystallization. By way of illustration I take an extremely familiar example—the purification of saltpetre. This substance, when first brought to market in its rough or impure condition, consists of nitrate of potash mixed with various proportions of nitrate of lime, chloride of sodium, and chloride of magnesium, the whole of which are soluble in water, but the one which is the least soluble in cold water is the nitrate of potash; consequently, if we dissolve the rough saltpetre in water, and after evaporating a part of the water we set the remainder aside to cool, the nitrate of potash alone will separate or crystallize from the liquor, and leave the other constituents dissolved, forming what is called the "mother liquor," so that if we pour off this mother liquor we obtain purified nitrate of potash.

To appreciate the resemblance of this process to the one which I am about to describe, we must take a view of the composition of common cast iron, usually called pig iron. This kind of iron consists of two distinct carburets of iron, the amount of carbon in the one being much larger than in the other, so that they may be very conveniently distinguished from each other by the names of carburet and supercarburet of iron, and thus identified we say that common cast iron is composed of carburet of iron and supercarburet of iron, with variable quantities of phosphuret of iron, sulphuret of iron, siliciuret of iron, and occasional traces of manganese, vanadium, and titanium. If now we can find a fluid which will dissolve cast iron as water dissolves rough saltpetre, we have only to evaporate cautiously a solution of cast iron in that fluid, and we shall find that the different constituents of the cast iron will separate or crystallize according to their insolubility in the fluid, and thus we shall be able to separate them from each other. Without using any hyperbolic form of expression, we may say that heat or caloric is the fluid required in this case, and when cast iron is melted we may say that it is dissolved in caloric, and as the carburet of iron is much more infusible or insoluble than the supercarburet, it crystallizes or separates before any of the other constituents; so that if we watch carefully the evaporation of the caloric, or, in other words, the cooling down of a mass of melted cast iron, a time arrives at which the carburet of iron has separated from the supercarburet and the other impurities, and if we then pour these off, as we do the mother liquor from the nitrate of potash, we shall obtain purified carburet of iron, having a uniform composition, and possessing, therefore, uniform strength and tenacity, very much resembling in this respect good cast steel; whilst the impure supercarburet appears to have lost none of the resisting qualities of common cast iron. Here, then, rests the improvement in converting cast iron into steel, for even if the carburet of iron thus obtained is not identical with cast steel, it is, at all events, so freed from the impurities of cast iron as to render easy its conversion into steel.

It can scarcely be necessary now to point out the intimate connection which the making of coal gas has with the production of steel from cast iron. Both of these industries could be carried on upon a most extensive scale, and there is no reason to doubt that the conversion of cast iron into steel would profitably absorb all the coke that would be yielded by our gas manufactories, so that the realization of a large profit upon gas would be no longer necessary to ensure a reasonable dividend; and with respect to the mode of proceeding, the process may be said to explain itself, for the furnaces intended to melt the cast iron could be so arranged in number and position as to receive the whole of the coke red hot from the retorts, and thus not only effect a saving of fuel, but also avoid the nuisance, now unavoidable, created by extinguishing the red-hot coke. The cast iron having been melted and run into a suitable basin, is to be allowed to cool until a film or crust has spread upon it from the circumference of the basin almost to the centre, when this crust must be pierced, by an iron bar, midway between the centre and the circumference, and the basin turned over so as to pour out the fluid portion of the contents, the solid carburet of iron remaining in the basin, and fit for immediate removal.

In my experiments, which were made four years ago, and which I have never repeated and never shall repeat, the largest quantity of cast iron used at one time was 8 lbs., from which nearly 3 lbs. of fluid supercarburet of iron were poured off, and the residuary solid carburet then displayed a beautiful appearance of crystalline facets, mostly of a rhomboidal form. I must here, however, recall to mind the fact that experiments which succeed on the small scale very frequently fail on the large or manufacturing scale, and with this caution I conclude my remarks.

L. THOMPSON.

FROZEN LAMP SERVICES.

SIR,—Your correspondent, "T. R. V.," asks a very pertinent question about frozen lamps. Last winter, and in the early part of this one, we were much troubled with them; but we got rid of the difficulty by using methylated spirits. The *modus operandi* was to remove the lamp regulator, open the tap, and pour a small quantity of spirit down the pipe, close the tap for a few minutes, and then by introducing a strong wire, and alternately blowing and exhausting the air, we invariably effected a cure. In some cases where the services were near the surface, the cure was only temporary. But the best remedy is certainly to lay the services in wooden troughs, and fill them up with pitch. A large number of our house and lamp services are laid in this manner, and we are gradually doing the whole of them; and during last winter's severe frost not one of the lamp services so laid gave us the least trouble, although some of them were very near the surface.

I will endeavour to give "T. R. V." an idea of the cost of clearing the pipes with spirits, as it happened in our own case. A gallon of spirits, costing 4s., will clear, on an average, about 50 lamps, and this is a fair day's work for a man, where the lamps are not so very far

separated. It is, however, difficult to fix a number for a day's work of this kind; but say 50 lamps—man's wages 4s. 6d. + 4s. spirit = 8s. 6d. a day. This is about the cost, as near as I can give it.

Perhaps some of your correspondents who have tried other plans will give the cost in their cases.

Jan. 3, 1880.

W. S. M'G.

Parliamentary Intelligence.

GAS AND WATER BILLS, 1880.

The time for depositing memorials complaining of non-compliance with Standing Orders in the case of the first hundred petitions for private Bills expired on the 9th inst., on which day the following memorials relating to Water Bills had been received at the Private Bill Office:—

Rathmines and Rathgar Township Water Bill, from John Gelston and others.

Rochester Corporation Bill, from R. E. Gosbell and A. K. Robinson.

Southwark and Vauxhall Water Bill, from James Inglis.

The following Bills among the first hundred on the list will therefore go before the Examiners as unopposed:—

British Gaslight Company (Staffordshire Potteries); Burton-upon-Trent Corporation; Cork Gas; Cork Improvement; Dagenham and District Sewage; Denton and Haughton Gas; Eastbourne Gas; Exmouth and District Water; Gaslight and Coke, Commercial, and South Metropolitan as; Glinckley Local Board; Huddersfield Improvement; King's Lynn Corporation; Lancaster Corporation; Liverpool Corporation Water; London Gaslight; Oldham Improvement; Phenix Gas; Portmadoc Water; Prescott Gas; Sea Water Supply to London; Wrexham Water; Yeaton and Guiseley Gas.

Legal Intelligence.

CLERKENWELL POLICE COURT.—THURSDAY, JAN. 8.

(Before Mr. BARSTOW.)

CONVICTIONS UNDER THE METROPOLIS WATER ACT, 1871.

Three summonses were heard at this court to-day for non-compliance with regulations made under the above-mentioned Act. The first was against *William Torrell*, of 47, Rupert Road, Upper Holloway, who was summoned by the Governor and Company of the New River for wilfully neglecting to comply with certain regulations made under the Metropolis Water Act, 1871, and duly confirmed by the Board of Trade.

Mr. LYON, who prosecuted, stated that this was one of three prosecutions by the New River Company, which were very important, not only to the district immediately concerned, but to the community at large. If certain regulations, sanctioned by the Board of Trade were not carried out, the water supplied was fouled and wasted. In this instance the defendant had a waste or overflow-pipe, which discharged its contents into a drain, the consequence being that foul air made its way up the pipe and contaminated the water. The defendant, some months since, received a notice from the Company to remove the waste-pipe, or else to convert it into a "warning-pipe," as described by the Act. The defendant neglected to do this, in spite of frequent cautions that he would be summoned if he did not comply with the regulation.

Defendant pleaded guilty, but said his landlord ought to be regarded as the responsible party.

Mr. BARSTOW said this was a most important prosecution, for the defendant, by his conduct, was likely to spread dangerous fevers. He must inflict a fine of 20s. and the cost of the summons.

Charles Layton, of 12, Upper Hornsey Road, was summoned for having violated Regulation 13, made under the provisions of the same Act. This regulation provides that every cistern which is used in connection with the water supplied by the Company shall be made and maintained watertight, and shall be properly covered and placed in such a position as to render it capable of being inspected and cleansed at any time. It also provides that every cistern shall be furnished with a sound and suitable ball-tap of the valve kind, suitable for the inlet of water.

Mr. LYON said that the defendant had received constant requests to comply with these regulations, but had neglected to do so.

Evidence was given that there was insufficient covering to the defendant's cisterns, so that the water became fouled. There were two cisterns in his house, which were difficult and dangerous to get at, and there were two ball-taps which did not work effectually.

The defence was that the water was sometimes thick, and prevented the valves from working properly. The cisterns were accessible by a ladder.

Mr. BARSTOW said that the New River Company's water had the reputation of being the best in London, and it was highly important that the cisterns should be properly covered and kept clean. He ordered the defendant to pay a fine of 40s. and costs.

Margaret Lane, of 37, Liverpool Road, Holloway, was also fined 20s. and costs for disobeying the same regulations. In this case the defendant said she had no cistern, and was obliged to receive the water in a butt as it came in.

THAMES POLICE COURT.—SATURDAY, JAN. 10.

(Before Mr. LUSHINGTON.)

CONVICTION OF THE EAST LONDON WATER-WORKS COMPANY.

The East London Water-Works Company appeared in answer to 56 summonses, upon the complaint of Mr. James Moore, the Secretary of the Improved Industrial Dwellings Company, for having wilfully neglected or refused to furnish with water the Company's houses in the Commercial Road, the rates having been duly tendered or paid.

Mr. WHEELER appeared in support of the summonses; and Mr. WRAGGE on behalf of the Water Company.

Mr. WRAGGE said that he was not aware until the previous evening that there were 56 summonses issued. The understanding came to on Thursday, that the case should be heard to-day, was only in reference to one summons, and he was therefore unprepared with his answer, and thought a further adjournment should be granted.

Mr. WHEELER said that those for whom he appeared had no other course to adopt than to issue the whole of the summonses. The Improved Industrial Dwellings Company were established for the purpose of providing dwellings for the poor, and the first summons affected the building on the north side of the Commercial Road, in which 30 families, numbering about 150 persons, resided. It would be idle to suppose that the Company could continue their dwellings if they were not furnished with a proper water supply, which was the first necessary of existence. Friendly remonstrance had been tried, in order to induce the Water Company to supply water, but without success. The complaints extended over three years, but they reached a climax in November, 1878, and since that time 30 applications for water had been made to the Company. So serious was the evil that the Local Government Board had given notice that unless the water

supply was furnished they would declare that the buildings were unfit for habitation. The duty of the Water Company was regulated by the Water-Works Clauses Act of 1847 (10 & 11 Vict., cap. 17). The 35th section of the Act distinctly stated that the Company should provide a sufficient supply of pure and wholesome water, and that the supply should be furnished at such pressure as to reach the top storey of the highest building in the district. In this case there was an agreement with the Water Company that the water should be supplied to these buildings by meter, so that there was no question as to rates. Under the 63rd section of the Company's private Act, the highest point to which the Company could be compelled to supply water to any buildings was 40 feet above the level of the pavement, and he would be able to show that the height in this case was within the limit. The offences charged against the Company were neglect to supply and a refusal to furnish any owner or occupier with water. The only excuse could be that of non-payment of rates, and in this case he should be able to show that such an excuse did not exist, as the money had been tendered.

Mr. WRAGGE asked whether it was the intention of the Magistrate to take the whole of the summonses. The Clerk had been measuring the premises, and had not completed the work, and, consequently, his defence would be incomplete. In some cases they were below the limits, and in others above.

Mr. LUSHINGTON determined to hear one summons before deciding the course to be adopted in the other cases.

Mr. William Edward Lee, architect and surveyor, was then examined by Mr. WHEELER. He said that Morrison's Buildings, on the north and south sides of the Commercial Road, were erected under his supervision. He communicated with the Engineer of the Water Company, and the cisterns in the buildings were placed in position under his direction. In a letter to witness, the Engineer said, "You will get an adequate supply at 40 feet for every moment of the day and night." The cisterns were at the rear of the building, and were placed lower than usual, in order to suit the Water Company's convenience. From the pavement in Union Street, where the Company's main was, the height of the inlet-pipe was 89 ft. 7 in. He considered 40 feet to be a very low level to which to supply water. The New River Company supplied to the height of 70 feet.

In cross-examination by Mr. WRAGGE, witness said that he had been over the building several times in consequence of these complaints. He did not attribute the failure of supply to the recent frosts.

John Hughes, a porter and agent to the Company at Morrison's Buildings, said the tenants had been short of water since September. On the 2nd of December there was no water at all. On that day he wrote to the Engineer of the Water Company informing him of the fact.

In cross-examination, witness said the weather was frosty at the time.

Mr. James Moore, examined by Mr. WHEELER, said: I am Secretary and Manager of the Improved Industrial Dwellings Company. From September to the present time I have sent several notices to the Water Company relative to the short supply. I have never heard it suggested that the failure was due to the frost; in fact, I have had no reply from the officers of the Company. We have property elsewhere, and those houses have not been without water. I have received notice from the District Board of Health, to the effect that unless a proper supply of water is obtained the building will be closed. The Company agreed to supply water at the rate of 7½d. per 1000 gallons. The rates had been paid to the end of the year. During the year 1879 we paid £21 6s. 1d. for water. The amount would have been considerably more if an adequate supply of water had been furnished.

Cross-examined by Mr. WRAGGE: At Bethnal Green I think I may say that we are, on an average, three days a week without water.

By Mr. LUSHINGTON: Our cisterns will contain about 35 gallons per family, and if filled once a day this amount would be sufficient.

Mr. Edward Lawson Thompson, the chief collector and superintendent of the building, said he had made several complaints to the Water Company, not only in the winter but in the summer time.

Mr. George Borer, assistant to Mr. Lee, said he measured the only two of the cisterns on the north side of Morrison's Buildings which required to be measured. Those which were at the rear of the buildings were, from the pavement immediately over the main, 39 ft. 6 in. high.

Mr. Thomas Blashill, District Surveyor for Bethnal Green East, said that on Friday he visited Morrison's Buildings, and measured the height of the cisterns. The evidence of the previous witnesses was correct.

This was the case for the prosecution.

Mr. WRAGGE said that the summonses now being heard was only in respect of the 2nd of December, on which day there was a severe frost. The Company having now found that the height of the cisterns was within the prescribed limits, would do all they could to furnish a proper supply of water in future. He therefore asked that only a nominal penalty should be imposed.

Mr. Seaton, Engineer of the Water Company, said that there was a severe frost on the 2nd of December, and that many people who had a constant supply turned their taps full on during the night to prevent freezing, and this reduced the pressure.

Cross-examined by Mr. WHEELER, witness said it was possible that many complaints were made from Morrison's Buildings during the year 1879. He might have received 30 complaints, and on each occasion sent officers down to find out the cause, and they reported a short supply. The Local Government Board had communicated with the Water Company in reference to the water supply of industrial dwellings.

Mr. Nathaniel Dullforce, Chief Superintendent of the Water Company, spoke to the fact of the supply having been reduced by people allowing their water to run to waste.

In answer to Mr. LUSHINGTON, witness said that there was an abundance of water in the Company's reservoirs.

William Story, an inspector of waste water in the employ of the Company, also spoke to the waste of water during the frost.

This being the case for the defence,

Mr. LUSHINGTON said from the evidence it was clear that the Water Company had neglected a statutory duty in omitting to supply the water. The excuse was that on the particular day to which the summonses referred there was a frost, which induced people to waste the water. He did not think, if the Water Company had found there had been waste, that this could be regarded as an unavoidable cause. The persons who inhabited the complainant Company's buildings were entitled to a supply of water, and the Water Company having shown no cause why the supply had not been afforded, he should, on the first summons, impose a penalty of £10 and 6s. costs.

Mr. WRAGGE then, on behalf of the Water Company, pleaded guilty to the other summonses.

Mr. WHEELER thereupon applied for the full penalty in each case.

Mr. WRAGGE asked for a mitigated penalty.

Mr. WHEELER said that it had cost the Dwellings Company £50 to do that which the Water Company were bound to do, and, therefore, there were no mitigating circumstances.

Mr. LUSHINGTON, in each of the 25 cases relating to the north side buildings, inflicted a penalty of £2 and costs, the remaining cases to stand adjourned *sine die*.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

The Chief Gas Examiner for the Metropolitan Board of Works (Dr. Williamson, F.R.S.) has just presented his report on his examination of the gas supplied in the Metropolis by The Gaslight and Coke, Commercial, and South Metropolitan Gas Companies, during the quarter ending Dec. 31, 1879, of which the following is an extract:—

I. *With regard to Illuminating Power.*—The maximum, minimum, and average in standard sperm candles, at each of the testing-stations, was as follows:—

	Max.	Min.	Aver.
The Gaslight and Coke Company—			
Beckton (common gas)	18.3 ..	16.5 ..	17.3
Friendly Place "	17.3 ..	16.4 ..	16.7
Millbank Street (cannel gas)	22.6 ..	20.0 ..	21.5
Ladbroke Grove (common gas)	19.4 ..	15.9 ..	17.1
Devon's Road "	17.7 ..	16.2 ..	16.8
Carlyle Square "	17.6 ..	16.0 ..	16.7
Camden Street "	18.4 ..	16.0 ..	16.4
Graham Road "	19.3 ..	16.4 ..	17.3
Commercial Gas Company—			
Parnell Road	17.9 ..	16.2 ..	17.0
Wellclose Square	17.8 ..	16.2 ..	16.9
South Metropolitan Gas Company—			
Hill Street, Peckham	17.8 ..	15.6 ..	16.4

From these results it will be seen that at all the stations of the three Companies, with the exception of Ladbroke Grove of The Gaslight and Coke Company, and Hill Street, Peckham, of the South Metropolitan Gas Company, the minimum has been equal to, or above the parliamentary standard. The average at all the stations has been above the requirement of the Acts of Parliament.

II. *As regards Purity.*—Sulphuretted hydrogen has not been present in the gas at any of the stations. The proportions of sulphur in other forms than this, in 100 cubic feet of gas, were as follows:—

	Max.	Min.	Aver.
The Gaslight and Coke Company—			
Beckton	18.7 ..	6.9 ..	11.7
Friendly Place	16.7 ..	8.4 ..	12.6
Millbank Street	18.9 ..	8.7 ..	11.9
Ladbroke Grove	16.3 ..	7.1 ..	11.0
Devon's Road	20.8 ..	9.9 ..	15.0
Carlyle Square	22.0 ..	9.7 ..	15.6
Camden Street	16.7 ..	9.0 ..	12.6
Graham Road	21.5 ..	8.4 ..	15.3
Commercial Gas Company—			
Parnell Road	19.5 ..	7.1 ..	12.9
Wellclose Square	20.6 ..	6.1 ..	11.3
South Metropolitan Gas Company—			
Hill Street, Peckham	19.6 ..	8.5 ..	14.4

From these results it will be seen that at all the stations of the three Companies (with the exception of Devon's Road of The Gaslight and Coke Company) the maximum has been within the limits allowed by the Acts of Parliament and the average considerably better than the legal requirements, more especially at the Millbank Street, Ladbroke Grove, and Camden stations.

Ammonia has been present, in slight quantities, in the gas throughout the quarter at all of the stations of the three Companies. At the Devon's Road station it only appeared once during the quarter.

READING GAS SUPPLY.

At the Meeting of the Reading Town Council last Thursday—the Mayor (Mr. H. B. Blandy) presiding—the Sub-Committee appointed to take steps with reference to the proposed new Act of the Reading Gas Company reported that the Bill had the following for its objects:—

1. To enable the Company to increase their present capital from £80,000 to £200,000, by the creation and issue of new shares or stock, and to increase their power to borrow on mortgage from £20,000 to £50,000, the Company having, as stated in the preamble of the Bill, unexhausted powers under their existing Acts to raise capital to the amount of £14,000, and to borrow £8000.

2. To empower the Company to purchase a triangular piece of land, situate in the parish of St. Lawrence, lying between the South-Eastern Railway and the River Kennet, containing 12 acres 2 roods and 25 perches, or thereabouts, and forming, in fact, the extreme south-east corner of the parish of St. Lawrence, south of the railway, and to construct new works upon these lands; it being the intention of the Company eventually to transfer nearly all their works for the manufacture of gas and their other manufacturing works to this site.

3. To empower the Company to make a new road from the King's Road (near the entrance to their present works) to the site of the proposed new works, and to carry the proposed road over the River Kennet by a bridge.

4. To empower the Company, the Urban Sanitary Authority, and other necessary parties, to enter into agreements with respect to the extinguishment of certain rights of footpath possessed by the Sanitary Authority, from the Forbury Road, near Blake's Bridge, through the lands of Messrs. Huntley and Palmer and Mr. W. I. Palmer, to the sewage pumping station, and with respect to the construction, maintenance, and user of the proposed new road and bridge.

5. To substitute for the standard burner prescribed by the Reading Gas Act, 1862, for testing the illuminating power of the gas supplied by the Company, "Sugg's London Argand Burner, No. 1," and to fix the quality of the gas, with respect to its illuminating power, at 14 sperm candles of six in the pound.

The Committee state that they have considered the Bill generally, and particularly the questions above mentioned, and have also discussed the same, at two meetings, with a Committee of Directors of the Gas Company, consisting of the Chairman (Mr. J. O. Taylor), the Vice-Chairman (Mr. Lewis Cooper), and Sir Peter Spokes; the Secretary (Mr. R. Bradley) and the Engineer and Manager (Mr. Edward Baker) also being present. The Directors had expressed their desire not to interfere with (otherwise than as above mentioned) the settlement embodied in the Reading Gas Acts, 1862 and 1870, or to diminish the force of the provisions contained in those Acts for the protection of the public and the gas consumers; and had intimated their readiness to consent to certain modifications which had been suggested in the Bill as it stands, if upon further consideration they should appear to be necessary; also to provide in the Bill that the place for testing the illuminating power of the gas should be in the Municipal Buildings; and also for the protection of the public interests in regard to the sewers, the water power at Blake's Lock, and other similar matters. The Committee have very fully discussed with the Directors the questions connected with the construction, maintenance, and user of the proposed new road and bridge, and have arrived at an agreement on the point, which agreement was fully set forth in the report. The Committee then state that they are perfectly satisfied with the proposed new burner, as the one now generally adopted as a test-burner. Having regard to the fact that the proposed powers for the increase of capital and for the acquisition of lands by the Company would, both financially and as regarded their facilities for extending their works and erecting new works, place the Company upon a permanent footing, and render it unnecessary for them to go to Parliament again for many years to come, the Committee felt strongly that the new Act should provide for an increase in the minimum standard of illuminating power from 14 to at least 15 candles, with power to the Corporation to require it to be yet further increased. The Committee were also of opinion that the

maximum charges allowed to be made for gas supplied by the Company, as fixed by the Reading Gas Act, 1870, should be reduced so as to make the prescribed maximum accord more nearly with the actual charges now made by the Company to the different classes of consumers. If provisions were inserted in the Bill for these purposes, the Committee state they would be willing that the Bill should also contain a provision for a just and equitable increase of the maximum rate of charge now allowed to be made for gas, in the event of the Company being required to increase the illuminating power beyond the standard of 14 candles proposed in the Bill. The Committee had considered at some length the question of the propriety of endeavouring to restrict the powers proposed to be obtained by the Company, and to impose upon them the liability to dispose of any superfluous lands of which they may be possessed, and to appropriate the proceeds to the reduction of capital. The Committee thought that the very large increase of capital proposed was altogether disproportionate to the reasonable requirements of the Company; but they were of opinion that, having regard to all the circumstances of the case, the provisions of the existing Acts would be a sufficient safeguard to the public and the gas consumers against any undue increase or unnecessary expenditure of capital, and consequent tendency to keep up the price of gas, if the questions of the prescribed illuminating power and the maximum charge for gas were placed on a more satisfactory footing, as suggested. The Committee further reported that, acting under their instructions, the Town Clerk had returned an answer to the parliamentary notices served upon him on behalf of the Corporation, as the Urban Sanitary Authority, dissenting from the Company's proposed undertaking.

Alderman ANDREWES, in bringing the report before the Council, said that nothing could be more satisfactory than the way in which the Gas Company had discharged their public functions—and in that remark he included the Directors of the Company, and also Mr. Baker, the Engineer and Manager, who had certainly earned all the credit he had obtained, and deserved all the confidence the Company could repose in him. When, however, the proposed new Act was discussed between the Sub-Committee of the Gas Committee and a Committee from the Gas Company, some little divergence of opinion naturally arose upon two or three points. He was happy to say that upon some points they had no difficulty in coming to a preliminary understanding—such as the very important rights of the Sanitary Authority over lands of Messrs. Huntley and Palmer and Mr. W. I. Palmer. But there were two or three questions upon which the Company took very strong and decided ground; and it was because the Sub-Committee felt they would not be right in yielding their own judgment without referring the matter to the whole Council that they brought up the report they had. Anticipating that the matter would be referred to a Committee of the whole Council, he would not enter at large into the questions, but would simply say a very few words in justification of the course the Committee had taken. The Gas Company proposed to increase their capital from £80,000 to £200,000, and their borrowing powers from £20,000 to £50,000. The Committee had every confidence that in asking for this increased power a very wise discrimination would be used by the Company in their expenditure. When similar proposals had been made before for larger capital than appeared to Parliament to be desirable, the amount had been to a certain extent cut down by the Parliamentary Committee. He did not know what special reason the Company had for asking for so much additional capital, except it might be that they did not wish to be compelled to go to Parliament again within so short a period—eight and ten years—as elapsed between their last applications. There must be reasons why it was desirable that the Company should periodically go before Parliament, in the interests of consumers, as it was only on these occasions that any direct concessions could be obtained from companies, and there were always questions it was desirable to solve. This being the case, he thought there was sufficient justification for their asking the Company to reduce the proposed amount of their borrowing powers. As to the purchase of land, a satisfactory conditional arrangement had been made, and no objection could be taken to the formation of the bridge over the Kennet or the introduction of the Sugg burner for testing purposes. As to the illuminating power of the gas, however, the present standard, which was practically 14 candles, had existed a great many years; and as they were prepared to pay a higher price, they could not see why the Company should object to at once give them gas of 15-candle power, and the right to call for 16 or even more, if they were ready to pay for it, and the necessities of the town appeared to demand it. Another question in dispute was the maximum price to be fixed for the gas supplied. At present the price charged was about 9d. per 1000 feet below the maximum, and the Committee thought that as in the Acts of 1862 and 1870 the maximum was reduced, and as there was so wide a margin between their highest charge and the maximum they were able to charge, they ought to reduce the maximum *pro tanto*. Under all these circumstances the Committee had thought it advisable to bring the question before the Council, rather than yield to the request of the Company, or suggest anything in the form of opposition to it. They had such confidence in the maintenance of the good feeling which had always existed, that they did not fear any difficulty in coming to an understanding. He moved that the report be received and entered on the minutes.

Mr. SIMONDS seconded the motion.

Mr. COLEBROOK said they must all rejoice that the town had grown so considerably as to necessitate an increased provision of light, and they could have no quarrel with the Gas Company for seeking to supply a felt necessity. He wished to know if the Gas Committee had considered the desirability of the town becoming possessed absolutely of the gas-works, by agreement or otherwise. He believed some towns had done so with great advantage, though possibly there might be others to whom it had not been advantageous; but the question was fairly open to consideration whether towns should not regard light as they did water. It might be that if there should be a time for considering the question it was now. He offered no opinion himself, but should be glad to know whether the Committee had at all given the matter their consideration.

Mr. MESSER said if it was intended to discuss the matter in committee, he thought it would be best to let it drop at this stage.

Alderman ANDREWES thought the Council would do wisely to refrain at present from a discussion of the question. He would therefore simply say, in reply to Mr. Colebrook, that the question of the purchase of the gas-works had not been altogether overlooked by the Committee; but he feared the time had gone by when anything like a satisfactory arrangement could have been made in this direction. He felt that at one time it would have been wise for the Council to purchase the works, but considering the present value of the property, and that the shares only paid from 4½ to 5 per cent., he thought there was little chance of the town getting much from their acquisition, especially with the question of the electric light looming in the distance.

The motion was then put and carried.

Alderman ANDREWES then proposed that the report be referred to a Committee of the whole Council.

Mr. SIMONDS seconded the proposal.

Alderman PALMER suggested the advisability of obtaining the assistance of an expert in the matter. He said he was glad to know, from Alderman

Andrewes and other sources, that the Gas Company were meeting the Council in an open-handed and very friendly way, and that there was no ground for supposing that they were going to get into any difficulties with the Company.

The Mayor said he was a Director of the Gas Company, and therefore his remarks might be taken for what they were worth. He should be very sorry, not in the interests of the Company, but of all peace and quietness, if, upon subjects which were matters of common sense and not of scientific difference of opinion, they should introduce an expert, whose duty it would be to make opposition for them, and thereby probably embitter matters.

Alderman ANDREWES said the Committee had recently had an interview with Mr. Sugg, and it was upon his advice that they sought to get a higher standard of illuminating power. They would probably have taken further advice, but their Parliamentary Agents had already been consulted by the Gas Company, who had thereby cut the ground from under their feet.

The resolution was then carried unanimously.

BILSTON GASLIGHT AND COKE COMPANY.

The Annual General Meeting of this Company was held on Monday, the 5th inst.—Mr. T. HOLCROFT in the chair.

The SECRETARY and MANAGER (Mr. J. S. Reeves) having read the notice convening the meeting, the following report and statement of accounts were presented:—

The Directors herewith present to the Shareholders their 34th annual report, together with statement of accounts.

The trade account shows a profit of £3150 9s., which with £1822 7s. 7d. brought from last year's account, makes a total of £4972 16s. 7d.

The Directors propose to appropriate this amount as follows:—

Half year's dividend of 4s. per share paid Aug. 1, 1879 . . .	£1100 0 0
Debiture interest " " payable Feb. 1, 1880 . . .	1400 0 0
To reserve fund . . .	421 5 0
Carry forward to next year's account . . .	200 0 0
	1551 11 7
Total . . .	£4972 16 7

The Directors have pleasure in reporting that although the continued depression of trade has prevented any considerable increase in the sale of gas, the results of the year's operations are not unfavourable, especially when it is borne in mind that a reduction of 3d. per 1000 feet in the price of gas took place at the beginning of the year.

In accordance with the powers conferred upon them by the Shareholders, the Directors have issued the £5000 of debentures referred to in last year's report.

The old works at Moxley and the land adjacent thereto are still offered for sale. It is with deep regret that the Directors record the loss which the Company has sustained during the year by the death of its Chairman, the late William Hatton, Esq. He had been connected with the Company for 27 years, during the last 15 of which he had filled the office of Chairman, in which position his ability and large business experience had been of invaluable service to the Company, and had contributed much to its success. Mr. Thomas Baker, who was associated with the Company from its commencement, is also deceased; and the Shareholders will have to elect two new Directors to fill the vacancies thus caused.

Dr.	Trade Account for the Year ending Sept. 30, 1879.		Cd.
Value of stock, Sept. 30, 1878 . . .	£284	0 0	Gas and meter rent . . . £2,488 7 2
Coal	5,411	19 11	Residual products . . . 4,134 15 10
Mains	238	18 11	Sundries . . . 757 11 7
Meters	316	14 5	Estimated value of stock . . . 400 0 0
Retorts, fire-bricks, stores, wear and tear of works, &c. . .	850	7 10	Amount expended on works . . . 492 9 3
Materials and machinery for new works	492	9 3	
Wages	2,759	12 4	
Salaries and Directors fees . . .	604	0 0	
Rates and taxes	508	10 0	
Stationery	41	15 8	
General charges	453	12 3	
Abatements	197	14 3	
Amount written off works ac- count for depreciation . . .	560	0 0	
Balance, profit, carried to profit and loss account . . .	3,150	9 0	
	£15,873	3 10	£15,873 3 10

The CHAIRMAN, in moving the adoption of the report, said that it was with mingled feelings of regret and pleasure that the Directors met the Shareholders on this occasion—regret that for the first time for many years they missed the familiar face of one who had been accustomed to address them from the chair; he referred to their late Chairman, Mr. William Hatton. In the expression of feeling contained in the report relative to their loss he was sure the Shareholders would all concur. The exceptional ability possessed by Mr. Hatton made him (the Chairman) feel great diffidence in attempting to fill the position which he occupied that day. It was, however, a pleasure that, in a year in which trade had been so remarkably stagnant, they were able to meet the Shareholders with so favourable a statement of account. The profits were not quite equal to those of last year. This was due to the low price obtained for coke, and the reduction which had taken place in the charge for gas; but the improvement which had set in, in the trade of the district, gave promise of more favourable results for the ensuing year. He congratulated the Shareholders on the possession of the convenient and commodious offices in which they were met that day for the first time, and he believed, upon an inspection of the works, they would find that they also were convenient and substantial.

Mr. COLBOURN seconded the motion, which was unanimously agreed to.

A resolution authorizing the payment of the usual dividend of 8 per cent. was passed.

The retiring Directors (Messrs. Holcroft, Hickman, and Bradley) and Auditors (Messrs. T. S. Hatton and E. Ellis) were then re-elected.

For the two vacant seats at the Board there were five candidates—Messrs. E. Pugh, P. Bullock, J. Holliday, S. Thompson, and J. H. Farmer; and on a vote by ballot being taken, the first two were elected.

A resolution was afterwards carried empowering the Directors to remit a debt of £80 for gas-fittings supplied to some new schools which had been built in the neighbourhood by public subscription.

The thanks of the meeting having been given to the Directors and Officers of the Company, the proceedings ended.

THE GAS SUPPLY OF LIMERICK.—The transfer of the United General Gas Company's works at Limerick to the Corporation has been completed, the property having been handed over to the town authorities on the 1st inst. The purchase-money, including the cost of various extensions in progress, was £28,000. The two gas-works supplying the city—viz., those originally belonging to the Corporation, and the works recently acquired from the Company—will now be amalgamated, which will involve some considerable rearrangement and concentration of the manufacturing plant, and a complete reorganization of the mains and service-pipes throughout the city. This responsible duty has been entrusted by the Council to Mr. Thos. Newbigging, of Manchester, who will advise as to the best method of carrying out the alterations.

ON REGENERATIVE GAS LIGHTING.

By Herr F. SIEMENS.

[A Lecture delivered before the Society for the Promotion of Industry in Prussia.*]

As early as 20 years ago, at the period when the results of our heat regenerative furnaces were first demonstrated, I had some thoughts of using the same means of economizing the combustible materials used in the production of light, and with a view also of obtaining a light of intense power. The want of success which attended the experiments made at that time seemed to prove the impossibility of properly supplying a gas-flame with heated air, owing to my supposition that double glasses or chimneys, one within the other, were necessary in order to bring the combustion gases and the fresh air together, and the inner glass could not withstand the heat. Later experience of regenerative gas-furnaces taught me to utilize the natural currents of gas and heated air within a large clear oven or furnace chamber, to obtain better combustion of the gas, and consequently the former system of separate combustion chambers was entirely abandoned. It was found that a direct or artificial conjunction of the gas and the air in a special mixing chamber was very disadvantageous, not only with regard to perfect combustion, but also to economy of fuel and the durability of the furnace, and was in every way inferior to free combination caused by natural currents. The regenerative principle could only be applied to lighting purposes by taking advantage of the automatic motion of air, gas, and the products of combustion at different temperatures. The introduction of the electric light, and the opportunity thereby created for the employment of burners of higher lighting power, led me to return to this subject. The first experiments made with the mixing arrangements on the principle just described clearly proved to me that it was possible to obtain very satisfactory results by simple means.

I will now describe the three varieties of apparatus actually constructed, and the accompanying drawings show four varieties of them.

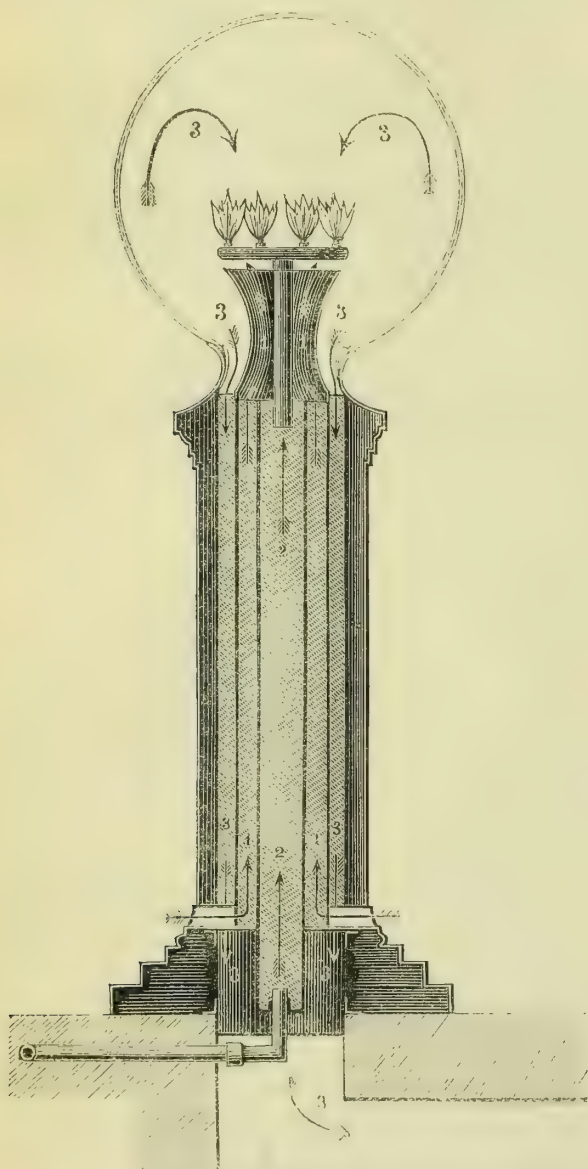


FIG. 1.

Variety A (fig. 1) is a pillar lamp, which, as may be seen by the drawing, consists of three concentric tubes, surmounted by a glass globe. At the lower part of the globe is an ordinary burner, with six radial flames. All the space in the tubes is filled with wire netting, which I call regenerators, and which serve either to abstract heat from passing gases, or to communicate heat to them. The middle pipe being the gas supply, the air is admitted from below into the second annular pipe, and, passing upwards into the globe, is there burnt with the gas. The products of this combustion pass away down through the annular space of the outermost pipe, into a chimney or aspirator flue. (The arrangement and course of the currents are shown in the drawing.) The wire-net regenerators in the annular space of the outer pipe are thus heated by the products of combustion as they pass away from the globe, and this effect is specially marked in the upper part of the wire-net. The heat thus extracted is

communicated by conduction and radiation to the regenerators in the air-pipe, and also through the side to the inside gas-pipe. Air and gas are thus pre-heated, and this pre-heating increases in proportion as the temperature of the flame, increased by the pre-heating of air and gas, increases the temperature of the regenerators in the outer pipe. The increase of temperature, and consequently of the illuminating power of the flame in the globe, continues until the cooling effect of radiation balances the production of heat.

It is necessary to explain the fact that the highly-heated products of combustion, rising upwards in the globe, turn therein and pass away downwards, without affecting the flame or the air supply. This is explained by the rising flame taking the hottest passage in the middle of the globe,

while the combustion products, in passing off, naturally take the coolest way, along the inner surface of the globe.

Variety B, in the style of a chandelier (fig. 2), is constructed on the same principle, but adapted to the different circumstances of the case. Air and gas enter the globe from above; and the former automatically passes along the inside of it, joining the flame in the proper manner. The products of combustion in this case pass off directly upwards. Instead of concentric pipes, the chandelier connection has (see cross section) a sheet-iron tube, so arranged that air and the products of combustion, in alternate divisions, pass through the regenerators, in order to obtain as close contact as possible for the due interchange of heat. The arrangement as a chandelier necessitates better means for the transmission of heat than are required in a pillar lamp. This is due to causes which will be better understood when I have fully explained the automatic currents, as I intend doing later.

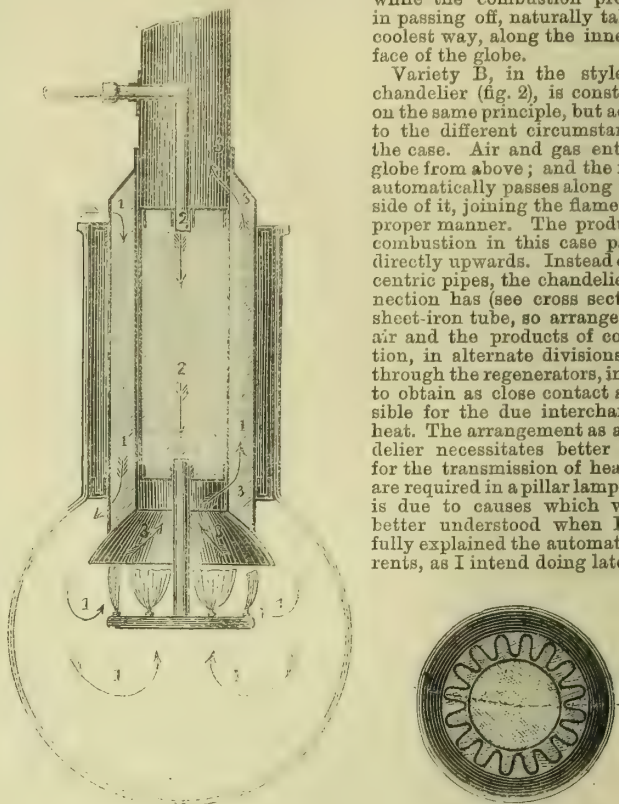


FIG. 2.

Variety C (fig. 3) represents a regenerative oven on the true principle, the same regenerator surfaces which have absorbed the heat of the combustion products communicating it in turn to the cold air required by the flame. There is only the superficial distinction that the entire oven changes its position instead of the draught. It will be seen by the

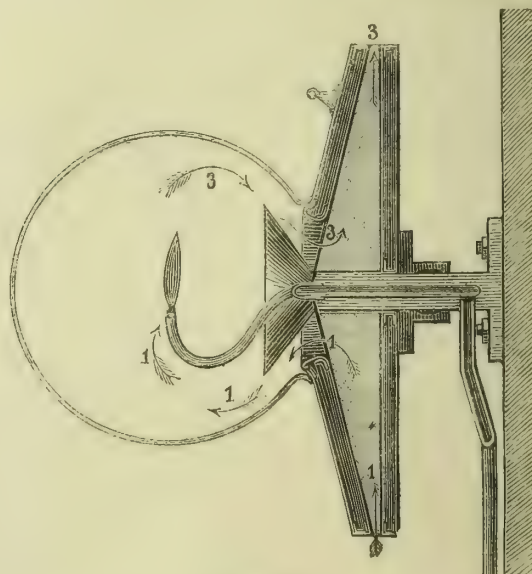


FIG. 3.

drawing that the regenerator is in the form of a plate round the horizontal gas-pipe, which serves also for a spindle. The flame is in the centre of the plate. The air necessary for combustion enters the regenerator at the lower edge of the plate, and flows automatically to join the flame, while the products of combustion pass off through the upper portion of the same regenerator. The upper portion of the plate will thus become heated, and can be made to heat the air directly by being continually turned slowly round, so that the heated portion gradually comes below. This style of burner is specially adapted for throwing light in one direction, as a reflector of brass, gun-metal, or china may be used, as shown. As either a hemispherical or entirely globular glass may be used, fixed to the generator or to the spindle, and the flame is fixed in its centre, this design is also as well suited for throwing light in all directions as the previously described varieties, A and B.

A number of other designs might easily be added to these. The heat regenerative system is also applicable to petroleum, solid luminants, and other substances. An alteration which would be very useful in certain circumstances could be made by using the apparatus C, just described, for the production of hot air only, which could be drawn off and used for

* The *Journal für Gasbeleuchtung* for December published the original, from which our translation has been made. The illustrations, too, have been reproduced from our German contemporary.—Ed, J. G. L.

burners in various places. I can prove the possibility of such a method of lighting by an experiment with variety A, taking off the glass globe, and allowing the flame, supported by the hot air from the regenerator, to escape into the open air. The illuminating power of the flame would soon decrease, because the heating of the generator is suspended, and the air supply soon falls to its usual temperature. You will have perceived already that the principle can be used in unlimited numbers of ways, and it is but right that I should point out that the subject is far from being exhausted, but, on the contrary, the applications and advantages of the heat regenerative system, as applied to lighting purposes, have been here set forth only as actually proved by the first incomplete but highly promising trials.

I promised to return to the automatic currents. As already mentioned, these currents are regulated by their temperature, and the temperature of the surfaces with which they come in contact, and I have utilized them for a long time with great advantage in my regenerative gas-furnaces, especially in furnaces for melting and annealing glass. By the proper utilization of these currents, the most complete combustion and most uniform temperature are obtained in the furnace; and, on the other hand, the completest possible exchange of heat in the regenerator can be established. Without going more closely into the particulars of furnace working, I will examine the effect of these currents in the three above-described apparatuses (A, B, and C), after which you will be able to draw your own conclusions as to other means of utilizing them.

In variety A the automatic currents are made use of in the manner already mentioned. The flame and its products rise straight upwards, the gases produced being hot, and of small specific gravity. At the top of the globe they encounter a natural obstacle and turn downwards, unless this movement has been previously induced by the action of the draught. As, however, the hot gases or combustion products have little inclination to move downwards, they will, when compelled to do so, take the coolest way—viz., past the inner surface of the globe. The upward and downward currents in the ball keep as widely separated from each other as possible. The peculiar effects of the automatic currents are also shown quite as favourably in the regenerators of variety A. The downward currents of the hot combustion products always take the coolest way, their specific gravity being greatest there. The upward currents of hot air, on the contrary, take the hottest course. The consequence is that regenerators are always uniformly heated in horizontal layers. The stream moving downwards, as well as the one moving upwards, always tends to keep as near as possible to the surface of the pipe by which they are separated, because directly on the surface of this pipe is to be found the heating influence for the rising current, and the cooling influence for the downward current. With this arrangement the exchange of heat is, therefore, as complete as possible. The general conclusion may be drawn from this that the regenerators must be arranged as nearly vertical as possible, with the hot end at the top and the cold end at the bottom. The results arrived at also prove that such a regenerator system, when placed upside down, effects but a very incomplete exchange of heat, and it is for this reason that in the variety B, where the cold end is at the top, the division-plate is so arranged as to artificially assist the contact between the combustion products which have to be cooled, and the air supply which is to be heated. Hence this design is less suited for giving a very intense light, and the arrangement is made only because circumstances sometimes require a lamp to be suspended overhead. This design, moreover, has the advantage that the globe does not become highly heated, and never blackens, its interior being exposed only to clean though hot air.

In variety C the system of natural currents is modified. The heating of the air in the generator takes place in the proper manner, from below upwards, and the currents in the globes take their natural course; but the absorption of heat is opposite, in consequence of the upward course of the combustion products in the regenerator. This unfavourable circumstance is, however, completely counteracted by constantly revolving the apparatus at a uniform rate by machinery or clockwork. The combustion products are thus prevented from taking hot channels in their upward course, because new and cold surfaces are continuously brought into position by the constant revolution.

There is another and very important fact which requires close examination in view of the successful application of the regenerative system to lighting purposes. There is much heat radiation from the visible flame, but very little from the transparent and invisible products of the flame. For this reason a very large glass globe may be used without incurring any great loss of heat. The invisible combustion products which appear to have a low temperature keep the regenerator glowing hot, as may be seen on inspecting the apparatus. It will also be readily understood that specially designed obstacles, such as the wire netting, for example, are necessary for abstracting and yielding up the heat of these invisible gases, contact of which with such obstacles should be as frequent and intimate as possible. Hence the incompleteness of a system of heating air by passing it through plain tubes, where it meets with no obstruction. This fact can be readily proved by experiment, and I have, in fact, utilized it with considerable success in my glass ovens, the sides of which have to be kept cool by currents of air.

I will now exhibit to you another mode of lighting. Variety D (fig. 4) represents a vertical gas-lamp and retort combined, in which the burner is supplied direct from the coal. This apparatus is designed for use in the open air, for which it is the more suitable, as neither chimney nor fixed attachments are necessary, and it can therefore be employed anywhere. The general arrangement will be clearly understood from the figure. It consists mainly of three concentric pipes, the inner being filled with coal and the outer ones with regenerators. The three pipes, which are of nearly the same length, and connected together, are placed over a furnace, so that the two inner pipes are open to the fireplace, and the outer, which is closed to the fire, stands over it as shown. The inner pipe is provided at the top with a branch, which passes through the other tubes, and is closed at the end with a cover and water seal. This is intended to receive the charge of coal, which drops through the inner tube to the furnace below. At the upper end, above the branch, this tube is closed with a thick plate, through which passes a vertical gas-pipe. The second or intermediate tube, open below, is closed at the top. Below its termination a branching chimney takes off the products of combustion from the furnace. The outer pipe, which is fixed over the furnace, without having any connection with it, but admitting air by a circle of holes at the bottom, closes round the gas-pipe at the top, where it has an orifice in the same horizontal plane. The outside pipe and the furnace are surrounded by a non-conducting coating, so as to retain the heat as much as possible. When the inside tube is filled with coal, and the feeding branch sealed, the furnace is lighted, and the flames, &c., pass up through the intermediate annular space, and find an exit at the chimney, heating in their passage not only the regenerators in the tube, but also the coal in the retort, and the air regenerator or outer pipe. The gas thereby expelled consequently burns at the top, together with the heated air from the outer pipe. The heat of the gas-flame in this case escapes without further use, which is really not material, because the combustion of the coke produced in the retort gives sufficient heat not only to gasify the coal above it, but also to pre-heat the necessary air for the burner. I reserve, however, the

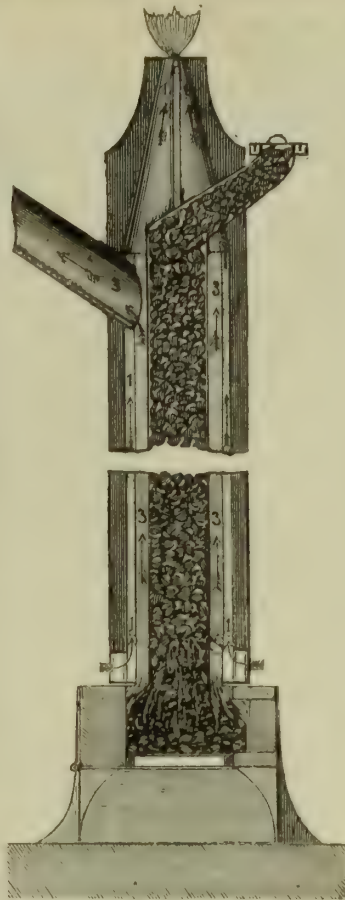
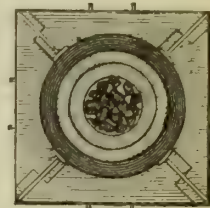


FIG. 4.

power of utilizing the heat of the gas-flame also, if required, by removing the products of combustion through an outer pipe, as in variety A, and providing a separate chimney. To avoid lighting the furnace afresh each time that the light may be required, I extinguish the burner by an air-tight cover, and similarly close the chimney and the ash-door of the furnace. No further consumption of coal then takes place, but incandescence continues on the fire-grate for several days, and it is therefore only necessary to put in fresh coal and open all the orifices in order to obtain light in from half an hour to two hours.

This arrangement has been chosen for explanation because of its simplicity; but, in reality, a more complex design appears to offer greater advantages. It would, for example, be easy to increase the height of the layer of coke in the furnace, and so produce carbonic oxide gas instead of the usual products, and to arrange a ring of holes in the middle tube for the admission of air to burn this gas. The bottom of the tube would not then burn so quickly, and a uniform heating of the retort and the outer



air-pipe would result. The burner could also be provided with double air draught, whereby the intensity of the light would be augmented. Several burners could also be used. When unpurified gas is employed, and a fire is also possible, it will be seen that this application of my system of regenerative lighting, combined with a gas-retort, is very economical, and will produce a good light. I consider it of great advantage in open street lighting and for large areas, and to assist in lighting up large works. Stoppages can only arise from accumulations of tar or soot in the gas-pipe when it is not carefully cleaned each day during use. There is no danger even in case of obstruction at this point, for the gas would then escape at the bottom, and pass up the intermediate tube.

I think I have given a clear idea of my system of lighting and the apparatuses in use, to which I give the name of "Light-accumulators," and also of the principles on which they are based. I will therefore only add a few words respecting the globes to be used. Though only the flame, and not its products, radiates heat, yet the glass is made very hot and is easily cracked. To avoid this I harden it so as almost to entirely overcome its tendency to fracture. As regards the intensity of the light, I can safely state that it is at least six times greater than in ordinary gas-burners, but the exact determination of this I leave to more skilled observers. I may, however, point out that the power of the light at present produced is no criterion of the future development of my system, since the apparatus used is still incomplete, and the intensity will be found to vary in different arrangements.

At the conclusion of the lecture the following discussion took place:—

Dr. W. SIEMENS: I will offer a few remarks as to the rotative regenerative apparatus (C). The best mechanism for causing it to revolve is still to be found, but I think it might be done easily by electricity. I am of opinion that, with a suitable motor, this form is the best, for all the others have the disadvantage of requiring a special chimney. The wonderful effect of pre-heating in increasing the illuminating power is most conspicuous. The same phenomenon has been observed in the electric light. The increase of light at high temperatures takes place very quickly, so that an increase of temperature alters very considerably the proportion between heat and light radiation. That the lighting effect of the same gas is increased from four to five times, by means of regenerative heating, over the usual method, can only be explained in this way. I do not think there will be any very great competition between the three methods of lighting—viz., common gas, gas which has been pre-heated, and the electric light. Each has its own field, where it will be found most suitable, and there will even be places where all three kinds can be successfully used together.

Mr. F. SIEMENS: It must not be supposed that this method of lighting is suited for every purpose, because it is not so divisible as ordinary gaslighting.

Mr. ELSTER said that as the difference between the light given by the French and the usual burners did not prove so great as was at first anticipated, it could hardly be supposed that this system would give four to five times more light.

Dr. SIEMENS: It is, however, quite possible, because the burners hitherto used are not based on the principle of regaining the heat of combustion and using it for the flame. That is the difference. Any one can test it. When the flames of two moveable brackets, each with a fishtail burner, are approximated to each other, a very bright light is obtained, but when the flames are separated again the light becomes disproportionately less.

Mr. DRUCKENMÜLLER: How is it with the heat evolved?

Mr. F. SIEMENS: There is proportionately no more heat evolved, but only the intensity of the flame increased. The flame is, of course, hotter, by giving more light, and radiating more heat; but 100° C. more heat makes, on the other hand, a very great difference in illuminating power. The temperature of ordinary gas-flames is 1600° C., but even 1700° is a very bright light indeed, and 1800° is probably the temperature of the electric light.

At the close of the meeting the different regenerative apparatuses were exhibited. Mr. F. Siemens's statements as to their illuminating power were confirmed, and their designs appeared well suited for many of the purposes of lighting.

SALFORD CORPORATION GAS SUPPLY.

The Monthly Meeting of the Salford Town Council was held last Wednesday—the Mayor (Alderman Robinson) presiding—when,

Alderman SHARP moved—"That the General Gas Committee be empowered to proceed with the following works required in extending the several gas stations, at an estimated cost of £52,600, being part of the works authorized by the Council on the recommendation of the Committee on Jan. 24, 1877, viz.—At Lamb Lane: New buildings for station governors, meter stores, workshops, and offices. At Regent Road: The completion of the new retort-house, stores, and other buildings, and providing new retorts and retort-fittings for both of the houses. At Liverpool Street: New condensers, exhausters, scrubbers, purifiers, and meters, with the necessary connecting-pipes and buildings." He said that the proposed extensions simply represented another section of the work which the Council had already agreed to undertake, and was part of the £160,000 scheme already sanctioned. When the Council passed the scheme the matter was fully discussed time after time, and an elaborate report and numerous plans were prepared by the Gas Engineer, Mr. S. Hunter. That report and the plans were submitted to one of the most eminent and successful of gas engineers—Mr. George Livesey—and approved by him. The scheme was strongly recommended to the Council, and it was ultimately unanimously adopted. Since then the Gas Committee had had ample time for reconsideration, and this reconsideration had convinced them of the wisdom of their action three years ago. Although so much had already been done towards extending and improving the gas-works, such was the rapid increase in the consumption of gas that it was imperative they should proceed further. In the year ended March last, notwithstanding the dulness of trade, there was an increase of 65 million cubic feet in the gas consumed. Whatever their opinion of gas as compared with the electric light might be, they were compelled to extend their works to meet the requirements of their customers. The extensions now proposed had been well considered by the Committee, and passed unanimously.

Mr. MAKINSON seconded the motion.

In the course of the discussion that followed, it was suggested that the extensions should be held over until something definite was known as to what the electric light promised from America really was worth.

Mr. W. H. BAILEY, however, said that when the electric light was resuscitated some two years ago—it had existed for 25 or 30 years—he was afraid that the gas-works would be a great loss to the public, but he had since found that the only people who recommended its use were the Yankee reporters. He did not know of a man of any position in the engineering world who had dared to say that the electric light would compete with gas. The Council chamber was lighted by 84 burners, at a cost of 10d. per hour. If the room were lighted by the electric light, under the best possible conditions, it would cost 2s. 3d. per hour. He had examined the question in every possible way, and was not afraid of the electric light. There had been a great many improbable statements made about the light, but the men who had written about it were the newspaper men of America who had interviewed Mr. Edison. Mr. Edison made a mistake in saying that he had divided the electric light; he did not divide it at all, for his division was simply addition. The electric light was no cheaper than it was 25 years ago, when Sir John Potter had it on view in Pendleton. There had only been a few improvements in the lamps for the electric light, and gas would hold its own for many years to come.

Mr. KEENEY said he had found that the consumption of gas in the borough was doubled in every ten years, and during the last three years the consumption had increased from 500 million to 700 million cubic feet. He thought the Committee were bound to make provision for the increasing demands of the consumers.

Mr. MAKINSON said from time to time, during the last two years, the question of the electric light had come before the Gas Committee, and had been carefully considered by them, and the Gas Engineer had also duly reported upon it. The Committee were bound by Act of Parliament to supply with gas all the consumers within a certain radius, and if they did not do so, they would be guilty of a breach of the law. The consumption of gas had very largely increased during the past two years, but more especially during the last year, when it actually increased something like 10 per cent.—that was to say, 60 million cubic feet—which amount represented what would supply a small market town for a year; so the Council could understand how great the increase was. With regard to the electric light, they had all heard rumours about it, and while gas shares fell one week they rose again the next. He had been assured by the Gas Engineer that at least £47,000 was absolutely necessary for increased improvements.

Mr. DEARDEN said when it was resolved to spend the £160,000 on the gas-works it was understood that the improvements would extend over a period of several years. Three years had passed, and he wished to know how much of the £160,000 would remain after the £52,600 now proposed had been spent.

Alderman SHARP said about £50,000. Whatever the cost might be, the gas department was a trading concern, and was bound to find gas for the people.

The motion was then carried by 41 votes to 5.

PROPOSED PURCHASE OF THE GAINSBOROUGH GAS-WORKS BY THE LOCAL BOARD.

At the Meeting of the Gainsborough Local Board of Health on Monday last week—Mr. PEARSON in the chair—the question of the purchase of the local gas-works by the Board was under discussion.

The CHAIRMAN said that Mr. Gamble had consented to recommend the proprietors of the works to accept from the Board £42,000 in cash. The Board would remember they had expressed a wish that instead of paying a large sum for perpetual annuities, at 3½ per cent., a fixed sum could be paid. The Company would be willing to leave the sum of £42,000 at 4 per cent. for a period not exceeding 25 years, or for a longer period, on conditions. They would require the Board to assume liability respecting £1339, which was the debenture debt, bearing interest at 4½ per cent., but which they would have the privilege of paying off if they obtained the money on better terms. It was to be distinctly understood that any information the Board obtained, or had obtained from the Company during these negotiations, was to be strictly without prejudice to the Company. Though not exactly treated as a private communication, it was not to be used at any time to the prejudice of the Gas Company. There were minor matters mentioned in the terms. There was about £200 worth of furniture and tools, for which the Company would make no charge, and there were various meters on hire, which would have to be taken over by the Board at a sum of about £250, and which, he was informed, were worth double this amount. Mr. Gamble also made an important stipulation. He (the Chairman) mentioned that he was strongly of opinion that the electric light would before long supersede gas for some, if not for all purposes, and Mr. Gamble stated his willingness to allow the Board the option of throwing up the bargain if, during a year after agreeing to terms, there appeared a probability of the electric light

becoming so far likely to supersede gas as to warrant such a step. If the Board did not give up the bargain they would be expected to pay an additional sum for any extension of the works the Company might engage in, which works were necessary in any event. The profit on the works last year was £1940. The Directors took £88, and the interest on the funded account amounted to £50. These would give £2078. Then the interest on the £42,000 would be £1680, from which £35 in respect of property-tax should be deducted, thus leaving as the difference between £2078 and £1645 the sum of £433, which Mr. Gamble said would be the profit derivable by the Board, supposing they continued to carry on the works as he had done. A calculation as to certain arrears would probably give about £100, which should be added to what was made.

In subsequent remarks by members of the Board, it was freely stated that they considered the recent reports from America of what Mr. Edison claims to be doing in reference to the electric light were worth consideration before negotiation went further, and

The CHAIRMAN said he quite agreed with the objections entertained on this ground, but Mr. Gamble had told him that if it had not been for this element of consideration he should have asked £10,000 more.

Mr. GREEN moved that no further discussion of the question should take place at the Board for six months; but it was afterwards agreed that the question be deferred for a fortnight.

WORCESTER AND THE LIVERPOOL (VYRNWY) WATER SCHEME.

At the Monthly Meeting of the Worcester Town Council last Tuesday—the Mayor (Mr. J. Noake) presiding—the Special Water Committee reported on the action recently taken with regard to the above-named scheme, from which it appeared that communications had been sent to the Corporations of Shrewsbury, Bridgenorth, Bewdley, Tewkesbury, Cheltenham, and Gloucester, asking what course they intended to take in the way of opposition to the Bill, and suggesting that the expenses of opposition should be contributed according to the rateable value of the cities and boroughs joining in the opposition. The Committee recommended the Council to oppose the Bill, and by their instructions notice of this had been advertised.

The MAYOR said that answers had been received from some Corporations, but they were unable to give a positive answer, as, after getting the consent of the respective Councils, there had to be a town's meeting in each place. They would know more about the matter in two or three weeks. It was contemplated to go before the President of the Local Government Board on the 10th prox., when a deputation from public bodies of towns in the watershed of the Severn would be received. The Committee could take no further step without the direction of the Council as to what was to be done. To go into parliamentary opposition would require an absolute majority of the Council and a town's meeting. It would be a serious matter as to cost—it might cost several thousand pounds. The question ought not to be fought out by the Worcester people alone; the Corporations of other boroughs up and down the river ought to contribute their quota. But it appeared to him that as the Worcester navigation was involved, its salmon fisheries, its water supply, and its sanitary arrangements jeopardized, the Council, as conservators of the public interests, were bound to take some step. The Council should, he thought, to take the initiative, and it was for members to determine to what extent they would go in opposition. He did not recommend them to give the Committee unlimited licence to spend £4000 or £5000, but to take the initiative. He thought it very likely, from overtures made by Shrewsbury, that a consultation would take place between the representatives of towns whose interests were involved, as to contributing to the expense. He thought the Council should give power to the Committee to take the necessary steps for fighting the question, but at the same time leaving it to their discretion as to what extent they might be induced by circumstances to go. He concluded by moving a resolution committing the Council to oppose the Bill.

Mr. BOZWARD seconded the motion, maintaining it would be cheaper to spend £5000 in successfully opposing the Bill than to have hereafter to provide another water supply.

The TOWN CLERK suggested the addition of a few words to the resolution, limiting the expenses to be paid by the Council to those only which they incurred; and said he did not anticipate that the Committee or the Council would go to £5000 expense without from time to time considering what they were doing.

The resolution was then adopted, as were also other resolutions as to the deputation to London on Feb. 10, and authorizing the Committee to confer with representatives of other public bodies.

THE WATER SUPPLY AND SEWERAGE OF PARIS.

Under the above title, M. Alphonse, the Director of Public Works in Paris, has published a series of papers of very considerable importance, not only to residents in the French capital, but to all who are engaged in the sanitary improvement of large cities. He commences by according a well-merited tribute of praise to his predecessor in office, M. Belgrand, who, he says, above all others, is entitled to the gratitude of every Parisian, for the magnificent water-works with which he provided the city, and by means of which the inhabitants have been furnished with a splendid supply of fresh spring water of superior quality. Having rendered this homage to one of the most illustrious men of his country, M. Alphonse proceeds to consider the various means of improving and developing the system of water supply at present in use in Paris.

While admitting, he says, the importance of providing a city with pure and wholesome water for domestic use, it must be conceded that it is no less necessary to relieve it of that which has been rendered impure, as well as of that which falls upon the soil from the clouds. The drainage system in Paris, which 20 years ago was so defective, has now been so nearly perfected, that only a comparatively small outlay will be required, if not to complete the work, at least to finish the main sewers, which are indispensable in order to secure the streets against the risk of being flooded.

The authority having the supervision of the water and sewerage works in Paris is likewise charged with the work of clearing the house cesspools. This is one of its most difficult duties, and one, moreover, requiring the greatest care in its performance. The separation system adopted in Paris, by which the liquid portion of the excreta is allowed to pass into the sewers—thus reducing the labour of removing the nightsoil to the carrying away of a certain quantity of solid refuse—would, if properly carried out, be in every respect a vast improvement.

Having relieved Paris of her sewer waters by pouring them into the Seine, M. Belgrand had to seek some means of remedying the inconveniences resulting from such a system, by making the best he could of the effluent waters themselves. After a number of trials, which were attended with more or less success, the problem seems now to have been solved, thanks to the energy and perseverance of MM. Mille and Durand-Claye. It is very doubtful whether we have yet heard all that science

has to say on the subject of the trials these gentlemen have been conducting at Gennevilliers. As the result of experience, a number of improvements have already been discovered. The road, however, is still open, and by continuing to advance along it with firmness and prudence, the double object will be attained of removing the impossibility or danger of employing the water of the Seine for culinary purposes, and of utilizing for the public benefit the powerful fertilizing elements contained in the sewer waters of the city.

These preliminaries having been stated, M. Alphonse proceeds to treat the several subjects of Water, Sewers, the Removal of Nightsoil, and the Purification and Utilization of Sewage Waters.

According to M. Belgrand, the volume of water at the disposal of the inhabitants of Paris in the year 1877 was 370,000 cubic metres, or about 81½ million gallons per 24 hours. Of this quantity 236,000 cubic metres, or about 52 million gallons, were obtained from the Rivers Seine and Marne and the Canal de l'Ouercq; 6000 cubic metres, or about 1,320,000 gallons, from artesian wells; and 128,000 cubic metres, or about 28 million gallons, from springs. In a dry year, when the want of water is most keenly felt, the total quantity supplied might be reduced to 296,000 cubic metres, or about 65 million gallons; but in the event of an accident happening to the machinery, or to the conduits conveying the water, the city might find itself reduced to 200,000 cubic metres, or about 44 million gallons, which would be altogether insufficient for supplying the wants of the inhabitants.

According to a statement compiled by the Engineer-in-Chief, it appears that the daily consumption of water in Paris, is now only 354,350 cubic metres, or about 78 million gallons, apportioned as follows:—For street watering, public fountains, &c., 228,569 cubic metres, or about 50½ million gallons; and private consumption and waste, 125,781 cubic metres, or about 27½ million gallons. It is clear, therefore, that the quantity of water at present distributed in Paris is much too limited. The great work of street improvement carried out during the last quarter of a century has been the means of giving light and air to the inhabitants of the city; it now only remains to give them water in sufficient quantity, and this part of the programme is not the least important, when regarded in its relation to hygiene and the public health.

To satisfy the wants of the population and the requirements of industry it is considered that a further supply of 150,000 cubic metres, or about 33 million gallons of water will have to be procured. Among the three sources at present available for the purpose—viz., the springs and the Rivers Seine and Marne—M. Alphonse gives preference to a supply from the Seine, to be taken at a point much higher up the river than Paris, and raised by means of steam-engines of 150-horse power. He, therefore, advises the Prefect of the Seine to lay before the Municipal Council a project by MM. Couche and Humblet, which will allow of an increase in the amount of water available for distribution in Paris by something like 150,000 cubic metres, and this in the most economical way; to call upon the Water Company to meet the Council and discuss with them the terms of a new contract having for its object the carrying out of certain measures for affording greater facilities for the use of water among the inhabitants, and the lowering of the charge to a rate proportionate to the means of small households.

The subject of water supply having been disposed of, M. Alphonse turns to the sewage question. The drainage system of Paris consists first of all of the large main sewers which intersect the city, and cut it up, so to speak, into drainage areas. The sewers collect the rain and house waters, and convey them to a spot where they may be discharged with safety into the Seine, even at the time of high water. Thus Paris is relieved of her refuse waters, which would prove a source of pollution were they discharged directly into the river, and the low-lying parts of the city will be protected against floods.

The total length of sewers actually finished is 619,715 metres, or about 380 miles. To complete the system, 420 kilometres, or about 260 miles of additional sewers will have to be constructed. When to the outlay necessitated by these works is added the cost of improving and completing the large main sewers, and the drainage of certain quarters of the city as yet but inadequately, or even totally unprovided for, a total is arrived at of 44½ million francs, or not far short of £2,000,000 sterling.

Intimately connected with the sewage question is the subject of emptying the cesspools. The method at present employed for removing the nightsoil from the houses is the carrying away of the solid portion of the excreta in suitable conveyances, and its deposition in the receptacles provided for it outside the city. Such a system may justly be regarded as barbarous, and is altogether unworthy of a city like Paris, where such great progress has been made in almost every branch of the public service. The nauseating odour pervading the streets when the operation of emptying a cesspool is in progress, the blocking up of the thoroughfare with the necessary appliances, the disturbance caused in the night, when this work usually goes on, the infection not only of the water-closets simply, but of the entire house under treatment—all these things place the inhabitants in circumstances which are not unattended by very considerable danger to the public health. Then, again, the depositories for the reception of the excreta; these, by reason of the unbearable stench emanating from them, are a perfect pest to the localities in which they are established, and the residents have thus to tolerate a nuisance which the law may allow, but which equity should certainly put a veto upon. The complete abandonment, or an entire modification of the present system of emptying the cesspools therefore commends itself to the serious consideration of the Municipal Administration as an imperative duty devolving upon them.

M. Alphonse next passes successively in review the questions of cesspools and their management; sewage receptacles and their present situation; private depositories for nightsoil; the abandonment of the present system of removal, and the substitution of one by which the refuse would flow into the drains; the processes in use for removing the solid and liquid excreta; the revenue that would be produced by imposing a tax upon all closet pipes in connection with the drains; the advantages of rendering compulsory the flowing away of the liquids, and the connection of this subject with the completion of the sewerage system. He then asks the Prefect of the Seine to make the following proposals to the Municipal Council:—

1. The establishment of the system of conveying all the liquid refuse into the sewers, and the adoption, in place of the fixed and moveable cesspools now in use, of appliances for separating the solid matter, with discharge-pipes leading into the drains.
2. That authority should be given to apply to the Government to impose a tax of 30 frs. on every such discharge-pipe.
3. That the proceeds of such tax should be specially applied to the completion of the sewerage works of the city, to the development of the use of the sewer waters for agricultural purposes, and to the general extension of the water supply in Paris.

With these recommendations M. Alphonse concludes the third section of his work. In the next he deals specially with the question of sewage purification; but this, with the conclusions arrived at, will be noticed next week.

AMERICAN GASLIGHT ASSOCIATION.

[Abridged from the "Official Report" in the *American Gaslight Journal*.]

(Continued from p. 23.)

Mr. W. H. PEARSON (Toronto, Canada) read a paper on

THE LOWE (WATER) GAS PROCESS.

At the last meeting of this Association, in reply to some statements made by a member, in a paper on "Water Gas," unfavourable to the Lowe process, I gave an account of what I had seen of its working in several places which I had visited, and expressed my conviction that the chief cause of its failure, where it had failed, was the want of proper purification. I stated, further, that the Consumers Gas Company of Toronto, of which I am the Secretary, had purchased the patent right for Toronto conditionally, and that the proprietors were about to erect two sets of apparatus in the works of the Company; and I promised that if I should be present at this meeting, I would give an account of its working there. It is in fulfilment of that promise, and in compliance with the very urgent request of the Secretary of the Association, that I now present this paper.

As Mr. Chambers, in his paper,* gave an account of the origin and progress of water gas in general, I shall confine my remarks entirely to the Lowe process. I would, before proceeding further, state that I am not in charge of the works of the Company; they being under the superintendence of Mr. Alex. Patrick, under whose supervision the works now in process of erection (hereafter referred to) are being built. I have had, however, ample opportunity of watching the working of the system in Toronto and elsewhere, and of becoming acquainted with its details, and can speak with full confidence as to the financial results.

As most of the members of the Association are doubtless aware, the Lowe gas process was invented by Mr. T. S. C. Lowe, of Norristown, Pa., and the process was patented by him in the United States in September, 1875. It was first worked upon a very small scale, by the inventor, in 1874, at Phoenixville, Pa., where the original works are still in operation, and subsequently works were erected at Conshohocken and Columbia, Pa.; Dobson's Mills, Philadelphia; Trenton, N.J.; Harrisburg, Pa.; Fort Plain, Utica, and Clyde, N.Y.; Lancaster, Pa.; Indianapolis, Ind.; Baltimore, Md.; Scranton and Wilkesbarre, Pa.; Newburgh, N.Y.; and Kingston, Brockville, and Toronto, Ca. It will thus be seen that the process has made considerable headway since its introduction at Phoenixville five and a half years ago, and with the exception of Trenton and Harrisburg, where the gas was not purified, most of the above Companies have, in a published statement, expressed high satisfaction with the process.

The apparatus consists of oil storing and distributing tanks, a generator, superheater, wash-box, scrubber, condenser, hydraulic main, and multitubular condenser, boiler, and blower. The oil-distributing tank is placed above the working gallery, and has tubes at the bottom to convey the oil to the generator. The generator is the chamber in which the gas is made. It is a cupola made of boiler plate, lined with fire-blocks. It has an opening at the top with a cover, which is clamped down during the process of "blowing up" and gas-making. There is a grate at the bottom, with an open space below, through which it is blown up by the air-blast. A pipe is inserted a short distance above this space, through which the steam is forced during the process of gas-making. A pipe from near the top of the generator conveys the gas to near the bottom of the superheater. The superheater, where the gas is "fixed," is also a boiler-plate cupola, lined in the same manner as the generator. It is generally from one-third to one-half higher than the generator, and one-fifth less in diameter. There is an arched air space in the bottom, the arch being perforated. Above this space, and nearly up to the gas outlet at the top, fire-bricks are placed in layers, with spaces of about two inches between them. It has an opening at the top, communicating with the smoke-stack, which is left open during "blowing up," and is closed with a valve during gas-making. Another pipe from near the top of the superheater conveys the gas to the wash-box, and an air-blast pipe enters the bottom of the superheater near the pipe connecting it with the generator. The wash-box is an oblong boiler-plate box, square on three sides and rounded at the bottom. A perforated boiler-plate diaphragm is placed across about one-half of the box, for the purpose of breaking up and more thoroughly washing the gas. The wash-box is about three parts filled with water, and the gas from the superheater is conveyed by a pipe which passes through the top at the end nearest the superheater, to a sufficient depth in the water to seal the gas. The tar is run off from the bottom into a well. The gas passes from the top of the wash-box to the bottom of the scrubber. The scrubbers, of which there are two for each set, are a little higher than the generator, and about three-fifths of its diameter, and are also made of boiler plates. They are similar to the ordinary scrubbers of coal gas-works, and need no further description. The gas is passed from the wash-box to the bottom of the first scrubber, from the top of the first through the top of the second, then down through the hydraulic main, from thence to the bottom of the multitubular condenser, and from the top of the condenser to the main leading to the purifiers; from thence to the meter, and to the holder. The multitubular condenser, also made of boiler-plate, is only used when the works consist of two or more sets of apparatus, and is generally placed in the centre of the scrubbers. Being similar to that used in coal gas-works, it need not be described.

The valve from the superheater to the smoke-stack being open, and its gas outlet being closed, the generator is kindled through the door at its base, charged with anthracite of large egg size through the top, and then closed and fired up by an air-blast entering below the grate. The gases formed by combustion in the generator—viz., nitrogen and carbonic acid—are driven out of it through the pipe to the chamber at the base of the superheater, where, meeting an air-blast, they ignite and flame up through the loose mass of fire-brick, evolving so intense a heat that, by the time the coal reaches a cherry red, this will stand at a white heat, which is the proper condition for gas-making. The air-blast is then shut off, the valve at the top of the superheater is closed, and at the same time steam (preferably superheated) is admitted a little below the grate-bars of the generator, and, by contact with the incandescent fuel, is decomposed, forming hydrogen and carbonic oxide. Simultaneously small streams of crude petroleum are dropped through the ascending gases directly upon the red-hot coal. The hydrocarbons thus released pass, together with the water gas, to the bottom of the superheater, rushing upward among the white-hot bricks therein to the outlet, by means of which they escape to the washer. Of course, the continuous passage of steam through the coal gradually reduces its heat, and when this falls below a certain point the gas-making is stopped, a small quantity of coal is thrown into the generator, and the blast is applied again until the heat is sufficiently restored. When the amount of gas required is considerable, two or more sets of apparatus are employed and used alternately—that is, one is running gas while the other apparatus is re-firing, thus securing a continuous production of gas.

It will thus be seen that the distinctive feature of the Lowe process is the introduction of petroleum or other hydrocarbons to the incandescent coal in the production of the divers gases simultaneously in the same

* See JOURNAL, Vol. XXXII., p. 931.

chamber, and this is claimed to be one of its chief advantages, inasmuch as it prevents that waste of heat which takes place when it is applied externally, as in other gas processes.

As I gave an account of the introduction of the process at Toronto, at the last meeting of this Association, it will not be necessary for me to go over the same ground again. Two sets of apparatus, of sufficient capacity to produce 150,000 cubic feet per diem, were at that time in process of construction for the proprietors of the patent. They were not completed, however, until February last. Gas was first made on Feb. 9, and on March 1 the works went into full operation; and up to Sept 30 last 26,641,000 cubic feet of gas had been produced.

In the following table I have not considered it necessary to give the prices of materials and expense of labour, as these vary in different places, and it could be of no practical benefit. Each one can make up the cost for himself at the prices prevailing at the place where his works are located.

Average Results for Seven Months.

Year 1879.	Average Production per Diem, when Works were Running Full Time.	Average Number of Charges per Diem.	Average Production per Charge.	Average Materials Used per 1000 Feet, working Whole Time.			Gas Purified per Bushel of Lime.	No. of Men Employed in 24 Hours.
				Crude Petroleum.	Anthracite Coal in Generator.	Coke for Boiler.		
March	Cubic Feet.	38	4037	4'46	54'91	18	16,610	17
April...	153,000	41	4066	4'11	53'17	11	8,910	7
May...	155,000	39	3604	4'18	52'48	18	11,630	7
June...	129,000	34	3794	4'09	62'46	22	11,050	7
July*	107,000	33	3242	4'14	68'91	36	9,700	7
August.	162,000	35	4674	4'08	58'91	38	13,960	7
Sept....	163,000	36	4527	4'04	59'09	38	13,160	7
Average	148,000	36'56	3992	4'15	58'56	26	10,717	7

On eleven occasions 190,000 feet and upward per day were made, and on one occasion 210,000 feet.

* During these months a number of samples of coal were tested, some of which were very inferior. There was also a partial stoppage in the supply through the fusion of the bricks and deposition of carbon immediately over the arches in the superheaters.

† Discontinued burning tar after four months.

‡ Comprising one engineer, one oil-man for gallery, one stoker for ground floor, and one labourer in the daytime. The same force at night, with the exception of the labourer.

Until February all the gas made was from coal, about 8 per cent. of canal being used. In February only about 6 per cent. of Lowe gas was made. After April 4 no canal was used except on Sundays, when no Lowe gas was made. After February the following quantities were made:—

March, Lowe gas, 3,837,000; coal gas, 8,250,000; total gas made, 12,087,000.
 April, " 4,493,000; " 5,367,000; " 9,860,000.
 May, " 4,188,000; " 4,076,000; " 8,264,000.
 June, " 3,096,000; " 3,809,000; " 6,905,000.

In the months during which the largest proportion of Lowe gas was made the quantity of sulphur found was very much less than the average, the ammonia considerably less, and no sulphuretted hydrogen at all was detected; while the average illuminating power during the time when Lowe gas was made, when no canal was used, was equal to that of the coal gas enriched by canal. As the average candle power from April to June was 15'15 (the candle power of the coal gas without canal being under 14 candles), and as less than half of the gas made was Lowe gas, it is fair to assume that the illuminating power of the Lowe gas was over 16 candles. Tests of this gas taken separately by a Sugg Illuminating Power Meter showed between 16 and 17 candles, and daily tests, taken by the same apparatus, of the mixed gases averaged from 15½ to 16 candles. It has also been demonstrated that the illuminating power of the gas can be kept at nearly the same figure.

No difficulty of any importance was experienced until the works had been in operation over three months, when a gradually diminishing yield gave warning that something was wrong, and a careful examination resulted in the discovery that the loose bricks in the superheaters immediately over the arch had fused together to such an extent as to stop the free flow of the gas. Two or three days, however, were sufficient to remove and replace them, and one day would have been enough, had it not been necessary to wait until the superheaters cooled. As the quantity of bricks destroyed was only about 200, the expenditure was not great.

This difficulty was unexpected, as we had not then heard of its having taken place elsewhere; but we have learned since that similar trouble has arisen in other works, and we think it will be necessary to have the superheaters examined every three or four months.

In our opinion, a larger amount of purification is required than for coal gas. The cost per 1000 feet, including labour, with lime at 22 cents per bushel, amounts to about 3½ cents; and, owing to the great rapidity with which gas is made, larger purifiers are required than would be needed in coal gas-works, where the same quantity of gas is produced per diem. It has also been found necessary to use lime exclusively for purification.

Men of greater intelligence are needed than answer for stokers in coal gas-works—more care, watchfulness, and judgment being required.

Owing to the character of the petroleum used, it is found necessary to steam out the wash-boxes for about half an hour each day; but as this is done while the fires are being raked down, no time is lost. Where naphtha is used, it is not necessary to do this. It is also desirable to steam out the scrubbers two or three times a week for a few minutes.

We have had but one stoppage in the pipes in the works after purification of the gas, and that was in the pipe between the purifiers and the station-meter, which was partially clogged with naphthaline, but not to a greater extent than has been the case with our coal gas.

There have been no stoppages in the mains outside of the works. A few service-pipes have been partially obstructed with naphthaline, but not more than in former years. We have had no complaints of the stoppages of burners.

A large amount of tar is produced, and we are now having an analysis made for the purpose of ascertaining its value.

The advantages of the process, as compared with coal gas manufacture, may be summed up as follows:—

1. The great saving in the cost of labour. In works where two sets of apparatus are used, seven men can produce an average of 150,000 feet per diem, and in large works the same number of men can work three sets, and produce 225,000 feet per diem. In Baltimore they claim that twelve men can work eight sets—six men in the day and six in the night.
2. The small amount of wear and tear as compared with the retort system.
3. The comparatively small amount of storage room required where all the coal needed for the year has to be laid in in the summer. One ton of coal being sufficient to make 34,000 feet of gas, not much more than one-quarter of the room is needed.

4. The saving in interest in not having to purchase so much material in advance—the petroleum being obtainable as wanted.

5. The rapidity with which gas can be made in cases of emergency. In Toronto, as stated, 200,000 feet per diem were made, and in Baltimore I am informed that 600,000 feet have been made in eight sets of apparatus during the night.

6. The heats can be let down at any time without injury to the apparatus; consequently work can be stopped on Sundays. Gas can be made within four hours from the time the fires are lighted in the generators, and it has been done in two hours at our works.

The Directors of the Company were so well satisfied with the general working of the process and the results obtained, that in July last they completed the purchase of the patent rights for Toronto, paid the proprietors for the works they had erected, took them off their hands, and decided upon erecting five additional sets of apparatus, another purifying-house, additional purifiers, and a station-meter. The work is now far advanced, and the whole is expected to be completed before the close of the year. These apparatus, with the others erected, will have together a capacity of over 500,000 cubic feet per diem.

Situated, as we are in Toronto, with anthracite coal a little cheaper than bituminous, and petroleum at a moderate price, we find it considerably to our advantage financially to make gas by the Lowe process—so much so, that we felt justified in reducing the net price of our gas on the 1st of October from 2 dols. and 1'75 dols. to 1'75 dols. and 1'50 dols. per 1000 cubic feet; and unless anthracite and petroleum advance and bituminous coal decline very considerably, we shall make by far the largest proportion of our gas by the new method; and probably should make the whole, were it not that the works now nearly completed will not be of sufficient capacity to supply the rapidly-increasing demand.

Mr. HELME said Mr. Pearson had omitted to state anything about carbonic oxide. This had often been a mooted question in connection with the Lowe process of making water gas, and he should have been glad of some information on the point. He asked if an exact record of the quantity of carbonic oxide obtained per 1000 feet of gas made had been kept by Mr. Pearson.

Mr. PEARSON said he had not such a record, as the gas had not been analyzed.

Mr. LITTLEHALES asked whether the gases were measured separately, or when mixed; also the difference in cost between the two gases.

Mr. PEARSON said they were measured separately; and, as stated in his paper, the difference in cost was about 15 cents per 1000 feet—that was leaving the cost of the plant out of question.

Mr. LITTLEHALES said it would make a considerable difference if the interest on the cost of the plant, patent rights, &c., were added. What he wanted to get at was what the commercial advantage was over coal gas.

Mr. PEARSON replied that there was a considerable saving in the matter of coal; besides, if he had not used the process described, he would have had to erect more coal-sheds and have purchased additional property. He thus saved the interest on the outlay which otherwise would have been necessary.

Mr. LITTLEHALES submitted that this was scarcely an answer to his question. What he wanted to know was this: The amount per 1000 feet for patent rights, and the cost of the plant, with interest added at, say, 8 per cent., compared with the reduced cost as stated in the paper, and what was the commercial advantage in making gas by the Lowe process over the coal process. This was the most important consideration in the whole thing.

Mr. PEARSON said he could not answer this. He asked the Association to bear in mind that they had only commenced the use of the process last spring, and that they were running the two systems together side by side. They were now erecting larger works; and, after a year's experience in the manufacture of gas by the Lowe process, he would be able to give satisfactory data.

Mr. DENNISTON asked if the expense of purification were included in the estimate.

Mr. PEARSON said it was. When speaking of saving 14 or 15 cents per 1000 feet by making gas under the Lowe process, he estimated for all expenses of putting the gas into the holders, including purification.

Mr. LITTLEHALES inquired if this included the cost of plant and the patent rights.

Mr. PEARSON stated that it included materials and labour only. Mr. LITTLEHALES asked Mr. Pearson how much gas he made from coal under his coal gas process—how much per retort and per man—as these were important points bearing upon the comparative cost.

Mr. PEARSON said they made 9400 or 9600 feet per ton (2000 lbs.) of coal; 34,000 or 35,000 feet a day per bench of sixes—two men being required, one for the day and one for the night; size of retorts, 9 feet by 21 in. by 14 in. That showed per man per day about 18,000 feet of gas from Youghiogheny coal.

Mr. DWIGHT said his make of gas averaged during the past year 42,000 feet to the bench of sixes—9 feet long by 14 in. by 26 in. For a week he had made more than 50,000 feet per bench. He used the same kind of coal as Mr. Pearson, and the illuminating power of the gas was from 16 to 17 candles all the time.

Mr. CARTWRIGHT had heard some of the criticisms of the Lowe process, and he should like to ask Mr. Pearson if he had made photometrical observations during the progress of the charge.

Mr. PEARSON said he had, and found the gas vary, between the first of the charge and the last, probably from 22 down to (say) 20, and even to 10 candles. There was great variation between the first gas and the gas made later on; but the quality supplied to the city was uniform—there was no variation after the gas left the holder.

Mr. CARTWRIGHT asked what had been the experience with the consumers. Had any difference, as far as they were concerned, been found between the old and new processes?

Mr. PEARSON replied that there had been some complaints, but not more than in ordinary cases. In every instance in which they had investigated complaints it had been found that the cause was the defective burners used, or a partial stoppage of the pipes.

Mr. HARRISON questioned the accuracy of the figures adduced as to the cost of purification, which he maintained should have been stated at 5½ not 3½ cents per 1000 feet.

Mr. SHERMAN asked if the mains had had to be enlarged consequent upon the change of supply from coal gas to water gas.

Mr. PEARSON said they had been enlarged on account of increased consumption; but not consequent upon the change of supply. In answer to further questions, he said they had not made any change in the burners, but kept the distributing pressure a little higher. He had not made up the leakage account for the last two or three months, and so could not state the loss in this way. They sent the gas by the two processes to the same holder, the gases being mixed in the proportion of one-half or two-thirds coal gas. The holders were exposed to the atmosphere.

Mr. HARRISON said he understood Mr. Pearson to state, in answer to Mr. Cartwright's questions, that the quality of the gas varied during the charge from about 22 to 10 candles; also that the gas became mixed with

the other gases in passing into the holder. He (Mr. Harbison) would like to inquire whether the variation of the temperature had been such as to affect it; and, if not, whether a very radical change of temperature on the same day would affect it. What would be the effect upon the gas in the holder if the thermometer should fall 40° within a few hours, as it sometimes did?

Mr. PEARSON said he could not answer this question. As he had stated before, they had only been making gas by the Lowe process since last spring, and had been making it in connection with coal gas. He had given, in the paper, all the facts and all the data he had been able to gather from personal experience and observation of the use of this process of making gas since it was introduced at their works. They had not been making it for a sufficient length of time, and had not been making it in such a way as to enable him to give the most precise and definite information. They were now enlarging the works, with a view of making gas by the process on a larger scale, and after the experience of the coming year he might be able, at the next annual meeting of the Association, to give detailed and precise answers to any questions that would be asked.

Mr. M'ELROY asked, in regard to the naphthaline to which the author of the paper had referred, what kind of weather there was at the time of its formation.

Mr. PEARSON said it was pretty warm weather.

Mr. C. A. WHITE did not see how there could be any naphthaline in oil gas. He had always supposed that crude petroleum vaporized was the very best thing possible to be used to clean naphthaline out of the pipes. He could not conceive of any situation or condition of things which would permit of the existence of naphthaline in oil gas-works, and asked Mr. Pearson if he examined the substance carefully to know that it was naphthaline, or if it was lampblack, or an excess of carbon carried over.

Mr. PEARSON said it was a very hard substance, and they concluded that it was naphthaline. It was of a brownish colour. They had had similar deposits from the coal gas-works.

Mr. WHITE thought that it must certainly have been the carbon carried over.

Major DRESSER was on Mr. Pearson's side upon this question of naphthaline in oil gas-works, because he had it from the very best authority that works making gas exclusively by the decomposition of steam by incandescent carbon, and the introduction of petroleum oil or naphtha for illuminating purposes, had very serious trouble with naphthaline, so much so that they had been obliged to stop work until they could clean out the pipes. This same difficulty had been experienced by a certain company in New York, and it was a very serious inconvenience at times. He confessed it did seem to be a singular thing, and from the experience they had previously had of naphthaline, it seemed incredible; but he had had it from the most excellent authority that the thing did actually exist, and he believed the man who told him of it knew what naphthaline was.

Mr. M'CAULEY asked if they had found any difficulty in running the generators; as he had. Their bricks became carbonized, and would not give out the heat.

Mr. PEARSON said he did not find any difficulty of this kind. They had found that there was a slight deposit of carbon on the bricks; also that the bricks ran into each other, and they were obliged to take them out and put in new ones. They had only lost about 200 bricks in the two generators.

Mr. SLATER said they had been asking Mr. Pearson a great many questions, but it seemed to him that he was hardly in a position to answer them satisfactorily, either to themselves or to himself. The questions that had been asked were those that called for very precise and detailed information, which Mr. Pearson's present experience in the use of the Lowe process did not enable him to answer in a perfectly satisfactory manner. He had stated that he was making by the Lowe process one-third of the gas which he sent out, and two-thirds by the coal-gas process. He had also stated that he did not begin to use the Lowe gas process really until the beginning of March last. It seemed to him, therefore, that he could not be expected, with the experience he had thus far had, to answer every question that might be asked, or to meet every suggestion as it was made. His Company proposed to erect additional buildings, and continue the use of the Lowe process on a much more extended scale. If these works were put in operation during this year, Mr. Pearson would have abundant opportunity to enlarge his experience and his knowledge in relation to the practical working of the process, and he would undoubtedly be able, at the next annual meeting of the Association, to furnish the members with information of the most minute and satisfactory character. As the matter now stood, however, he did not think they could reasonably or fairly expect Mr. Pearson to answer all the questions that had been propounded. He had prepared and read a most able and interesting paper, which embodied all the facts in relation to the Lowe process that he had been able to gather from his personal experience and observation during the time the process had been in operation at his works. He could, at the present time, do nothing more than reiterate the statements he had made, and it therefore seemed to him (Mr. Slater) that the question had better be left where it now stood until Mr. Pearson, after a more enlarged experience and more extended observation, should be able to give the information which it was not now in his power to furnish.

Mr. M'ILHENNY inquired whether Mr. Pearson had made any calculations as to what the result would be if all the companies in the United States made gas from oil; because, if the process was so much superior, as Mr. Pearson evidently thought it was, all the companies in the country would adopt it. He (Mr. M'Ilhenny) thought Mr. Pearson had given a very fair and impartial statement. He had stated the cost upon both sides, so that it was easy to calculate the advantage. He had told how much labour and material it took to make 1000 feet of both kinds of gas; and he thought the Association was under many obligations to him for the clear and explicit manner in which he had stated the facts. He would, however, like to ask whether, owing to its great superiority and cheapness, he anticipated the universal use of petroleum for making gas; and, if so, whether he had calculated what the commercial effect upon the market would be.

Mr. PEARSON did not anticipate that it would be universally used in the United States, but he thought it would be in Canada. If it was, they had such an abundant supply of petroleum that all the gas companies could use it, and such use would have very little effect upon the market price of the oil.

A vote of thanks was then passed to Mr. Pearson for his paper, and for the answers given by him to the questions propounded. He was also requested to continue his observations, and report upon them at the next annual meeting.

(To be continued.)

TRANSFER OF THE DERBY WATER-WORKS TO THE CORPORATION.—The undertaking of the Derby Water-Works Company was transferred to the Corporation on the 1st inst., in accordance with the provisions of the Derby Improvement Act, 1879. The purchase-money agreed upon was £308,000.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There has been rather a dull tone in the Lancashire coal trade since the commencement of the year. The open weather has naturally had an effect upon the demand for the better classes of round coal suitable for house-fire purposes, and as the new year holidays have recently caused partial stoppages at many of the local works, there has been rather less inquiry for manufacturing classes of fuel. There is, however, a very fair demand for forge coal, which has a tendency to advance in price, and the improved shipping demand for steam coal is also contributing to the enhanced value of the lower classes of round coal. Burgy is still only in poor demand, and this is a class of fuel which is practically going out of the market, users of burgy now generally falling upon slack, which is more adapted to the improved furnace appliances in use. Slack, as a consequence, is moving off more freely; but although there are some collieries which are fully sold, the supplies of this class of cheap fuel are generally tolerably plentiful in the market. So far as prices are concerned, there is no very material change since last week, any general advance being effectually checked by the large quantity of coal that is being offered in the market. The average quotations at the pit mouth are about as under:—Best round coal, 8s. 6d. to 9s.; seconds, 6s. 6d. to 7s.; common house coal, 5s. 6d. to 6s.; steam and forge coal, 5s. to 5s. 6d.; burgy, 3s. 9d. to 4s. 3d.; good slack, 2s. 9d. to 3s. 3d.; and common, 2s. to 2s. 6d. per ton.

The wages question in the coal trade is still unsettled. Some of the notices expire this week, and it seems doubtful what course the men will take; but the masters are, apparently, determined not to give way.

There is a good demand for coke, and better prices are obtained.

The iron market continues very firm, with steadily advancing prices. Makers have very little iron to offer for anything like prompt delivery, and although local consumers are not, with the exception of forge proprietors, large buyers at present, there is a considerable inquiry from merchants for delivery over the second quarter of next year, but the prices asked by makers tend to check much actual buying just now. For Lancashire pig iron the quotations at present are little more than nominal, but for delivery into the Manchester district orders could not now be placed at less than about 67s. 6d. to 68s. per ton, less 2½ for both foundry and forge qualities. In the finished iron trade prices are also very stiff, and considerable orders are coming into this district from America for bars and light rails. For Lancashire bars, delivered into the Manchester district, most of the makers are very firm, at from £8 10s. to £9 per ton, although there are some cases where makers are waiting for specifications. Orders for prompt delivery could be placed at about £8 5s. per ton. Founders, however, are not yet able, notwithstanding the increased cost of the raw material, to obtain very much better price for their castings, and pipes are being delivered into Lancashire at less than £5 per ton.

Following Mr. Chamberlain's award in Staffordshire, an advance in wages is being granted, by the employers, to the finished iron workers in Lancashire.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The main feature of interest in connection with the coal trade of the North is the increasing local demand for inferior coals. The iron manufacturing, the iron shipbuilding yards, the chemical works, and other local industries on the Tyne and adjacent ports, are getting into full employment, with a prospect of better business further on in the year, and the local consumption of fuel is increasing considerably. The demand for coke for home use and for shipment is likewise strong, 16s. 6d. per ton being the last quotation. Makers are not disposed to do business more than a fortnight ahead at that price. The shipments of gas coals by the regular boats do not alter very much. The recent stormy weather put several steamers out of time, but a week of tranquil seas and moderate winds, and, above all, an absence of fogs, has enabled them to get into their regular way again. Most of the small sailing vessels which were taken up to load coals last week—and these were not many—were for the gas-works in the towns on the English Channel. Freight rates were easier; the following rates being paid:—Poole, Folkestone, and Cowes, 7s. per ton, with other ports in proportion. As low as 4s. per ton has been taken by steamers to load coals for London.

The manufacturing iron trade on the Tyne has not been so busy in the past four years as it is at present. The large factories of Messrs. Hawks, Crawshaw, and Co., and of Messrs. John Abbot and Co., Limited, at Gateshead, are so full of work that the former have been obliged to decline to take some large orders. The ironfoundries on the Tyne are in a similar favourable position. The price of manufactured iron is very much higher than what it was two months ago. It is believed in the North of England that the present prices will be fully upheld over 1880. There is a good demand for gas and water pipes, and large quantities of drainage pipes continue to be despatched from the Tyne to the principal cities of Northern Europe.

The position of the chemical trade has very much improved. There are extensive inquiries in the market for chemicals to be sent abroad in the latter part of February and the whole of March. Much higher rates are offered for March than for January and February shipments. The stocks of chemicals are low at the manufactories. Makers hold out for higher prices for this year's business, and they are in no hurry to bind themselves down with contracts until they can see the tendency of trade.

Some large orders for fire-bricks were booked last week. The price of this class of goods is very much higher than it was this time last year. Cement, too, and other articles of that description, are in improved demand. The shipments to the Continent are likely to be large throughout this year.

According to the advices received in Newcastle-on-Tyne from correspondents on the Continent, the Belgian and German iron business promises to be equally as flourishing as our own. Most of the foreign manufacturers are well off for orders.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

Some time ago the Banchory Gaslight Company, which has been in existence for the last 25 years, resolved to take advantage of the Companies Act, and have itself registered and incorporated as a limited liability company. This has now been done, and the first meeting of the Company, as now constituted, was held last Tuesday, when the following gentlemen were elected Directors:—Messrs. Gilbert Sadler, Geo. Merson, George Craigmile, James Scrogie, Alexander Black, and William Lindsay. Mr. Sadler was unanimously elected Chairman.

At a meeting of the Partick, Hillhead, and Maryhill Gas Company, Limited, held on Friday, it was unanimously agreed to forego interest upon their claims against the City of Glasgow Bank, whose disastrous failure occurred about 15 months ago. The liquidation of the ill-fated corporation is now rapidly progressing towards a close.

When speaking, in last week's "Notes," of the Dundee Gas Commission's affairs for the past year, I omitted to mention that the annual statistics bearing upon the revenue, expenditure, and debt of the public corporations of the town contained the following figures in respect to

the Gas Commission:—Revenue, £57,985 18s. 6d.; expenditure, including interest and sinking-fund on debt, £58,282 7s. 6d.; debt, £116,447 10s. The last-mentioned item includes annuities, not capitalized, to the extent of £8337 4s. 6d. Before leaving Dundee gas affairs, I may mention that at the usual monthly meeting of the Gas Commissioners, held during the past week, Provost Brownlee, who presided, introduced the question of the Tay Bridge Disaster Fund; and inasmuch as some of the servants of the Commission had lost their lives by the disaster, he moved that the Board contribute a donation of £50 to the relief-fund. The motion was seconded by Councillor Drummond, and at once unanimously agreed to. Besides the two workmen named last week, who were passengers by the ill-fated train, there was another victim closely connected with the Gas Commission, in the person of a son of one of the gas inspectors. There appeared to be some doubt in the minds of the Commissioners as to their power to subscribe to such a fund, and the Clerk told them they had no power, but that they did many things without power. The Provost got over the difficulty by saying that financially the Corporation in a first-class condition.

An indication was recently given by one or more members of the Town Council of Inverkeithing to take over the gas supply of the town, under the provisions of the Burghs Gas Supply (Scotland) Act, and notice of motion to that effect was given by Councillor McDonald. However, at a special meeting of the Council, held last Wednesday, that gentleman announced that his views on the subject had been somewhat modified, owing to the circumstance that the Gas Company had agreed to reduce the price of the gas supplied by them to the public, to which the Provost replied that the resolution of the Gas Company was that a reduction in the price of gas should only be allowed to such consumers as paid for their supply within a month from the date of survey. Another member of the Council directed attention to the fact that the Magistrates were either Directors or Shareholders of the Gas Company, and that consequently they had the whole matter in their own hands. Mr. McDonald subsequently gave notice of a motion to the effect that the Town Clerk should be instructed to ask the Gas Company whether they would be prepared to grant the Council a discount on the cost of gas supplied to them, and that in the event of the Company refusing to do so the Council should consider the propriety of purchasing the works.

A meeting of the Local Authority of the burgh of Irvine and the Committee of the Dundonald Parochial Board, as Water Commissioners, was held last Wednesday, when there was submitted a report from Mr. Gale, C.E., Glasgow, as to a supply of water to Kilwinning. The report recommended the Kilwinning Local Authority to throw in their lot with Irvine, and share their assessment; failing that, to try and get a supply by meter from the Irvine works as near 3½d. per 1000 gallons as possible.

At a meeting of the Town Council of Kilmarnock, held last Wednesday, the report from the Gas Committee was submitted, in which the Manager stated that since the pressure was reduced he had tested it at 22 places, principally at the extremities of the burgh, and had found the maximum to be 21 inches; minimum, 1 inch; and the average, 1·6 inches. The Committee agreed to keep the initial pressure at the present point. Gas sold for November, 1878, 4,845,650 cubic feet; value, £1110 9s. 2½d. Gas sold for November, 1879, 4,194,300 cubic feet; value, £961 3s. 10½d. Illuminating power, maximum, 29·8; minimum, 28·1; average, 28·4 candles. Mr. Brown said the Committee had found that the saving of coal, wages, &c., nearly balanced the loss they had sustained in the revenue.

As might be expected, the stoppage of the water supply to Newport by the destruction of the Tay Bridge is causing a great amount of trouble and disappointment to a large number of the inhabitants of that important Fifeshire suburb of Dundee. As many as 80 pumps are said to have been taken up in one locality, and great expense will be incurred in restoring the former fittings; but the worst is the apprehension of a serious scarcity whenever a season of drought occurs. Various suggestions are made by way of meeting the difficulty which has unfortunately occurred, and the Water Committees of Dundee and Newport and the Trustees of Tayfield Estate are being urgently advised to lose no time in coming to an understanding on the subject.

The Glasgow pig iron warrant market was exceedingly strong all last week, and an immense amount of business was done at rapidly advancing prices. As high as 71s. 7½d. cash was paid on Friday afternoon, but at the close the prices for sellers were 71s. and 71s. 6d. one month; buyers offering 1½d. per ton less.

Since the close of the holidays there have been evidences of peaceful counsels prevailing on the part of the coalmasters and miners, who have for some time been at war; but, on the whole, the coal trade is pretty quiet, there being nothing pressing in the shape of shipping orders.

HALSTEAD GAS COMPANY, LIMITED.—A Company with this title was registered on the 2nd inst., with a capital of £10,000, in £10 shares, and proposes to acquire the existing works for supplying gas to the town and parish of Halstead, Essex.

READING WATER SUPPLY.—At the meeting of the Reading Town Council last Thursday, it was reported by the Borough Accountant (Mr. R. Bradley) that the clear profits of the works for the last half year, after carrying to the interest and sinking-fund account the sum of £1375, would be more than sufficient to pay the full annuities in respect of the half year.

SALE OF SHARES IN THE BARNSELEY GAS COMPANY.—On Wednesday last, Messrs. Lancaster and Sons offered for sale 12 D shares, entitled to 7 per cent., and some original 10 per cent. stock in the above-named Company. The shares realized £14 15s. each, £100 worth of the original stock sold for £205, and £200 worth for £413; the remainder, amounting to £111 16s. 9d., fetching as much as £231.

CARDIFF WATER-WORKS COMPANY.—An extraordinary meeting of this Company was held last Tuesday—Mr. Griffith Phillips in the chair—to give the authority of the Shareholders to the Bill now being promoted in Parliament by the Directors of the Company, for the due appropriation of the surplus capital left after paying the Shareholders £200 per cent., as agreed upon. The promotion of the Bill was unanimously agreed to.

STAVELEY GASLIGHT COMPANY.—This Company, which was provisionally incorporated under the 7 & 8 Vict., c. 110, on April 1, 1856, and completely registered by the filing of a deed of settlement on the 22nd of July of that year, was constituted a limited company under the Acts of 1862 and 1867 on the 1st inst., in accordance with a resolution passed by the Shareholders at a general meeting held on the 30th ult. The capital is £3000, in 300 shares of £10 each; 150 of the shares being fully paid, and £6 per share having been paid on the remainder.

HULL LIGHTING BILL.—On Saturday, the 3rd inst., a meeting of the Parliamentary Committee of the Hull Corporation was held, when the Town Clerk reported the steps he had taken with reference to the above-named Bill, and produced a copy of the Bill, which he said was framed upon the Liverpool Corporation Act of last session. In the Liverpool Act, however, five years were asked for in which to make experiments; but in the Hull Bill he had inserted a clause to allow ten years. On the motion of the Chairman (Alderman Waller), seconded by Mr. Elam, the Bill was approved.

SINGULAR DEATH FROM SUFFOCATION BY GAS.—On Saturday last an inquest was held at Stockport on the body of Elizabeth Doyle, a domestic servant, aged 28, a native of Blackburn. Last Monday she entered the service of a Miss Goodall, of Southport, and not coming down at the appointed time on Friday morning, her door was opened, when she was found lying insensible on the bed, having been suffocated by gas. One of the bed-posts had broken through the flooring and fractured a gas-pipe, the result being that the gas escaped into the room and was inhaled by the young woman, who remained insensible until Saturday morning, when she expired. A verdict of "Accidental death" was returned, and it was remarked that no blame attached to anybody.

Register of Patents.

APPLICATIONS FOR LETTERS PATENT.

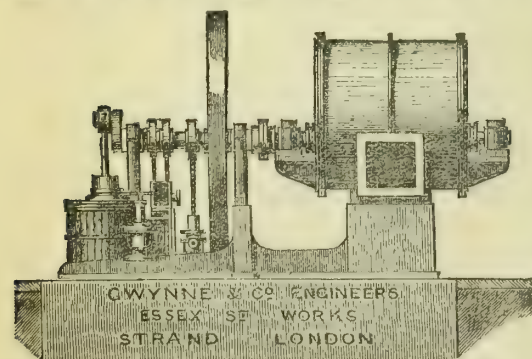
- 17.—JENSEN, P., Chancery Lane, London, "Improvements in and connected with steam and water jet motors, partly applicable to fluid-meters." A communication. Jan. 2, 1880.
- 56.—WOODWARD, J., Manchester, "Improvements in arrangements and apparatus to be used in the working of gas-purifiers. Jan. 7, 1880.
- 62.—SILBER, A. M., Whitecross Street, London, "Improvements in lamp or gas stoves." Jan. 7, 1880.
- 83.—VALE, J. H., Hamburg, Germany, "Improvements in apparatus for enriching gas." Jan. 8, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 2756.—HARRISON, F. J., Queen Victoria Street, London, "Improvements in gas-burners for increasing the illuminating power of gas." July 7, 1879.
- 3745.—KITTE, B., Bristol, "Improvements in gas-lamps." Sept. 18, 1879.
- 4290.—SMITH, G., Shepherd's Bush Common, London, "Improvements in the apparatus for the manufacture of gas and machinery used for charging receptacles for the same, whether on railway carriages or elsewhere." Oct. 22, 1879.

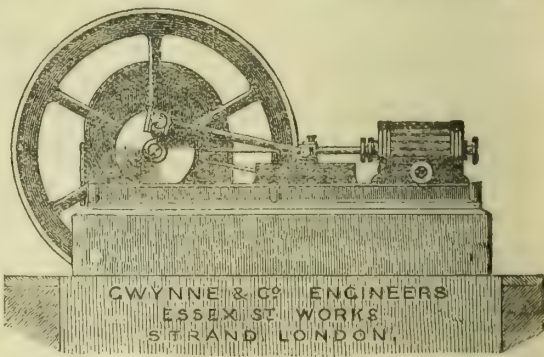
The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

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Post Orders to be made payable at the Chief District Office, St. Martin's-le-Grand, London, to Walter King, 11, Bolt Court, Fleet Street, E.C.

TO CORRESPONDENTS.

THE HYDRAULIC MAIN.—We have received from Mr. R. H. Patterson a "Postscript" to his two recent articles on the above subject. This, with the illustrations which accompany it, will appear next week.

R. B. and S.—The subject you mention shall be looked into before next issue.

J. H.—Thanks for letter, re "Frozen Lamp Services."

RECEIVED.—"Hot Air, v. Hot-Water Baths for the Working Classes." By Richard Metcalfe.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 20, 1880.

Circular to Gas Companies.

ALL the gas-works undertakings in the kingdom belonging to Companies have not yet been transferred to Local Authorities, as we are told will be the case within a comparatively short period of time. For the present session we find only two Bills to confirm agreements already entered into between Local Authorities and Gas Companies for the transfer of their undertakings, and one (Cork) which offers a Corporation the opportunity of absorbing the works within a period of three years. On the whole, we think it will be admitted that the Companies whose dissolution we notice to-day have been very fairly dealt with by the Authorities to whom they transfer their undertakings. The Hinckley Gas Company, for example, receive about £175 for every £100 of invested capital; and this, it must be admitted, is a good price for the undertaking of a non-statutory Company. Supposing the Hinckley Company to have been incorporated, they would have been in a position to command twenty-five per cent. more; and it is for reasons such as this that we constantly urge the desirability of Companies becoming possessed of statutory powers, especially in cases where the probability of purchase is to be considered.

The terms obtained by the Lancaster Gas Company—a statutory one—are, of course, better. In this case the Company receive £80,000 for £30,000 expended, or £266 per £100 of invested capital. This is a little above the recognized price for a statutory undertaking. The Company is, however, of much antiquity and great stability, and the price the Shareholders have obtained is rather below than above the real value of the undertaking. The Corporation will soon find that they have secured an excellent bargain, which there is no doubt will turn out extremely profitable.

The remainder of the Bills we have to notice in relation to illuminating purposes are those promoted by Local Authorities mainly with the object of obtaining power to furnish the electric light. To make use of this light is, at present, to them an object of extreme anxiety. Unfortunately, many Local Authorities envy Gas Companies in the profits they earn. All we can say is that they are welcome to every farthing they can make out of the electric light. The means are not yet established by which the amount of electric force expended in the production of the light is to be estimated. In the Bills, however, we read of "meters;" but we are sorry to say that we are as yet ignorant of the nature and construction of the instruments intended to estimate the amount of electric force that is used to give a certain amount of light. We shall not say that an electric meter is an impossibility; for one has been proposed by Mr. Edison, but of very doubtful value. It may be that in times to come bills may be sent in for so many "Ohms" and so many "Farads," or something like this; but at the present day we are in a complete state of mystification as to the appliances for valuing the electric force. We are still more mystified when the "storing" of electricity is spoken of. So far as we know, no means of conserving electricity in quantity is possible, except in a Leyden jar; and with the use of such an instrument as this, very little could be done to promote the use of electricity for illuminating purposes. It is well that while we have no means of estimating the quantity of electricity which must be circulated to give a certain amount of light, the Corporations from whose Bills we are quoting should arrange that all charges for the light should be fixed by agreement. This will be a very sensible proceeding, but we think that care will have to be exercised in drawing up agreements, otherwise large loopholes will be left through which the illuminated—we can hardly say, in this case, consumers—will escape. Of course, to work the electric light it will be necessary for the Corporations, &c., to acquire authority to use patent licences—even one of Mr. Edison's, if that distinguished inventor should ever advance so far as to make a really useful invention. Whilst waiting for this, the Local Authorities may avail themselves of such patents as are recommended to their notice. It is, no doubt, a great advantage to both Companies and Corporations to be legally qualified to make use of patent rights; but all we can say is, that the less they have to do with them the better. Necessarily, in all these Bills a clause is inserted for the protection of telegraphic wires from the inductive action of the wires intended to illuminate, as they carry so much more powerful

a current. It is to be regretted we have as yet no positive information as to the exact influence which one wire may exert on another at certain distances. This is a point that should be determined at once, and we may especially refer it to the notice of Mr. Preece. If little or no disturbance occurs, there is no reason why the two wires should not travel side by side, and so save a large amount of pavement disturbance.

We are not at all disconcerted or alarmed at the fact that the use of the electric light is spreading among certain trading establishments in the Metropolis. There are now several business houses in which the light is used, either for purely illuminating purposes, or as an advertisement. The last display made of it—that at Messrs. Samuel Brothers, of Ludgate Hill—is somewhat of a failure. The pedestrian may go three or four doors beyond the place, and see a shop, devoted to the same description of business, illuminated by gas, and he will immediately recognize the immense superiority of the latter illuminant. In this most recent display brought under our notice, a Crossley's "Otto" gas-engine of twelve-horse nominal power actuates a Gramme dynamo-electric machine, which furnishes the electric force to thirteen lights on the Jablochkoff system. Here we have a practical illustration of the beautiful simplicity of a gas-engine applied to furnish motive power. It is only necessary to light a jet of gas, give a few turns to the fly-wheel, and the action of the machine proceeds by the aid of the consumption of the gas which is supplied to it. It will be seen that these engines require none of that expensive attendance and those disagreeable surroundings consequent on the employment of steam. They are, in fact, at this moment the most useful engines in existence. The latest application of a gas-engine we have heard of, is for pumping sewage at Middlewich, Cheshire.

It is absurd to expend too much force in breaking a butterfly on a wheel, but this we think has been done in an article which we reproduce elsewhere from the *Saturday Review*. There can be no doubt that Mr. Edison is a genius of a certain kind. That he has failed to make the electric light a domestic illuminant, can hardly be considered surprising. He has, however, we presume, done the best he could, by furbishing up old inventions, to give an appearance of novelty to worn-out notions. Thus, one after another of Mr. Edison's crudities have dropped out of recognition. By the aid of newspaper correspondents they have been made, in the hands of speculators (we are here speaking only of the electric light) the means of depreciating to a serious extent the value of gas property. We do not, however, expect that Mr. Edison will harm us much more. Reports of inventions brought from so great a distance as Menlo Park, U.S.A., should not scare gas shareholders until something decided and pronounced has been sent to verify the statements put forward by Mr. Edison's supporters. In the meantime, it is in the highest degree satisfactory to see that no sooner have the American "bears" brought down the price of gas stock, than at a bound it returns at once to its legitimate value. This has been the case in the two "scares" which have so frightened the holders of English gas stock, and so successful have been the tactics of these unscrupulous speculators, that we are informed by a financial journal that as much as from six to eight per cent. has been realized by them. We cannot believe that in the course of this jobbery much stock passes from the hands of real investors. The prices quoted, no doubt, represent transactions which are peculiar to the Stock Exchange. If we thought that real investors had, upon such representations as have been made respecting Mr. Edison's discoveries, been induced to part to any great extent with their savings, we could express no pity for them; but might, in fact, rejoice that the property had fallen into the hands of some who know better how to take care of it. We hope, however, that this business is entirely at an end. Mr. Edison admits that his last pretended discovery is a signal failure, and unless *The Times* spreads abroad more audacious statements, obviously designed to frighten gas proprietors, it will, we think, be a long time before we hear any more of these misleading American telegrams.

We do not yet know whether the scheme for the amalgamation of the Phoenix with the South Metropolitan Company has received the sanction of the Board of Trade. The opinion of the Board is, we know, strongly in favour of combination, and, seeing that the scheme has been modified to suit their views, we imagine that their approval will very shortly be expressed. The opposition which has been made by the two Vestries in the district of the South Metropolitan Company has been of an almost puerile and selfish character, so much so that we cannot for a moment suppose that the Board of

Trade will be in the least influenced by the representations made in their memorials. We look forward, then, to an early announcement that the Board of Trade have sanctioned the scheme, and the immediate confirmation of it by the Privy Council may be looked upon as a matter of certainty. We shall not speculate on the probable consequences of this. The Bill promoted by the Phoenix Company will, in all probability, be dropped; that of the South Metropolitan Company will then, as a matter of course, go forward. It is hardly to be disguised that the latter Company will be a little handicapped by their union with the Phoenix; but we have no doubt they are well able to carry the weight, and will pull through with triumph.

We notice that the Chelsea Vestry are making an endeavour to persuade the Metropolitan Board of Works to avail themselves of the opportunity presented by the promotion of a Bill by the London Gaslight Company, to obtain the insertion of a clause for compelling the Company to supply sixteen-candle gas. Whether the Board will take any action in reference to the matter remains to be seen. As a fact, the London Company now continually supply gas having an illuminating power close up to sixteen candles, and sometimes above that standard. We can hardly suppose, therefore, that the gas consumers in Chelsea will be benefited by any action their Vestry and the Metropolitan Board of Works may take. The time will come when the London Company will have to submit to legislation more modern than that of 1860. Then will be the time for the Authorities to bestir themselves; but then the "stir" will not be needed, as no Bill of the Company's could be successful which is not drawn upon the now established lines. In the meantime, the London Company ought really to consider whether they might not improve their position by dividing their disjointed undertaking, and enter into combinations north and south of the river.

The Long Eaton Gas Company, Limited, are making application to the Board of Trade for a Provisional Order, and the opportunity is being seized by a section of the ratepayers of the place, and some members of the Local Board, to force the Company to sell their undertaking to the Local Authority. The opinion seems to be that gas is too dear in the district (it is 4s. 2d. per thousand feet) and that the Board might sell it much cheaper. On this point, not being acquainted with the circumstances of the case, we cannot here give an opinion; all we know is that the terms which are reported to be talked about in the district are utterly inadequate. For £5 shares £8 is spoken of as the price; but it is clear the Company could not accept such compensation for an undertaking now paying large dividends.

The Corporation of Birmingham do not get on happily with all the outlying districts whom they supply with gas. A complaint is made, but certainly not with justice, of the quality of the gas furnished. Some districts, too, are dissatisfied with the quantity supplied. To remedy this, the Corporation are laying larger mains in one of the districts, and hereupon an uproar occurs. Birmingham will, of course, continue their work notwithstanding, and in the long run, we have no doubt, Oldbury and Langley will be much benefited. In the meantime, it suits the purpose of some persons to keep up an agitation against the Corporation of Birmingham. Smethwick appears to be perfectly satisfied, and indeed acknowledges the liberality of the Corporation in offering to part with the Board's portion of the undertaking as soon as they are in a position to manufacture gas.

REDUCTION IN THE PRICE OF GAS AT STAPLEHURST.—At a recent meeting of the Directors of the Staplehurst Gas Company, it was decided to reduce the price of gas, as from the 1st inst., from 6s. 8d. to 5s. 10d. per 1000 feet.

YESTERDAY'S PRICES OF GAS AND WATER SHARES.—Mr. A. G. Prater, Stock and Share Broker, of 23, Cornhill, gives the following as the closing prices yesterday of some of the principal gas and water shares:—

Gas Companies.	
Commercial	180 —183
Continental Union	17½ — 18
Crystal Palace District	173 —176
European	17½ — 18
Gaslight and Coke "A"	181 —183
Imperial Continental	179 —182
London	178 —182
Phoenix	35 — 36
South Metropolitan	190 —200
Do. do. "B"	183 —185
Water Companies.	
Chelsea	187 —192
East London	191 —194
Grand Junction	112 —115
Kent	258 —262
Do. New, £5 paid	10 — 12 pm.
Lambeth	194 —198
Southwark and Vauxhall	182 —185
West Middlesex	173 —176

Water and Sanitary Notes.

THE speculation in the shares of the Metropolitan Water Companies has for the moment ceased. A considerable decrease was noted in the latest quotations, the reason for which is not very apparent. A rumour is abroad that Mr. Cross has been frightened by the long price put on the undertakings by his own valuers, and there is a suspicion in some quarters that the purchase will not be proceeded with. We put no reliance at all on these statements, conjectures, or whatever they may be called. The Home Secretary is so far committed that he must go on, and leave Parliament to decide whether a purchase shall be made or not. It seems to be admitted that the position taken up by Mr. Cross, when he announced that the undertakings would be purchased at the prices which obtained last July, is perfectly untenable, and in the face of it a wild speculation set in which brought up the prices of the Companies shares some thirty or forty per cent. This shows what little faith was put in the possibility of the Government carrying out an uncommercial transaction. The astute speculators of the Stock Exchange saw at once that if the Water Companies were bought up, they must be paid for at the current value of their shares when the purchase was effected; and, willing enough to exchange water stock for Government securities, they were nevertheless anxious to secure all the advantages which could be derived from the exchange. Thus, as we have said, water stock went up, notwithstanding the report of Mr. Cross's speech. It has since receded somewhat in value, but still stands much higher than it did when the Home Secretary made his now celebrated announcement. It was, perhaps, an illustration of rash speaking which induced the Home Secretary to make the statement he did; but having made it, he must put up with the consequences. An effort has been made by an eminent firm of auctioneers to show that the words of the Home Secretary do not bear the interpretation which has been put upon them; but Mr. Cross is an eminently clear speaker. He never leaves his hearers in doubt as to the meaning his words are to bear, and we take it that in this case, led away by a desire to close the debate which was growing irksome, he made the statement to which so much objection has been raised. We shall not, however, have long to wait for explanations. Parliament will shortly meet, and this Metropolitan water business must, of necessity, form one of the first attempts of the session at domestic legislation. In the meantime we shall this week learn the value put upon water property by the public. The Grand Junction Company are about to issue £50,000 of the capital they have power to create under their Act of 1878. This will be put up to auction on the 22nd inst., and the public will then have an opportunity of expressing a practical opinion on its value. Recently the price of the £50 shares of the Company, entitled to seven per cent., was 116½. Since then they have declined but a mere trifle. The same shares stood at 87½ last July. It is perfectly certain that people who bought shares at 116 cannot accept 87 for them. Some way out of this difficulty must be found. Either Mr. Cross must abandon his idea of purchase, or must consent to amend his terms. We may just add here that a properly-constituted Water Trust would have no difficulty in recouping the Government in the course of time for the advances they might make. The question is, after all, not a difficult one to solve, and a bold financier would settle it in a moment.

We are happy to see that Dr. Frankland again reports favourably of the condition of the waters sent out by the Metropolitan Companies. He gives every one of them credit for efficient filtration, and notices in some instances the unusual absence of organic impurity. At this season of the year, and with such weather as we have had, it must have cost the Companies some care and attention to keep the water in such a condition as is here reported. In critical times like these, it is well for the Companies to show how efficiently their duties are discharged under somewhat difficult circumstances. Sometimes a great deal is made out of a very little, as when an infinitesimal portion of organic carbon or nitrogen is alleged to be present, and still more when a few living and moving organisms are seen in the deposit from a litre of water, by the aid of a powerful microscope. We ourselves have not the smallest objection to a little organic matter, nor have we any antipathy to living and moving organisms in reasonable quantity. Still we may admit that water must be considered better without such additions, and we hope that when the undertakings pass into the hands of the Trust, we shall hear no more of them.

Since we last noticed one of these reports, a new Registrar-General has been appointed in succession to Major Graham,

in the person of Sir Brydges Henniker. The appointment, which is practically a sinecure, appears to have given satisfaction to very few, and is generally regarded as a piece of jobbery. A successor has also been appointed to Dr. Farr, whose state of health is still regarded as precarious. Dr. W. Ogle, who, we understand, succeeds Dr. Farr, is an amiable man, and a good physician; but he has not, so far as we are aware, made health statistics his study, and the absence of Dr. Farr from the office will be seriously felt. The first appointment we have named has given so little satisfaction to the medical profession that they have requested Dr. Lyon Playfair to make it the subject of a question in the House of Commons. Sir Brydges Henniker was the private secretary to Mr. Selater-Booth, the President of the Local Government Board; and hence, probably, his appointment.

We have before us a nondescript Bill, which it is proposed to promote in the coming session of Parliament. It is entitled the Dagenham and District Farmers (Optional) Sewage Utilization Bill. It is to be put forward by a few gentlemen, who propose to start with a capital of £150,000, and borrowing powers to the extent of one-fourth of this sum, with a view to take sewage from the Metropolitan Board's northern sewage outfall at Crossness, and, by means of extensive works, distribute it to the farmers at Dagenham and the adjacent district, at the rate of 1s. per thousand gallons. We shall not attempt to describe the nature of the works, which are intended to convey the sewage over a large portion of Essex and Herts. Nothing is said in the Bill of any arrangement with the Metropolitan Board of Works. We may, however, take it that the Board will gladly, for the present, give any amount of sewage gratis. Bargains may be made when the Dagenham Company are assured of a success, which, we are sorry to say, we cannot promise them. Their design is excellent, but we can hold out no hopes that, in the time they ask for, they will be able to make a profit, or for many years afterwards. Nevertheless, they should not be discouraged in their efforts to increase the use of sewage for manurial purposes on a tradesmanlike system. Hitherto one cause of the failure of sewage irrigation has been that it was spread over the land whether it was wanted or not. On the system proposed by the Dagenham Company, it will only be turned on to the land as it is required.

GAS BILLS FOR 1880.

(Continued from p. 54.)

THERE are only two Bills to be promoted next session to authorize Local Authorities to purchase the undertakings of Gas Companies.

The first we shall notice is the *Hinckley Local Board Bill*, which is promoted by the Local Board to empower them to effect the purchase of the undertaking of the Hinckley Gas-light and Coke Company, Limited. The Company were formed in 1872 with a nominal capital of £20,000, in £10 shares, on which only £7 10s. has been paid. The arrangement which has been made by the Company with the Local Board is the payment of £30,000 for the 2000 partly paid-up shares. This must be a very satisfactory arrangement for the Company. We regret one thing, of course, and that is that the Company, not having statutory powers, have not succeeded in obtaining such terms as they might have secured if they had had an Act of Parliament at their back. In this Bill it is proposed to make provision for extending the gas limits of the Local Board so as to include the parishes of Burbage, Stoke Golding, and Higham-on-the-Hill. The estimated cost to complete the purchase is £30,000; £1000 for the portion of the Company's works at Burbage, &c.; and £4000 for extensions of plant. Power is sought to borrow £40,000, which sum is to be repaid by means of a sinking-fund in sixty years, the usual returns being made to the Local Government Board. The Local Board are to supply fourteen-candle gas, tested by Sugg's No. 1 "London" Argand burner, at a price not to exceed 6s. per thousand feet.

The *Lancaster Corporation Bill* is to confirm an agreement contained in the Company's Act of last session, which continued an agreement made with the Corporation in 1856 for the purchase of the undertaking of the Gas Company. No statement is made in the Bill as to the sum which is to be paid to the Gas Company as a consideration for the transfer. All the Bill tells us is that the Corporation propose to borrow a lump sum of £120,000 for gas and lighting purposes, the latter term including the electric light. This sum is to be repaid, by means of a sinking-fund, within seventy-five years of the time of borrowing; the usual returns being made to the Local Government Board.

It will be remembered that notice was given of a Bill to authorize the Corporation of Monmouth to purchase the undertaking of the Monmouth Gas and Water Company;

but the transaction has dropped through, the Corporation, we presume, having thought better of it.

There are five Bills by which Corporations and other Local Authorities seek further powers for the extension of their gas undertakings, and at the same time ask for power to supply the electric light.

The *Burton-upon-Trent Corporation Bill* is, so far as illuminating purposes are concerned, to enable the Corporation, for the object of experiment, to expend £5000 in supplying the electric light for a period of five years, the money to be repaid in ten years. The joke is that the Corporation ask for power to supply meters for the measurement of electricity, which is also the case in most of the Bills that follow. The usual clauses are inserted for the protection of telegraph wires. The customary returns in relation to sinking-funds are also to be made to the Local Government Board.

The *Denton and Haughton Gas Bill* is to confirm the dissolution of the Dukinfield and Denton Joint Gas Committee, and empower the Denton and Haughton Local Boards to combine for supplying gas to Denton and Haughton. Power is sought to supply the electric light; also to supply heat and motive power by means of electricity. The usual clauses are inserted for the protection of telegraph wires. Powers are asked to supply electric light for a period of ten years, and to expend the sum of £5000, which is to be repaid in ten years; also to borrow a further sum of £25,000 for gas purposes, which will be a more reasonable expenditure.

The *Hull Lighting Bill* is to enable the Corporation to supply the electric light for a period of ten years; and for that purpose to borrow £50,000, which is to be repaid by means of a sinking-fund in the same time, the usual returns to be made to the Local Government Board. Clauses for the protection of telegraph wires are inserted.

The *Oldham Improvement Bill* is, among other things, to grant further powers to the Corporation in respect of their gas and water undertakings, and also to enable them to supply the electric light. The district in which the Corporation may supply gas it is proposed to considerably extend, by including the district of Royston. The Corporation propose further to borrow £5000, in order to furnish the electric light, first of all to their own buildings, and then to the public. The charge to be made is to be fixed by agreement. The usual clauses for the protection of telegraph wires are inserted.

The *Preston Improvement Bill* is, *inter alia*, to empower the Corporation to supply the electric light for a period of five years, and for this purpose to borrow £10,000, which is to be repaid in the course of thirty years.

The last Bill we have to notice in this article is that promoted by the Corporation of the City of London, with or without (we cannot yet tell which) the co-operation of that august body, the Metropolitan Board of Works. The Bill has on several occasions been referred to in our columns, but it may be as well to repeat here that its object is to alter the clauses relating to forfeitures for defects in illuminating power, purity, and pressure in the several Acts of The Gas-light and Coke, Commercial, and South Metropolitan Gas Companies. For the future, if the illuminating power of the gas of any Company be found defective, that Company is to forfeit a sum of 40s. for the first half candle deficiency, and a further sum of from £25 to £100 for the first whole or any subsequent candle. With regard to impurities, the forfeitures are to be fixed on the average of three days testings, and if above the standard prescribed by the Referees, it is to be visited by a fine of £50. Any deficiency of pressure, which is to be estimated by an automatic gauge, will render the Company liable to a fine of £10.

MR. JOSEPH FRANCIS, of the New River Company, was last Tuesday elected an Associate Member of the Institution of Civil Engineers.

WELLINGTON (NEW ZEALAND) WATER-WORKS.—The Corporation of Wellington have recently been applying in England for a loan of £130,000, to provide for the construction of water-works on the Wainui-o-mata, at a distance of about 15 miles from, and the leading of water thence for the supply of the city, the present works having proved inadequate to meet the increasing requirements of the population. The interest on the loan is secured by power to levy a special rate of 3d. in the pound on the rateable property in the city, in order to supplement the available surplus of income at present derived from other sources. The existing water-works, which represent an expenditure of £80,000 (part of the consolidated loan of £200,000), yield a surplus revenue of £5057, after providing for interest and sinking-fund on the outlay, and all maintenance charges. The land and buildings belonging to the Corporation are valued at £558,200. Tenders were asked for the loan, which is to bear interest at 6 per cent. per annum, the minimum price fixed being £2 per cent. premium. Last Friday, the tenders were opened at the London office of the Bank of New Zealand. The total amount tendered for was £492,600, at prices ranging from the minimum to £110. Tenders at and above £103 16s. receive allotments in full, and those at £103 15s. 6d. about 65 per cent. of the amount applied for.

URBAN WATER SUPPLY.

IN an article under this head in a former number of the *JOURNAL* (*ante*, p. 12) we drew attention to the want of completeness in many respects in the accounts of the water supply of towns in the drainage area of the Thames, as given in a Blue-book issued about two months ago. We confined our attention then to the sources of supply, pointing out the position of the various towns in relation to the main stream or its tributaries; but there are several other points concerning which inquiries have been made. Among these are the conditions of supply, whether constant or intermittent, the quantity supplied per head of the population, the cost of works, and the charge to the consumer. There is also a column devoted to the authority under which the works are carried on, and another is given to the need and prospect of improvement.

Still limiting our inquiry to the Thames drainage area, and excluding the various towns round London supplied by the Metropolitan Water Companies, whether entirely or mainly, we find that in the whole of the Upper and Middle Thames drainage areas there are only ten towns (Oxford, Reading, Chipping Norton, Aldershot, Watford, Harrow, Uxbridge, Alton, Guildford, and Epsom) the supply of which is provided by the town authorities under local or general Acts. In all these the supply is constant, or nearly so. In eight towns there is a supply provided by Companies. In one of them (Windsor) it is intermittent; in five (Eton, Slough, Banbury, Wantage, and Aylesbury) it is constant; and in Maidenhead and Swindon the return does not state whether it is constant or intermittent. There are eight towns, all of some magnitude (Abingdon, Wallingford, Henley, Staines, Cirencester, Witney, Bicester, and Thame), of which it is only recorded that their supply is drawn from wells. These are in most cases surface wells, and they are not connected with special arrangements for supply either from Companies or Local Sanitary Authorities. There are upwards of twenty towns within the Metropolitan limits supplied by the Metropolitan Water Companies.

Of the towns on the Thames above Teddington there are 25 whose population amounts to or exceeds a thousand, but of these the particulars of the quantity and cost of the water supplied are only given as regards four—viz., Oxford, Reading, and Windsor, the latter town also supplying Eton. At Oxford there is a constant supply of 50 gallons per head, which is certainly in excess of the requirements. At Reading it amounts to 34 gallons, and at Windsor and Eton, which are supplied by the same Company, the quantity consumed per head per day is said to be 38 gallons at Windsor and 30 gallons at Eton. In all cases the waste is remarkable as compared with that of towns having constant supply under proper supervision. The cost of the works at Oxford is not known. The total amount of the water-rates, however, is stated at £6400, and as the average daily consumption is 1,750,000 gallons, the price of the water is a trifle less than 2½d. per thousand gallons. At Reading the capital cost of the permanent works is stated to have been £82,500, or 51s. per head of population. The rates, taken on an average of five years, show that the price has been about 4.9d. per thousand gallons. At Windsor and Eton the capital cost is stated at £50,000, or about 63s. 5d. per head, and the cost per thousand gallons to the customers was 4.7d. The Company therefore supply the inhabitants of Windsor and Eton at a somewhat lower price than that charged by the Corporation of Reading, and both charge nearly double the price paid for water at Oxford, where, however, the waste is very much greater.

Below Twickenham, as far as Erith, the towns on the river are, with very few exceptions (Richmond being the only one referred to in the return), within the range of the Metropolitan Water Companies. At Richmond, supplied from deep wells, the daily quantity averages 475,000 gallons, being more than 30 gallons per head. The cost of the works has been about 53s. per head of population, and the price paid by the ratepayers is 3.46d. per thousand gallons. Gravesend is the only other town on the river about which details are given. The daily supply there is stated to average little more than 7½ gallons. No information is given as to the charge made for the water.

When we turn to the towns within the Thames drainage area, but not on the river, it is impossible not to be struck with the extreme paucity of information given in the Blue-book. At Chipping Norton, in the Evenlode sub-drainage, although arrangements were in progress in 1875, no return is made in 1879. At Banbury, on the Cherwell, there is a constant supply of 22 gallons per head from a Company, but no information is given as to cost, either as to the capital of the Company or the charge to the customers. At Wantage,

on the Ock, there is a private Water Company, obtaining water from wells, not artesian, and springs which at some seasons run freely, but are occasionally dry. The water is charged for at the rate of 1s. to 1s. 6d. per thousand gallons. Aldershot is described as badly supplied with hard water from land springs, a small quantity being stored, but an artesian well in progress. A constant quantity, equivalent to less than 5 gallons a head per diem, is stated as all the available supply to be depended upon, and no information whatever is vouchsafed as to the cost of work, or the charge to the consumer.

In the sub-drainage area of the Colne we have some facts with regard to four towns out of the fourteen it contains. At Watford the supply is from artesian wells in the chalk, and as much as 40 gallons per head per day are raised by pumping, the supply being constant for fifteen hours per day. The works were constructed under the general Acts, at a cost of 23s. 4d. per head, and the water is supplied to the inhabitants at the rate of 2s. 3d. per thousand gallons. The figures, however, do not carry out this statement, as we are informed that the average annual cost for maintaining the works is £700, and the annual payment for principal and interest on money borrowed is £745, whereas the amount of water-rates in the last financial year was only £1040. At St. Albans there is a Company raising from deep wells in the chalk an average of 12 gallons per head of the population; but only supplying 9 gallons per head. Nothing is stated as to cost or charge. Harrow gives a constant supply of 34 gallons per day from chalk wells, the capital cost of works having been about 40s. per head, and the charge to customers 7-74d. per thousand gallons. Uxbridge is also supplied from wells in the chalk, the quantity used and wasted being nearly 27 gallons per head per day. The cost of the works was £3 6s. 8d. per head, and the charge is 3-74d. per thousand gallons.

In the sub-drainage area of the Wey we learn some particulars about Alton and Guildford, but none of Farnham, Godalming, Woking, or Weybridge. Alton is supplied with less than 6 gallons per day per head of population, from a deep well in the chalk, yielding, or capable of yielding, by estimation nearly 20 gallons per head. The cost of works has been about 35s. per head, but rates had not been levied at the date of the return. Guildford has 21 gallons per head per day, from a well connected with reservoirs. The supply is constant for thirteen hours, the cost of works being little more than 20s. per head, and the charge 5-6d. per thousand gallons.

Of the Mole sub-drainage area, with its seven considerable towns, there is only information as to quantity and cost as regards Reigate, which is partly supplied from deep wells in the greensand, and partly from Caterham, where the water comes from the chalk. The quantity supplied is not stated. The Companies supplying Reigate also supply some smaller towns, and no clear account of the cost of the water to their customers is given.

Epsom is in the Hog's Mill drainage area. The consumption there per head is 28 gallons per day, and the supply is constant for twelve hours. The cost of works is about £2 per head, and the charge 5d. per thousand gallons.

We come next to the towns in the drainage areas below London. In the Wandle sub-drainage, Croydon is the only town concerning which any sufficient information is given. There the deep wells, sunk at a cost of little less than £100,000, including distributing charge (about 33s. 5d. per head of the population), supply nearly 50 gallons per head per day, at a cost of 2-58d. per thousand gallons. The supply is constant, and the waste considerable; but the town is wealthy, and the borrowed capital is being rapidly paid off.

In the Lea drainage area we find artesian wells at Dunstable raising and delivering on an average a constant supply of 6 gallons per day per head. This is described as being "abundant," and it is said "no improvement is necessary." The capital cost is stated to have been only £650, and the charge is 8-9d. per thousand gallons, which will quickly be reduced to one-third if the statement of cost is correct. Hertford has an intermittent supply of 31 gallons per head, at a charge of about 2d. per thousand gallons; but the works are about to be enlarged. Ware has a constant supply of 34 gallons per head, at a charge of a little less than 2d. Bishop's Stortford has only 16 gallons per head, but the charge is 4-46d. per thousand gallons. Enfield has nearly 19 gallons per head, at a charge which, as stated, appears to be equivalent to almost 10d. per thousand gallons.* Tottenham has

26 gallons per head per day, and the charge is 2-9d. per thousand gallons. All these towns in the Lea drainage area are supplied from chalk wells.

We have thought it desirable to give the substance of the information in the Blue-book before us, so far as regards the Thames drainage area. Our readers will perceive the limited scale on which it can be regarded as satisfactory. In only three cases have successful attempts to obtain information been recorded as to the dealings of Companies with their customers, and only in two of these cases is the charge per thousand gallons deducible. Out of a total of nearly a hundred towns, exclusive of those taking supply from the Metropolitan Water Companies, the facts and details are only given of one-fourth. On the whole, it may be remarked that the waste is generally very great, the charge for water very low, and the cost of works very small in proportion to the population and supply. In the great majority of the towns here referred to, the water is extremely hard, being pumped from the chalk, but the quality is good.

Communicated Article.

THE CORROSION OF IRON.

By Mr. WILLIAM FOSTER, M.A. (Cantab.), F.C.S., &c.,
Professor of Chemistry at the Middlesex Hospital.

FOURTH ARTICLE.

I now come to the consideration of the subject of corrosion of iron gasholders, and I would refer my readers to Mr. Monk's paper, read at the last meeting of the British Association of Gas Managers, and the discussion thereon, published in the JOURNAL OF GAS LIGHTING for July 22, 1879, p. 144.

The duration of an iron gasholder is much shorter in a hot climate than that of a similar one at home. The cause of this difference is primarily due to the higher temperature, and therefore augmented corroding action which obtains in the former case. The experience of different engineers, as given in the paper and discussion to which I have referred, is not by any means uniform in all particulars. For instance, in one case the crown and upper portions of the holder were those in which the corroding action was most exerted. In another instance the greatest corrosion was found to take place in those parts which were immersed in the water of the tank. The opinions expressed as to the cause of these results were also numerous. The bad quality of the iron, the presence of free oxygen in the gas stored in the holder, the presence of ammonia and of sulphuretted hydrogen as impurities, the use of brackish water for filling the tank, were severally advanced as causes in special cases. Each is undoubtedly an important factor in the change; but, from a careful consideration of the whole subject, I am of opinion that no one of these agencies is sufficient to account for all that is known in connection with the matter.

And, firstly, with reference to the corrosion of the upper parts of the interior of the holder, usually surrounded with an atmosphere of coal gas. The corrosion of the outside of a holder, whether at home or abroad, is a simple and easily understood process. That of the interior is not by any means so obvious. I believe that I am expressing the general experience of engineers at home when I say that there is little or no corrosion of the interior of the upper part of a gasholder in its ordinary use. In such cases the coal gas contains, at the most, but small quantities of impurities, and these are not likely to be seriously prejudicial if the surface of the iron be coated periodically with tar in the ordinary way. The atmosphere of coal gas in the interior of the holder does not contain more than a very small percentage of free oxygen, and, therefore, oxidation can only proceed slowly at ordinary temperatures. That there must always be a small quantity of free oxygen in coal gas is apparent from a consideration of the methods of charging the retorts. The coal and a quantity of atmospheric air are introduced at a comparatively low temperature. This air is sealed up along with the coal on closing the lid of the retort, and is almost immediately very considerably raised in temperature. The rapid increase of temperature of the air thus confined is attended with an increase of volume, and a portion of the air passes over into the hydraulic main. The bulk of the oxygen shut up in the retort is, of course, consumed by the hydrogen of the coal, or gas, forming steam; but still there must be a small and intermittent supply of atmospheric oxygen to the contents of the gasholder. Further, in consequence of the solubility of oxygen in water, there is a feeble, but regular, supply of this element to the interior of the holder through the medium of the water in which it is immersed. This small quantity of free oxygen in coal gas would be unimportant in a temperate climate were the holder not continually rising and falling in the water. As a matter of fact, certain parts of the iron are oftener in the condition of being alternately "wet and dry" than others, and these are the parts in which the corrosion is the greatest. This alternately wet and dry condition exerts a deleterious action on the paint or other medium employed for preserving the surface of the iron, inasmuch as it tends to detach it from the latter at certain spots. These become centres of oxidation, the areas of which gradually increase, removing portions of paint in the course of their growth.

There is no essential component of purified coal gas, so far as I know, which is calculated to corrode iron. Sulphuretted hydrogen exerts a very deleterious action, but this impurity is absent in the gas supplied by the London Companies. I can recall two instances

* The rate is said to be 1s. in the pound on a rental of £90,362, which amounts to £4518 2s. for water-rate, and is equivalent to nearly 10d. per thousand gallons. The cost of maintenance and repayment of principal is, however, stated at only £2100, which is 4-6d. per thousand gallons.

only of the presence of traces of this gas during a daily experience of more than two years as a Gas Examiner to the Metropolitan Board of Works. The removal of sulphuretted hydrogen by means of ferric oxide is so simple and complete a process, even when conducted at unusually high atmospheric temperatures, that there can be no excuse for the continual presence of even small quantities of the impurity. Could it be shown that coal gas manufactured at any given works in a hot climate is allowed to be contaminated regularly with sulphuretted hydrogen, it would be quite safe to predict rapid corrosion of the iron holder used for storing it. The sulphuretted hydrogen, aided by the small quantity of free oxygen in the gas and the moisture, the latter of which must inevitably trickle down the sides of the holder at nightfall, would soon exercise a marked corrosive action. I have not any evidence as to the freedom, or otherwise, of a given gas supply from sulphuretted hydrogen, such gas having exercised a marked corrosive action on the iron holders; but, at the same time, I strongly suspect that this impurity is an important factor in cases of excessive corrosion. Gas managers thus situated cannot be too alive to the importance of keeping their gas supply continuously pure, not only on the score of public health and convenience, but also on that of personal reputation for economical working of their plant.

I am unable to find any evidence respecting the influence exerted by ammonia on iron when the former occurs as an impurity in coal gas. The case is not by any means analogous to that of exposing iron to dry ammonia gas or its solution. It is said that a small quantity of ammonia in air does not exert any action on iron. But here I wish to remark that the evidence on this point is extremely meagre. I have just now quoted from Dr. Percy, who in turn quotes from Bonsdorff (*Répertoire de Chimie*), and Bonsdorff again takes his information from the *Annalen der Chemie*. A given strength of solution of ammonia gas in water is said to act as a preservative of iron, like solutions of the other alkalis and alkaline earths already noticed. Now, assuming that ammonia gas is generally present in small quantity as an impurity, and that the quantity present is greater in gas manufactured in a hot climate than in a temperate one, what influence is it likely to exert on iron? From the evidence before us we may fairly consider that, *in itself*, its action will be neutral, or perhaps preservative. What substance or substances, then, are likely to impart to it a corroding influence? The only one, so far as I can see, is sulphuretted hydrogen. The two compounds are well known to be capable of entering into chemical combination, producing sulphide of ammonium, which is a volatile and unstable salt. The vapour of this substance, acting on the iron in the presence of moisture and small quantities of free oxygen, would effect rapid corrosion at high temperatures.

With reference to the amount of ammonia in coal gas. The London Companies furnish their consumers with a product containing but mere traces of this impurity. It requires no argument in the present case to show how desirable it is, from a commercial point of view, to recover all the ammonia manufactured in the retorts. Speaking generally, the means adopted are those of simply washing the crude gas with water in such a way that it shall finally emerge from what is, approximately, pure water. In a temperate climate the process can be worked much more economically and successfully than in a hot one. The solubility of ammonia gas in water is much greater at ordinary than at high temperatures, and, therefore, in order to remove it as perfectly in a hot climate as at home, necessitates the use of much larger volumes of water. No doubt it is found inconvenient in practice to do this, and, therefore, it is extremely likely that gas manufactured in a hot climate, and washed with water *only*, contains more than mere traces of ammonia. The difficulty could be easily overcome in such cases by washing the gas, after final purification, with a solution of a cheap salt capable of fixing the ammonia. A solution of green vitriol (ferrous sulphate) would effect the desired purpose, and furnish a liquor from which the ammonia could be eventually recovered as easily as it is from ordinary ammoniacal gas liquor.

An ingenious hypothesis has been advanced to account for these cases of excessive corrosion. It is to the effect that moisture raised by the sun's rays, and diffused through the gas, would re-act on the sulphur compounds (presumably bisulphide of carbon, CS_2) causing chemical decomposition, the hydrogen of the water being liberated in the gaseous state, whilst the sulphur and oxygen combining would furnish an acid product. From what is known concerning such decompositions, it is extremely improbable that this would occur under the circumstances. Although the sun's rays are powerfully exerted outside the holder, and raise its temperature, still their influence on the contents is purely of a thermal or heating character. Ordinary solar rays exert their influence in three ways—firstly, they have a thermal or heating effect; secondly, they render luminous most bodies on which they may fall; and thirdly, they are capable of bringing about certain chemical actions. The three kinds of rays, therefore, which make up solar light are technically known as thermal (heating), luminous, and actinic (chemical). All these are arrested when they fall on the iron holder, the thermal rays in particular being in a large measure absorbed, and in that way they raise the temperature of the holder. This in turn radiates heat rays from its inner surface, and brings about elevation of temperature of the gas. The luminous and chemical rays, however, are never radiated from the inner surface. The former would only be possible were the holder raised up to a red heat, and the latter would only appear when the iron had been further considerably raised in temperature. The case, therefore, is resolved into the question of what will occur when the sulphur compounds in coal gas are moderately heated in the presence of vapour of water. But these conditions obtain in the manufacture of coal gas, only in

a more exalted degree, and therefore I think that the hypothesis is untenable. Further, from what we know respecting the chemical affinities of hydrogen, sulphur, and oxygen, as exemplified by a solution of sulphuretted hydrogen in water exposed to atmospheric oxygen—in which case the hydrogen is oxidized and the sulphur is deposited as such—we should still expect that the superior affinities of hydrogen and oxygen would be maintained, although the sulphur might be present in the form of vapour of bisulphide of carbon.

And, secondly, with reference to the corrosion of the parts of the holder immersed in brackish water. In my second article the general principles involved in a case of this kind were briefly discussed. The wrought iron contains fine particles of crystalline graphite disseminated throughout its mass, and the whole is surrounded by a weak exciting liquid. Such a case is very like that of commercial zinc placed in dilute sulphuric acid. Chemical action at once commences, attended with the evolution of hydrogen gas. Pure zinc is practically unacted on by dilute sulphuric acid. Commercial zinc contains small quantities of other metals as well as free carbon. These bodies, foreign to the zinc, and differing from it in their chemical characters, form local galvanic couples, in which the zinc is the more negative of the two, and is therefore consumed. The particles of graphite in wrought iron are positive relatively to the mass of the iron; and, therefore, when a sample of wrought iron is immersed in brackish water, there is a manifestation of local action similar in a modified degree to that which obtains when commercial zinc is placed in very dilute sulphuric acid.

But "local action" is not the only difficulty which the gas engineer has to cope with. There may be a general action in such instances, due to the coupling together of dissimilar metals, or pieces of a metal in dissimilar conditions. It is not probable that an engineer would fasten together iron and copper, and then employ the combination in brackish water. One trial would be sufficient to prevent him from repeating the experiment. Now, the binding together of wrought and cast iron in certain structures is extremely objectionable, if the whole is situated so as to be affected by saline solutions. Yet this arrangement has been adopted in at least one of the cases where there has been notorious corrosion of the wrought iron. The wrought iron holder in this instance was immersed in brackish water, contained in a cast-iron tank, and it is fair to infer, from the disastrous results which followed, that the wrought and cast iron were intimately connected through the medium of the vertical pillars of the holder. Such being the case, the arrangement was that of a huge galvanic cell, in which the wrought iron was negative to the cast iron. Each was, no doubt, the seat of some local action, and particularly the wrought iron. But, in addition to this, the latter was affected by a general action set up in consequence of the metal, iron, in two dissimilar states being coupled together in a weak exciting liquid.

Cases of excessive corrosion, such as we have now considered, have been attributed to the employment of iron of bad quality. I fear that such statements have been made without due consideration of the circumstances. Wrought iron is obtained from cast iron by a succession of chemical and physical processes, the chief aim of which is to burn out *nearly* all the carbon, and as much of the impurities as possible. If this burning out of the carbon is not sufficiently prolonged, the resulting iron contains more carbon than good wrought iron should contain, and less than good cast iron; in fact, the product would be technically called *bad* wrought iron. As the result of experimental evidence, we know that cast iron resists corroding influences better than wrought iron, and therefore we are justified in assuming that, other things being equal, the more nearly a sample of wrought iron approximates to that of cast iron, and particularly of white cast iron, the better will it resist the action of agencies tending to produce corrosion. In short, the worse the iron (using the word "bad" in the popular sense) the better is it calculated to resist these influences. I have heard it cynically remarked that the mere fact of goods being British productions is no longer a guarantee of superior excellence abroad. I do not suppose that the constructors of gasholders are so short-sighted as to merit that sweeping assertion.

The subject of paints and similar matters will next claim my consideration.

THE PURCHASE OF THE CARDIFF WATER-WORKS BY THE CORPORATION.—At the meeting of the Cardiff Town Council on Monday, the 12th inst.—the Mayor (Mr. J. McConnochie) in the chair—the Water-Works Committee presented a report as to the water-works purchase, which was completed on the 24th of December last. The report stated that of the sum of £309,019, the total amount paid to the Water Company, one quarter's gross revenue—say about £4300—was due to the Corporation, which, with the expenditure on account of capital, £1627 2s. 9d., would reduce the amount to about £304,800. According to the terms of the agreement of purchase, the Corporation were to take over the debenture debt of the Company, amounting to £20,450. Towards the deficit the Committee had accepted various loans, amounting to £29,278 1s., to be paid on or before Jan. 7, 1880, and the sum of £25,778 1s. had been paid in respect of this. The first payment on account of the loan was made on Nov. 5, 1879, and on Dec. 17, 1879, the Committee determined to close the list of applications, so that in 42 days they had negotiated the whole of the loan required—viz., £310,523 10s. 1d.—at interest after the rate of 4 per cent. per annum. With regard to commission, the Committee had obtained the loan at the following rates:—£60,000 at 1 per cent.; £93,500 at 10s. per cent.; £12,200 at 5s. per cent.; and £144,823 10s. 1d. without any commission—total, £310,523 10s. 1d. The Committee having completed the transfer of the undertaking, felt that their duties were nearly at an end so far as regarded the purchase, and they had only to ascertain the cost of obtaining the Cardiff Corporation Act, 1879, and other incidental expenses, in order that the Corporation might be in a position to know the exact cost of acquiring the water-works. The report was, on motion, adopted after a short discussion.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE HYDRAULIC MAIN.

SIR,—I have read with much pleasure Mr. R. H. Patterson's communicated article on the Hydraulic Main, which appeared in your issue of the 6th inst. This pleasure was alloyed, however, to a considerable extent, by having to disagree with him in his remarks on the pulsation of the gas, induced by the seal in the hydraulic.

Mr. Patterson admits that the seal will have the effect of allowing the gas to escape intermittently, and that the pressure will be variable inside the retort, yet withal it seems to him that the mere manner in which the back-pressure works (by producing pulsation in the gas) is of little effect; but he says he goes further, for although admitting that the intermittent escape of the gases from the retort causes pulsation beyond the seal, he alleges that it has no reflex action to result in pulsation inside the retort. To illustrate his reason for arriving at such a conclusion, he says: "Take a cistern, or any open vessel, and allow the water to rush out by alternately opening or shutting the outlet. You will see plainly that, beyond the outlet of the cistern, the water moves along the pipe or channel in rushes or pulsations; but you will not find such pulsations in the mass of water within the cistern. Each time the outlet is opened there will be a movement of water towards the outlet, but there is no back-flow. The water that has issued is gone, and the water which has been moving towards the outlet simply fills the place of the water which has escaped, and then comes to rest."

Had Mr. Patterson actually made this experiment more particularly, employing a long, retort-shaped cistern, he would have found that his inferences were not borne out by the results, for he would have seen that, on opening the outlet, the whole mass of water in the cistern would have been set in motion towards the opening; that on suddenly closing the outlet, the motion of the water would not, as he supposes, be suddenly arrested, but the accumulated motion would be expended in lifting the water in a sort of tidal wave against the outlet end. This wave would in turn subside and drive back the water, which would pass to the opposite end; and if the outlet were opened and closed to synchronize with this tidal wave, it would, provided the supply of water were kept up, grow higher and higher.

Further, to make conditions alike, Mr. Patterson would require to attach a pipe to his cistern, as an equivalent for the stand-pipe from the retort, and he would require to place his valve on the further end of this pipe, and attach an air-vessel as a substitute for the hydraulic seal. Under such modified conditions, he would be enabled to obtain still more conclusive evidence that the column of water when set in motion tends to keep in motion. On opening the valve, the column of water contained in the pipe, as well as the water in the trough-shaped cistern, would flow forward, and on again shutting the valve the forward motion of the water would expend itself in compressing the air in the air-vessel; but the compressed air, in again expanding, would drive back the water with great force into the cistern. The common hydraulic ram furnishes a good illustration of the application of this force, when the inertia of a column of water is employed to raise a quantity of itself to considerable heights.

The analogy, however, in this experiment, to gas in a retort is not quite perfect, water being almost non-compressible, whereas the gases in the retort are highly elastic; and this very elasticity of the gases tends if anything to increase the pulsations, from the freedom of the motion of its molecules over each other. This, I think, was pretty clearly shown in the experiments which I had the honour of showing before the North British Association of Gas Managers at Stirling, on July 13, 1877.

Mr. Patterson further says I hold that the carbon deposits are almost entirely due to these pulsations; or, in other words, not to the back-pressure, but to the manner in which it operates; and alleges that I have neglected to take notice of the fact that carbon is deposited without any back-pressure at all, owing to the mere fact that a portion of the gas must come into contact with the sides of the retort, whereby a part of the constituent carbon tends to be solidified and deposited; secondly, that the longer this contact endures, the greater will be the deposit, always supposing that the heat of the retort and the smoothness or roughness of the inner surface is the same; and as back-pressure tends to retain the gas in the retort, that, consequently, the greater the back-pressure, the greater will be the deposit of carbon.

If Mr. Patterson will refer to the paper of mine to which I have just alluded, he will see that I hold that heat is the prime cause of the deposition of carbon; that carbon is necessarily deposited before the volatile constituents of coal can be arranged to form permanent gas; that the higher the temperature the greater will be the amount deposited; that it depends upon how the heat is applied to bring about the decomposition of the volatile constituents of the coal when and where the carbon is deposited, and in what condition or state; that I hold that surface contact is the principal medium through which heat is transmitted to the volatile constituents of the coal to tear asunder and re-arrange them into permanent gas; that carbon is necessarily deposited on such surfaces as bring about decomposition; that any condition which will bring about an extra amount of contact between the volatile constituents of coal and the heated surface, will also bring about an extra amount of deposited carbon; that the conditions of gas-producing plant bringing about such extra amount of contact are (1) the state of the internal surface of the retort itself, rough or smooth; (2) the compression of the volatile constituents of the coal whilst undergoing decomposition; (3) transpiration of the volatile products of the coal through the walls of the retort, due to the greater or less back-pressure over that of the surrounding atmosphere, and the more or less porosity of the retort-walls; and (4) the pulsation of the volatile products inside the retort, already referred to. He will also see that I hold that the mere compression of the gases I consider to have a small influence in affecting carbon deposit, and much smaller than that induced by the pulsations of the volatile constituents in the retort; but, at the same time, I wish him to observe that I do not include transpiration due to back-pressure, as he appears to have understood me to do. I would also ask Mr. Patterson to refer to a paper, the result of further investigation

of the subject, which I laid before the West of Scotland Association of Gas Managers, at their meeting at Kilmarnock on the 26th of September, 1878, and which was published in your columns immediately afterwards. He will there see what I consider to be a fifth condition influencing the amount of carbon deposit, and which I believe to be a more potent one than any other—I refer to the diffusion of gases and vapours through porous septa. He will also observe a sixth, and I believe an entirely new view of how heat acts upon the volatile constituents of coal in the empty space over the coal in the retort—viz., by the absorption of radiant heat, the carbon in such cases being deposited as soot, and carried forward with the current of gas.

There are some other points in Mr. Patterson's most interesting article which I would have liked to touch upon; but the time at my disposal for such subjects is now limited. I may, however, on a future occasion have the pleasure of recurring to the subject.

W. YOUNG.

Clippens Oil-Works, Jan. 14, 1880.

GAS-ENGINES.

SIR,—I have just learned that a letter of mine, on "Gas-Engines," appeared in the last number of *Engineering*. As the subject is interesting to Gas Companies, and is treated in a novel way, perhaps you would find room for it in the *JOURNAL*. It is a subject to which I may return, taking up the economical part of it.

DENNY LANE.

Cork Gas Consumers Company, Jan. 13, 1880.

To the Editor of *Engineering*.

SIR,—In all industries which require a small amount of motive power, the use of the gas-engine is extending day by day. The fact that it is ready at a moment's notice without the delay caused by lighting fires or getting up steam, or the expense of keeping up the pressure during intervals of work, the small amount of attendance which it requires, and its immunity from danger of explosion, are some of the reasons that specially recommend it. On the other hand, it has not been long enough in use to enable practical men to decide on its probable durability, and the high temperature at which it works makes considerable doubt be entertained upon this point. In some kinds of engine the slide-valve especially seems to undergo rapid deterioration. In some of the latter patterns, however, it is said that the valve is maintained at so low a temperature that no apprehension need be entertained upon this point. Again, up to the present the price charged for gas-engines has been rather high, but competition will doubtless remedy this objection, and, indeed, of late some engines which have not as yet fully come into the market are advertised at prices remarkably low. If these engines are good they will be sold largely, not only for manufacturing but domestic purposes, and the pumping of water, the cleaning of cutlery and plate, the polishing of boots and shoes, &c., will ere long, not only in hotels, but even in private houses, be performed by this cheap and handy "slave of the lamp."

My object in writing to you at present is to call the attention of your readers to the relative efficiency of the heat employed in the gas-engine as compared with the steam-engine.

All your readers are, of course, aware of the meaning of the mechanical equivalent of heat, or the quantity of dynamic energy that is equal to a thermal unit. I will employ the English mechanical unit—viz., a foot-pound, or the quantity of work employed in raising 1 lb. 1 foot vertically, and the English thermal unit, or the quantity of heat which is sufficient to raise 1 lb. of water 1° Fahr. I will call the first foot-pounds, and the second θ .

The mechanical equivalent of heat, as experimentally determined by Dr. Joule, and theoretically calculated by others, is $1 \theta = 772$ foot-pounds, that is to say, that if all the heat in 1θ unit were converted into work, this work would be equal to 772 foot-pounds; or 772 foot-pounds, if converted into heat, will produce 1θ .

The large unit employed by engineers—viz., the horse power, is 33,000 foot-pounds, and therefore the thermal equivalent of the amount of work is $33,000 \div 60 = 550 \theta$, or 550 heat units are converted in producing

1-horse power.

It is calculated that good coal by its combustion generates 14,000 θ . If all the heat could be converted into work, it would thus require only $\frac{2,563}{14,000} = 0.081$ lb., or about 1-12th of a pound of coal to maintain 1-horse power for an hour.

We know that the best compound condensing engines use 2 lbs. of coal, a good ordinary condensing engine uses 5 lbs., and small high-pressure engines from 4 lbs. to 10 lbs., and even more, per hour. It must be remembered that when the fuel is interrupted at night and at meal times, a considerable quantity of work is used in getting up and maintaining steam.

The economical result may be summed up as follows:—Engines using the quantities of coal enumerated below, convert into work the following percentage of the total heat of combustion:—

Engines using 2 lbs. per high pressure convert 8.0 per cent.

"	3	"	"	5.3	"
"	4	"	"	4.0	"
"	5	"	"	3.2	"
"	6	"	"	2.6	"
"	7	"	"	2.3	"
"	8	"	"	2.0	"
"	9	"	"	1.8	"
"	10	"	"	1.6	"

Let us now take the use of the gas-engine. I will give four examples, taking the maker's statement as to the consumption of gas:—

I.	20 cubic feet per hour.
II.	15 " "
III.	Not condensing. 15 " "
IV.	Condensing. 10 cubic feet, and 12 gallons of water.

There is considerable variation in the quality of coal gas. The higher the illuminating power, the higher also the heating power; but the latter quality increases in a less ratio than the former. For example, canal gas of 26 candles is, for supplying light, 75 per cent. better than ordinary 15-candle coal gas, but some recent experiments show it only about 23 per cent. better for heating purposes.

Canal gas of 33 candles, although 120 per cent. better for lighting than the first, is only about 50 per cent. better for heating.

In order to fix on some standard, I will take ordinary coal gas of, say, 16-candle power, such as is supplied in London. The heating power of coal gas has been variously estimated as under:—

M. Morin, 696 θ ; Dr. Letheby, 650 θ ; Mr. Evans, 650 θ ; Mr. Goddard, 652 θ ; Mr. A. G. V. Harcourt, 756 θ .

I am inclined to think that the latter estimate is nearer the average than the others. I will, however, assume 700 θ , being the mean between

the extremes given above. We, therefore, see that the gas-engines mentioned above should develop by the combustion of gas—

No. I.	(20 × 700)	=	14,000 θ.
Nos. II. and III.	(15 × 700)	=	10,500 θ.
No. IV.	(10 × 700)	=	7,000 θ.

If all the heat of combustion of 1 cubic foot of gas were converted into work, 1-horse power would require only $\frac{700}{2560}$ = 3·66 cubic feet per hour.

If we do as before, and divide 2563 θ by each of these numbers, we get the following results:—

No. I. $\frac{2,563}{14,000}$	=	·183
Nos. II. and III.	=	·244
No. IV.	=	·366

Or, in other words, the percentage of the heat of combustion converted into work is as follows:—

No. I. gas-engine converts	Per Cent.	18·3
Nos. II. and III. gas-engines convert		24·4
No. IV. gas-engine converts		36·6

If we contrast these percentages with those already given for the steam-engine, we find that No. I. converts into useful effect twice as much of the heat as the best steam-engine, six times as much as a good condensing engine, and eleven times as much as small high-pressure engines commonly employ. No. IV. is said to turn into useful effect four, twelve, and twenty-three times as much heat respectively as the several classes of steam-engines referred to.

These results seem remarkable for a machine which I may say, as compared with the steam-engine, is almost in its infancy, and it is almost possible that some special qualities of gas will hereafter be manufactured, at a low cost, for the production of heat and motive power. If such be the case the province of the gas-engine will be far extended.

I will not at present go into the question of cost, but a friend of mine has remarked that a very important social change may arise from perfecting the gas-engine. If the production of motive power on a small scale can be made economical, the small manufacturer may be able to compete with the great millowner, and the productions of the country may to a great extent come from men and women and children associated in families, and not from "hands" crowded together in great factories.

Cork, Jan. 5, 1880.

DENNY LANE.

SAFETY LAMPS IN GAS-WORKS.

SIR,—I have your JOURNAL of Jan. 6, and have read the letter of Mr. Mann with great interest; as also that of Mr. Key. I give you my experience—viz.: Last year, when we were in full winter work, I was called up at 12.30, my foreman reporting that there was a great escape of gas in the purifier-house. I at once went down with one of Armstrong's lamps, and, without hesitation, entered the house. We found a syphon-pipe was blowing; and, to enable my men to put in more water, I held my lamp over the faulty syphon-tank. The lamp was directly over the free flow of gas, and was extinguished four times; but we had no explosion in the house. One night this winter, too, we had a very great escape of gas in the condenser-house. Two of these safety lamps were in the house on this occasion, and we had no explosion. These are facts.

I may mention that, before giving the lamps to my men, I tested their efficiency by passing a full stream of gas into them; and, in every case, the light was extinguished.

Like everything about a gas-works, the lamps should be examined daily, kept perfectly clean, and in good repair.

Porto, Jan. 14, 1880.

LAYARD JONES.

FROZEN LAMP SERVICES.

SIR,—In answer to your correspondents on this subject, I never knew of any inconvenience caused by frozen lamp or other services when properly laid—that is, with sufficient fall to the main-pipe. Of course, if so laid as to hold condensed or other water which expands on becoming frozen, they must be troublesome. In such cases I would rather lift and re-lay them properly than incur the expense of spirits.

Sligo, Jan. 17, 1880.

T. GILCRIEST.

THE USE OF STEAM IN THE HYDRAULIC MAIN.

SIR,—About two years ago (having then but recently entered my present works), I found that there was a great deal of thick pitchy tar in our hydraulic main, so much, in fact, as to almost seal the dip-pipes. As the dark season was upon us, and we could not then well spare the time to clean the main, I introduced a small steam-pipe into it, below the seal, in the hope of (with steam) softening the pitchy tar sufficiently to cause at least some of it to run off, thus temporarily relieving the dip-pipes; intending in the spring to clean the main properly. The expedient was entirely successful, but that is not the subject of this communication.

Soon after turning on the steam, I noticed the flame of our jet photometer—which is kept burning constantly—got very high and smoky; and, finally, I could not, with that instrument, approximate the candle power of the gas at all. A short time after turning off the steam in the hydraulic main, the flame of the photometer resumed its normal appearance; and on turning on the steam again became as high as before. I will not presume to advance a reason for all this, because the matter is so simple, and your scientific readers can easily account for it to their own satisfaction. But to continue with my experience.

From the time the foregoing was observed, I have kept the steam in the main, the result being an increase of the candle power of our gas of from one to three candles, the average for the past year being two candles. We use steam at 30 lbs. pressure, the amount being what a $\frac{3}{4}$ -inch globe valve one-sixth open will let through. The end of the steam-pipe is 3 inches below the seal, and just at the outlet of the hydraulic main. There is a photometer in our principal office, about a mile from the works, and daily observations are taken there as well as at the works. Comparing the observations recorded at these two points, the quality of the gas corresponds, and does not show any greater difference when using the steam as described, or when not using it.

These are the plain facts; and, having no patent, nor intention to patent what accident brought to my observation, I give them to you, and hope that this letter may prove of service to some of your readers.

FREDERIC EGNER, Mechanical and Gas Engineer.

City Gaslight Company, Norfolk, Virginia, Jan. 1, 1880.

Parliamentary Intelligence.

GAS AND WATER BILLS, 1880.

The following memorials, complaining of non-compliance with Standing Orders, had been deposited in the Private Bill Office on Friday, the 13th inst., that being the last day for depositing memorials in reference to the second hundred Bills on the list of petitions for private Bills:—

Rathmines and Rathgar Township (Vatry Water Supply) Bill, from (1) Rathmines and Rathgar Improvement Commissioners and others; (2) Edward Fottrell and others; (3) Robert Dalby and others.

The following Bills among the second hundred on the list will therefore go before the Examiners as unopposed:—Ackworth, Featherstone, and Purston Gas Bill; Birkenhead Borough Bill; Cardiff Water-Works Bill; Chester Gas Bill; Dartford Gas Bill; Dearne Valley Water Bill; Doncaster Corporation Water Bill; Edinburgh and District Water Bill; Hull Lighting Bill; Lancashire County Justices (Water) Bill; Lincoln Gas Bill; Liverpool United Gas Bill; Malton Gas Bill; Maidstone Gas Bill; Reading Gas Bill; South Metropolitan Gas Bill; Stafford Borough Bill; Wakefield Corporation Water Bill; Wandsworth and Putney Gas Bill; Wigan Improvement Bill; Yarmouth Water Bill.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

MONDAY, JAN. 12.

(Before Vice-Chancellor MALINS.)

SIMMONDS v. VESTRY OF RICHMOND.

This case, which has been before the Court on several occasions, arose out of a dispute that had taken place between the Southwark and Vauxhall Water Company and the Vestry of Richmond as to the supply of Richmond with water. The defendants, in sinking an artesian well, erected a steam-engine and pumps close to the premises of the plaintiff, who was the proprietor of a boarding-house, and the noise made, as well as the dust and dirt arising from the machinery, created such an intolerable nuisance that the plaintiff's lodgers left. Thereupon an action was instituted to recover damages and for an injunction, and upon a reference to chambers the Chief-Clerk, after inspecting the premises, awarded the sum of £250. This sum the defendants had offered to pay, as well as the costs after the date of the reference, and the "out of pocket" costs of the plaintiff; but the offer not being accepted, application was made for an order upon the pleadings for payment of the £250 and costs of suit.

MR. PEARSON, Q.C., and MR. BRADFORD appeared for the plaintiff. MR. GLASSE, Q.C., and MR. GLENN, who appeared for the defendants, submitted that the Court had no jurisdiction to make such an order upon motion.

The VICE-CHANCELLOR, after reviewing the facts of the case, said the only question now to be decided was, who should pay the costs of the suit. He was surprised to hear it urged on the part of the Vestry that, upon a question so insignificant as the present, the cause should be carried to a hearing, and so delayed for another five or six months. The only question in the suit was whether the plaintiff had sustained damage, and that question had been answered. What else remained? Nothing but costs. The plaintiff was right in coming to the Court, remaining before the Court, and was right now; therefore he had no hesitation in coming to the conclusion that as she had succeeded she must have the costs of the suit throughout. He believed it would be acting in mercy to both sides to cut short such a litigation upon the motion; and the order of the Court would be for payment of the £250, with interest at 4 per cent. from the date of the Chief Clerk's certificate, to be paid within seven days, and the costs of the suit including the costs of the motions; in other words, the successful party would get all the costs of the suit.

GLAMORGANSHIRE ADJOURNED EPIPHANY SESSIONS.

TUESDAY, JAN. 13.

(Before Mr. R. O. JONES, Mr. J. C. FOWLER, Mr. G. PHILLIPS, Mr. O. H. JONES, and Mr. C. THOMPSON.)

APPEAL AGAINST THE ASSESSMENT OF THE SWANSEA CORPORATION WATER-WORKS.

An appeal was to-day heard, brought by the Swansea Corporation, as the Urban Sanitary Authority, against the assessment of the Churchwardens and Overseers of the parish of Mawr Higher, on one of the reservoirs of the water-works system, purchased by the Swansea Corporation and managed by them, situated in Mawr Higher.

MR. M'INTYRE, Q.C., and MR. DAVID LEWIS appeared for the appellants; and MR. MICHAEL, Q.C., and MR. BOWEN ROWLAND for the Overseers.

MR. M'INTYRE, in opening the case, said it was an appeal made by the Swansea Corporation, who were the Urban Sanitary Authority, against the assessment of the Overseers and Churchwardens of the hamlet of Mawr, and the Assessment Committee of the Pontardawe Union, on the Blaenantddu reservoir, situated in the hamlet of Mawr, and which is one of four reservoirs, forming the group of reservoirs supplying the town of Swansea with water. The reservoir is a new one, recently constructed by the Corporation, and was assessed for the first time to the rate made on the 19th of April, 1879. The assessment then placed upon it was £1604. This was an assessment made by the valuer upon the rateable value of the works *per se*; but it was contended by the appellants that the works in any one parish could not be assessed at a higher rate than the proportion of the whole works would give to this one parish; and not that the works in any one parish, from which the actual income was derived, should be rated in excess of the others in such a way that a larger sum than the whole value would be derived from the accumulated amounts of the several parishes when joined together. The total capital expended in the purchase of the water-works, and the execution of permanent works since, amounted to £210,888. The actual cost of the reservoir which was the subject of dispute was originally to have been £49,748, which gave a net rateable value of £762, as against £1604, at which the works had been assessed by the Overseers of the hamlet of Mawr. In addition to this, there would be the owners repairs, insurance, &c., that the owners would have to pay, and which would amount to £190. This would give a gross estimated rental of £952, with a rateable value of £762. The difference between the amount assessed by the Overseers and the amount at which the works ought to be assessed to the Corporation formed the subject of dispute. The rateable value of the whole works was taken at £3255, and therefore he contended the rateable value of one of four reservoirs could not be £1604. The rateable value of the works, he maintained, should be based on the net income, and not on the amount the works would fetch in the market, because by their Act of Parliament the Corporation were not a trading company; as the surplus, after paying expenses, would go towards the reduction of rates.

MR. E. COUSINS, the Engineer and Borough Surveyor for Swansea, was the first witness examined. He said he had been with the Corporation for 25 years, and a part of the present water-works system was constructed under his direction. With the exception of the Lliw reservoir, and the

reservoir in dispute, the other works were constructed by the old Water Company. The Lliw reservoir cost £22,121; land, £5978; way-leave, £1895. The works were purchased of the old Company for £30,000. The land for the Blaenantddu reservoir cost £3571; way-leave, £16; the reservoir cost really £94,801; engineering expenses £2201; making a total of £100,589. The Lliw reservoir had a capacity of 300 million gallons, and drew its supply from an area of 1860 acres. The capacity of Blaenantddu reservoir was 160 million gallons, and the ground from which it drew its supply of water formed an area of 710 acres. The original expenditure was estimated at £43,689, but the additional expenditure was caused by the imperfect nature of the soil. Had the ground turned out what from the character of the adjacent soil they assumed it would, the reservoir would have been constructed for the sum originally estimated, or the total sum would have been £49,478.

In cross-examination he said that by their Act of Parliament the Corporation were compelled to construct the reservoir on the precise spot they did, as the place was indicated on the plans submitted to the Parliamentary Committee, and they could not vary the position, even to the thickness of the embankment. He admitted that the additional sum expended in the construction of the reservoir was necessary, and arose entirely from the faults in the soil, which gave a defective foundation. Had he been aware that the subsoil formation was of the character it turned out to be, he should never have recommended the Corporation to have constructed the reservoir upon the place where it was.

Mr. T. W. E. Young, the Borough Treasurer, stated that the total income from the water-works undertaking for 1878 amounted to £7795 3s. 11d. The establishment expenses were formerly put down at £500, but on the suggestion of Mr. Cousins the proportion of the establishment expenditure was increased to over £1000, as it was considered that the proportionment was unequal, and that a larger proportion of the Corporation expenses ought to be charged to the water-works undertaking. The receipts for 1879 amounted to £7999 3s. 11d., but the average income for the last three years had been £8472. The receipts amounted to a sum nearly equal every year. The arrears carried over would be from £1000 to £1200, but this would go on from year to year, so that the actual income from all sources would be about the same.

Witness was cross-examined at considerable length to show the amount of money borrowed for the construction of the Blaenantddu reservoir, £80,000 of which was borrowed at $\frac{4}{5}$ per cent.

Mr. T. L. Headley, Auditor of the Consett Water Company, said he had had great experience in the valuation of water-works. He had made a valuation of the Swansea works, having taken the details as supplied by the Borough Engineer. He considered that the proper way of estimating the value of such works was to take the gross receipts for, say, 1878, amounting to £7999. The working expenses were £2205, which was a very small percentage, leaving a balance of £5794. The working capital, stores, and material he estimated at £1000; meters, &c., £1500; making a total of £2500. He had not allowed any sum for cash balance, as the water-rents were payable in advance. The life of a reservoir he had estimated at 80 years, and then made a proportionate deduction for depreciation. These and other expenses reduced the balance to £4513, and this gave a rateable value of £3906 *plus* the rates, and it was upon this sum the rates would have to be applied, taking the works as a whole. Deducting the rates, there would be left £3251. That proportion as a rateable value to the gross receipts was about 40 per cent. This was a large percentage, as there were other water-works where the rateable value was less than 20 per cent. Taking the cost of the Blaenantddu reservoir at 1-64th of the whole, the rateable value of it was £762.

When cross-examined, he stated that the cost of a work was not the basis of its value, and in this case he had taken the cost of the reservoir at the sum originally estimated, and not at the cost it actually entailed on the Corporation.

WEDNESDAY, JAN. 14.

Mr. Cousins, the Borough Surveyor of Swansea, was again examined with reference to the contract entered into for the construction of the Blaenantddu reservoir, but this contract appeared to have been so materially altered that it became of little value.

Mr. C. Stephenson, a surveyor, and Mr. T. Waring, C.E., were examined with reference to the value of the Blaenantddu reservoir. Neither of these gentlemen had seen the reservoir, or been consulted before the previous day, when the case was opened. They had been furnished with the data given to Mr. Headley, and coincided with him in the rateable value which he placed upon the reservoir.

This was the case for the appellants.

Mr. MICHAEL then addressed the Court for the respondents. He contended that the basis of rating any works similar to those now the subject of inquiry was the value of things as they were, supposing that they were the property of a private company. The Swansea Corporation were bound by their Act of Parliament to construct the reservoir where they did, even though it should have cost them £500,000. The inhabitants of Swansea were dependent on this reservoir for their supply of water. The Lliw reservoir was so leaky that it could not be used, and it was obliged to be closed. The Corporation were, therefore, compelled to go to Parliament for an Act, and they borrowed £70,000, at $\frac{4}{5}$ per cent., to enable them to construct the reservoir. This was the principle upon which the rateable value of the reservoir should be based—the value of the reservoir to the whole, and the necessity of this particular reservoir to the supply of water to the town.

Mr. E. Ryde, of Westminster, was called as a witness for the respondents, and stated that he had had great experience in the valuation and purchase of water-works. He had seen the Blaenantddu reservoir at the request of the Assessment Committee, his opinion being asked whether their assessment could be maintained. He estimated that from £95,000 to £100,000 had been expended on its construction. The reservoir was most important to the Urban Authority, as it was from it that they drew their supply of water. The other reservoir was without water, and could not be used at the present time. It seemed to him also that the Blaenantddu reservoir was pretty freely bled, as the water in it, when he saw it, was very low. He considered, after a careful examination, that the rateable value of this reservoir was £3000. The Swansea Corporation paid 4 per cent. on their capital, and taking this as a portion of the whole, it would give £5000 for the reservoir. He considered that the sum named by the Assessment Committee, £1600, was not one-half what could be placed upon it by way of assessment. He then reviewed Mr. Headley's figures, and considered that the sum put down for working expenses, &c., was far too much. He considered that this particular reservoir was very material to the water-works undertaking. But for this reservoir, Swansea at the present time would have been, he believed, without water; and the reservoir, therefore, was most important.

In answer to the Court, witness seemed to think that while the reservoir was of a very great value, it might be that owing to the unproductiveness of the reservoirs in other parishes their rateable value might have to be reduced.

Mr. Samuel Harpur, Engineer of the Merthyr Local Board of Health, and Manager of the Merthyr Water-Works, also gave evidence. He valued the reservoir at a somewhat higher sum than Mr. Ryde, basing his valua-

tion to some extent on the cost of the work, not upon its productiveness; but he gave several instances at Merthyr where the reservoirs cost widely different sums with smaller capacity. These, however, he said, were rated at their cost; but, after long pressing by the Counsel for the Corporation, he said he thought that they ought to be rated equally.

Mr. MICHAEL, in reply, urged that cost was an element in the consideration of the rateable value of the reservoir, and its great importance to the whole concern in its supply of water to the town of Swansea.

In reply to Mr. Jones,

Mr. M'INTYRE said that the water-works were rated in Swansea at £2047; parish of St. John, £200; parish of Clare, £974; St. Thomas, £846; Penderry Higher, £104; hamlet of Mawr for the Clive reservoir, £780; and for the Blaenantddu reservoir, £1604; the total rateable value being £5455.

In addressing the Court on the part of the Overseers, he admitted that since the case had been before them a more careful investigation of figures showed that the rateable value of the reservoir, instead of being £762 as at first put down, should be £880, and it was this sum at which they now put it.

The Court then adjourned to consider their decision; and on re-assembling,

Mr. JONES said they had taken the gross value at £8000, on the authority of the case of *The Corporation of Worcester v. The Parish of Droitwich*. They had then deducted the working expenses, and various other items which he mentioned, reducing the rateable value to £4172. They had not taken the cost of the reservoir into consideration, but they had apportioned to the reservoir in dispute the rateable value of £1000. The rate would, therefore, be altered from £1604 to £1000.

Miscellaneous News.

EUROPEAN GAS COMPANY, LIMITED.

An Extraordinary Half-Yearly General Meeting of this Company was held at the London Offices, Austin Friars, on Wednesday, the 14th inst.—WILLIAM WHITE, Esq., in the chair.

The SECRETARY (Mr. Henry Dozell) read the advertisement convening the meeting, and the following report of the Directors:—

No events of importance, beyond the usual routine of the Company's business, have occurred since the annual general meeting held in July. The gasholders then in course of erection at Boulogne, Bolbec, and Sotteville have since been completed, and are now in action. At Nantes and Sotteville the execution of part of the extensions projected, including a new gasholder at the former station, has been deferred until the present year.

Generally the Directors are able to report that all the Works continue in good order, ready to provide the larger demand for gas which may be expected to arise from the revival of trade now taking place. Notwithstanding the depression which prevailed during great part of last year, the gas-rental shows that the interests of the Company have not been affected thereby, in the aggregate. At Rouen, Amiens, and Bolbec, however, prosperity is so much dependent on the active employment of the numerous and important factories established there, and which have in many cases either temporarily suspended operations or worked short time only, that gas has been less freely used than would have been the case under more favourable circumstances; but the falling off in this respect is more than covered by a large improvement elsewhere.

The demand for coke having become exceedingly active during the recent severe weather, an increase in price has been generally obtained, and stocks have everywhere been disposed of.

The Board have also the satisfaction to report that a great part of the supply of coals required at the Stations has been secured on favourable terms by means of contracts extending over two years, and shipping for conveying the same to destination having also been provided by agreements for a long period at low rates of freight, the Company are in a position to derive the full benefit of the rise in value of coke and other residual products, which has already set in.

Reviewing the whole of the operations since the 31st of March last, at the seven stations, it appears evident that substantial progress has been made, such as to encourage the hope that, when the accounts are made up to the 31st of March next, and the profits of the year ascertained, they will bear favourable comparison with any previous twelve months working during the existence of the Company.

Debentures bearing interest at 5 and $\frac{4}{5}$ per cent., to the amount of £17,000, came to maturity on the 1st inst., and were paid off, with the exception of £3800 renewed at 4 per cent. for a term of years.

The usual interim dividend of 4 per cent. will be paid on the 2nd of February next.

The CHAIRMAN: Gentlemen, having but little to say regarding the results of the past six months working, our report is necessarily a short one; but I think you will all agree that it is a satisfactory one. The main points are that our business is increasing, our residuals are becoming more valuable, and our raw material—that is, coal—has been secured for some time forward on highly favourable terms. In order to profit as much as possible by this state of affairs, we have limited the outlay on new works to the actual requirements of each station, whilst at the same time making sufficient provision for the future, deferring further expenditure where we could safely do so, as, for example, at Nantes and Sotteville, where, however, we still intend to carry out our extensions previously planned. Thus husbanding our resources, we trust that this time six months we may be privileged to lay before you such a statement of accounts as will ensure your unqualified approbation. The preliminary works relating to the deep-sea harbour at Boulogne have been energetically commenced, and as the present Prime Minister of France was one of the warmest promoters of the scheme, we may expect to see them continued in the same spirit. Our own interest, of course, cannot fail to be benefited by the large expenditure which is sure to be made there. We have suffered to some extent, as the report informs you, in what I may call our manufacturing towns; but Bolbec is fast recovering, and at Rouen the additional consumption from general lighting has compensated us for the suspension of the factories. At Havre the promoters of the electric light are making strenuous efforts to recover the ground lost by them; but the good sense of the Government officials in Paris has hitherto foiled all attempts to do so successfully. I believe the impression of the chief officials, on whom the decision depends, is that a similar effect to that produced by the electric light may be obtained at very much less expense from gas. Of course, you have all heard of the recent scare in gas shares. My conviction is that there is as little reason for it as there was for the previous one, which was from an alleged invention, now apparently set aside as worthless to make room for another, which does not appear to possess any greater practical value than to inspire telegrams at Christmas time, when they would be likely to produce the most effect on quotations. I am sorry for the weakness of any shareholders who may have been thus deluded into sacrificing their property; but, having been warned by experience, I must say I do not pity them for the losses they may have sustained. Even supposing Mr. Edison's cardboard light to possess all the merit claimed for it, is it likely that we could submit, in our shops and houses, to substitute for the great convenience of gas the intolerable trouble of vacuum lamps, liable to failure on the admission of atmospheric air, and deriving their supply of electricity from engines and generators placed in general on our own premises? It appears to me preposterous. In addition to this, the proposed lamps labour under the disadvantage of not affording any heat, which in gas is largely utilized as a substitute for fuel in factories, industrial establishments, and in private houses, during the winter months. I do not think I need say any more on the subject, nor should I have said so much, or indeed anything at all, if people's minds had not

been pre-occupied by it during the last few weeks. I am quite satisfied, as I have said before in this room, that the electric light of Mr. Edison is a very pretty plaything, and it is very much to his credit that he has produced it; but it is certainly not commercial. When you begin to talk of lighting houses and private apartments, and every man having the necessary machinery in his house, it is perfectly preposterous; and as to cheapness, I see by the paper to-day that he talks about something like an 80-horse power engine for 800 lights. Now, as far as my recollection serves me, an 80-horse power engine would cost for working about £3000 a year, with the necessary attendance, and then, to be safe, everything must be in duplicate. Therefore, I am quite satisfied, and I think the Shareholders may be also, that this is not a commercial way of lighting—it will not pay as a commercial undertaking. It is all very well for making speculative shares go up from 100 dols. to 3000 dols., but I am quite satisfied in my own mind gas has not anything to fear from it. I have nothing further to add to what you have already heard in the report, and I shall be happy to listen to any Shareholders who may desire to address the meeting on the Company's affairs. I beg to move—"That the report as read be now adopted."

Mr. H. SOLOMON seconded the motion.

Mr. T. N. STOKES thought the report was so satisfactory that no one had anything to say upon it. The Company seemed to be progressing, and he was sure this must be very gratifying to all the Shareholders.

Mr. R. H. JONES said he concluded that the £17,000 of debentures paid off would be really a reduction of the capital of the Company, so that for the future they would not have to pay the interest upon this sum which they had been paying.

Mr. H. M'L. BACKLER said that the money for the debentures paid off would be provided out of the depreciation-fund of the Company, and this fund was credited with interest out of profits, so that the interest would not really be a saving of revenue. It was a saving of expenditure so far, but revenue would not benefit by it.

The motion was then put, and carried unanimously.

The CHAIRMAN: As we have no accounts to place before you at this period of the year, that is the whole of the business.

Mr. STOKES said they could not think of leaving the meeting without giving the Chairman and Directors a hearty vote of thanks. Everything seemed to be progressing in the most satisfactory manner.

Mr. FREEMAN seconded the motion, which was carried unanimously.

The CHAIRMAN, in reply, said: Gentlemen, we have again to thank you for the vote of confidence in us which you have passed to-day. We endeavour to do our duty, and to look after your affairs; and I think we may say, and say very fairly, that while we do so we obtain our reward by the mode in which your business prospers. We think, as I said before, that we have very little to be afraid of as to the electric or any other light. As long as we can supply the towns, and different places where we supply gas, with the satisfaction we give at present, both to the authorities and to ourselves, I think we have little or nothing to fear. I thank you again for this vote of confidence in us.

The proceedings then terminated.

INSTITUTION OF CIVIL ENGINEERS.

The First Ordinary Meeting of the Institution after the Christmas recess was held on Tuesday last, when the recently-elected President, Mr. W. H. BARLOW, F.R.S., delivered an Address, in which it was stated that, his professional career having commenced in 1823, the same year as that in which the Institution had received its Royal Charter, he proposed to draw attention to the great changes and progress in engineering which had arisen since that time. Undeniably, he said, the influences that had mainly operated on the well-being of this kingdom, and on the world at large, were the improvements in the means of communication, by the application of steam to locomotion on land and on sea, and by the utilization of some of the powers of electricity in the transmission of intelligence. He then passed in review the progress that had been made in the use of steam for land and sea transport; and the origin of, and improvements made in the employment of electricity for telegraphic purposes, &c.

This naturally led to a reference to the use of electricity for lighting purposes, about which he said that the more recent electro-dynamic machines had placed lighting by electricity on a totally different footing to that on which it formerly stood, and left no doubt of its applicability to many important purposes. It was, in fact, already established in light-houses, where its intensity and power were of the highest value, and there were many examples of its application in public buildings and large shops, in railway stations and open spaces, and for street lighting. Whether it could be divided, so as to become equally economical and convenient for domestic purposes, had yet to be ascertained. The distinction between the intensity of light and its illuminating power ought not to be overlooked. The intensity of a light bore the same kind of relation to its illuminating power as the specific gravity of a substance did to its weight. The latest application of electricity—namely, for the transmission of mechanical energy—was suggested by Dr. C. W. Siemens, who had ascertained that, including all sources of loss, 50 per cent. of the original power could be realized at a distance of a mile, and that, with adequate provisions against heating, it would be no dearer to transmit electro-motive power to a greater than to a smaller distance. Sir William Armstrong had availed himself of this force for working a circular saw placed at a distance of quite a mile from the waterfall which supplied the power; the deep-sea sounding-line on board the telegraph ship *Faraday* was hoisted by mechanical energy thus transmitted from the engine; and Dr. Werner Siemens had succeeded in obtaining locomotive power sufficient to convey 30 persons by similar means.

In reference to gas, he said that its employment as a means of illumination, which was in its infancy in 1828, had increased in a remarkable degree. The capital invested in gas-works in the United Kingdom was £40,000,000, of which about £12,000,000 represented the capital of the London Gas Companies. At the end of 1878, the length of gas-mains in the Metropolis was 2500 miles, and there were about 58,000 public lamps for street lighting. In the same year the quantity of coal carbonized was 1,715,000 tons, which produced nearly 17,500 million cubic feet of gas, besides residual products of the value of £745,000. The coal used was about four-tenths of a ton per annum per head of the population. Of the gross revenue, 5 per cent. was derived from street lighting, 20 per cent. arose from the sale of residual products, and 75 per cent. from private consumers.

The application of wrought iron in the superstructure of engineering works having been touched upon, the President remarked that the improvements effected in the manufacture of steel assumed the character of new discoveries, which were tending to revolutionize the iron industries of the world; and, in conclusion, expressed his indebtedness to those men, both within and without the profession, in foreign countries as well as in this, who, by study and experimental research, were continually adding to an exact knowledge of the great sources of power in Nature—that power, the direction of which to the use and convenience of man, constituted the fundamental element in the Charter of the Institution.

METROPOLIS GAS SUPPLY.

METROPOLITAN BOARD OF WORKS.—At the meeting of the Board last Friday, a letter was presented from the Chelsea Vestry, asking the Board to take the necessary steps to procure, in the Bill to be promoted by the London Gaslight Company in the coming session, clauses requiring the Company to supply gas of as high an illuminating power, and of as great purity, as that furnished by the Companies under the supervision of the Referees. The letter was referred to the Special Purposes and Sanitary Committee.

METROPOLIS WATER SUPPLY.

The Registrar-General publishes the following table in reference to the water supply of London during December, 1879. According to the returns furnished to him by the Metropolitan Water Companies, 138,810,743 gallons, or 630,681 cubic metres of water (equal to about as many tons by measure, tons by weight), were supplied daily; or 242 gallons (110·0 decalitres), rather more than a ton by weight, to each house, and 34·1 gallons (15·5 decalitres) to each person, against 33·1 gallons during December, 1878.

COMPANIES.	Number of Houses, &c., supplied in		Aver. Daily Supply of Water in Gallons* during	
	Dec., 1878.	Dec., 1879.	Dec., 1878.	Dec., 1879.
Total supply	553,975	573,792	130,086,702	138,810,743
From Thames	262,210	275,095	64,893,002	68,214,415
„ Lea and other Sources . .	291,765	298,697	65,193,700	70,596,328
THAMES.				
Chelsea	29,438	29,945	7,531,400	7,663,600
West Middlesex	51,493	53,534	9,487,730	10,115,828
Southwark and Vauxhall . .	82,183	88,502	23,898,285	24,440,378
Grand Junction	38,989	40,285	11,222,887	11,652,109
Lambeth	60,107	62,829	12,752,700	14,342,500
LEA AND OTHER SOURCES.				
New River	127,673	129,554	25,961,000	27,198,000
East London	117,094	120,459	31,105,700	34,877,000
Kent	47,008	48,684	8,127,000	8,521,328

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for December, 1879, as compared with that for the corresponding month of 1878, shows an increase of 19,817 houses, and of 8,724,041 gallons of water supplied daily.

The following is Dr. Frankland's report on his analyses of the water supplied to London during December, 1879:—"Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies, and by the Tottenham Local Board, was—Colne Valley, 1·4; Kent, 1·4; Tottenham, 1·8; West Middlesex, 1·8; Southwark, 2·8; Chelsea, 2·8; Lambeth, 3·2; Grand Junction, 3·4; New River, 3·6; East London, 3·7. The Thames water supplied by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies was of superior quality, considering the season of the year, the West Middlesex Company's water being again distinguished by its comparative freedom from organic impurity. The Lea water, distributed by the New River and East London Companies, was slightly inferior to Thames water—a circumstance of extremely rare occurrence. All the river water was efficiently filtered before delivery. The deep well water supplied by the Kent and Colne Valley Companies, and by the Tottenham Local Board of Health, was of its usual excellent quality for dietetic purposes, and that sent out by the Colne Valley Company was suitable for all domestic purposes, having been softened before delivery. Seen through a stratum two feet deep, the waters presented the following appearances:—Kent, Colne Valley, and Tottenham, clear and colourless; West Middlesex, clear and nearly colourless; Chelsea, Southwark, Grand Junction, Lambeth, New River, and East London, clear, very pale yellow."

Results of Analyses expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Maters.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen, as Nitrates and Nitrites.	Total combined Nitrogen.	Chlorine.	Total Hardness.
Inner Circle.								
Thames—								
Chelsea	30·72	·138	·027	0	·224	·251	1·5	20·8
West Middlesex	32·50	·085	·018	0	·318	·336	1·5	29·3
Southwark	31·78	·130	·037	0	·341	·378	1·5	19·4
Grand Junction	32·78	·170	·038	0	·280	·318	1·5	19·9
Lambeth	32·72	·174	·016	0	·316	·332	1·5	20·6
Lea—								
New River	32·40	·181	·027	0	·266	·293	1·5	20·6
East London	37·24	·174	·046	0	·259	·305	1·7	21·2
Deep wells—Kent	44·08	·071	·016	0	·387	·403	2·5	25·1
Outer Circle.								
Colne Valley	12·28	·066	·015	0	·318	·333	1·4	6·0
Tottenham Local Board . . .	40·78	·092	·015	0·70	0	·073	2·8	23·9
Corporation of Birmingham*	30·84	·132	·036	·005	·286	·324	1·8	19·8
Corporation of Glasgow†	2·96	·119	·022	0	·009	·031	0·64	1·1

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
† Analyzed by Dr. E. J. Mills, F.R.S., of Anderson's College, Glasgow.

Note.—The numbers in the above table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

ADOPTION OF THE BURGHS GAS ACT AT MONTROSE.—A meeting of the Montrose Town Council was held on Thursday week, when Provost Japp, in accordance with the resolution, adopted at a preceding meeting, moved—"That the Council now adopt the Gas Act, and that a day be fixed in the month of November when they shall meet for the reconsideration of the resolution, as provided by the Act." Mr. Reid seconded the motion, which was eventually agreed to without dissent; and it was also agreed that the Council, after being reconstituted at the next election, should meet on Thursday, the 18th of November, to resume consideration of the matter. After a good deal of additional discussion, it was remitted to the Treasurer's Committee to confer with the Directors of the Gas Company, to ascertain at what sum they would be willing to sell the works, and to get other information.

AMERICAN GASLIGHT ASSOCIATION.

[Abridged from the "Official Report" in the *American Gaslight Journal*.]

(Continued from p. 65.)

At the close of the discussion on the "Lowe Water-Gas Process," reported last week, Major Dresser read a paper prepared by Mr. W. Farmer, of New York, upon the results obtained by the use of the regenerator furnace for heating retort-bouches, invented by Mr. Charles F. Dieterich, Engineer of the Baltimore People's Gas Company. This invention was described in a paper which Major Dresser himself prepared and read before the Society of Gas Lighting on Dec. 12, 1878. [See JOURNAL, Vol. XXXIII., p. 328.]

Major Dresser also read a paper by Mr. E. S. Cathels, entitled "A Few Supplementary Words on Retort-Settings," but as it was accompanied by, and had references to drawings which are not given in our American contemporary, it would be useless reproducing it.

Professor E. G. Love (New York) then read the following paper on
STANDARD BURNERS.

The question of a proper burner for testing the illuminating power of gas has created about as much, if not more discussion than that of a proper standard with which to compare the illuminating power. In 1849 the British Parliament first legalized a standard of the illuminating power of coal gas. The burner was described as an Argand of 15 holes, consuming 5 cubic feet of gas per hour, and having a 7-inch chimney. The candles were made of wax, six to the lb., and, as at present, intended to burn 120 grains per hour. In 1850, Dr. Letheby was appointed the first Gas Examiner, and to him are due many of the improvements in photometric work. Two years after his appointment, the sperm candle was substituted for the wax, and a plaited wick used.

The first public Act fixing a standard of illuminating power was the Metropolitan Gas Act of 1860, in which the burner prescribed was an Argand of 15 holes, consuming 5 cubic feet of gas per hour, and having a 7-inch chimney; the standard of illuminating power was continued at 12 candles, and the candles employed were made of sperm. It will be readily seen that with these very imperfect specifications as to what the standard burner should be, a great variety of burners could be constructed, each conforming to that mentioned in the Act. Nothing was said about the apertures, and their distance apart, the diameter of the channel through which air was supplied to the interior of the flame, diameter of the chimney, and so on. As might have been expected, burners were made which did not show more than 50 per cent. of the illuminating power of the gas. It was noticed, however, that the smaller the holes and the greater the pressure, the lower the illuminating power; and, also, that as the channel for carrying air to the interior of the flame increased in size, the illuminating power was diminished. With this knowledge as to what a burner should not be, it became merely a matter of patient study and experiment to make a burner what it should be.

The Birmingham and Staffordshire Gas Act of 1864 contained a feeble effort to describe a standard burner; but it was still incomplete, although an improvement on those preceding it. The Birmingham burner, although well suited to a 14-candle gas, for which it was designed, proved unfavourable to the gas if the illuminating power was greater or less than this.

The Leamington, Dublin, and other burners were used more or less as standards; but the burner containing more good qualities than any other that had preceded it, and one which at the present time is quite extensively used, was that designed by Dr. Letheby, and made by Mr. Sugg, and now known as the Sugg-Letheby burner.

In the City of London Gas Act of 1868, an entirely new departure was made. By it Gas Referees were to be appointed, and, among other duties, they were to "prescribe the burner for testing the illuminating power of the gas," which burner should be the "most suitable for obtaining from the gas the greatest amount of light, and be practicable for use by the consumer." The result of this Act was the adoption in 1870, of a burner constructed by Mr. Sugg, and known as Sugg's "London" Argand, No. 1. He gave the matter much careful study. The pressure under which the gas was supplied to the burner was greatly reduced; the air supply to the interior of the flame was carefully regulated by the diameter of the air-hole in the centre, while the air supply to the exterior of the flame was regulated by the length and diameter of the chimney; the temperature of the burner was also greatly reduced. While with a Sugg burner the pillow becomes heated to a distance of two or three inches from the top, with a Sugg's "London" the gas channels of the burner itself are not even warm. Calling the old test-burner used from 1852 to 1863, 100, the steady burner used from 1863 to 1869 equalled 111.1, while Sugg's "London" Argand equals 128. The burner now used by the Gas Referees in London is practically the same as that adopted in 1870, and some changes in the dimensions of the chimney have been made.

There are three elements to be considered in the construction of a standard burner, or any burner calculated to utilize to the fullest extent the power of the gas—1. Size and number of holes. 2. Air supply. 3. Chimney. I am speaking now of burners of the Argand pattern. First, the size and number of holes. With common coal gas (say 16-candle gas) the holes can be of larger diameter and fewer in number as the illuminants are in moderate quantity, and too great surface of flame must not be exposed to the oxidizing action of the air. With richer gases the case is different. Here we have a larger percentage of illuminants, and the object is to spread out the flame, and allow the air a fair chance of bringing the carbon particles to incandescence. Hence the number of holes is increased, and they may be of smaller diameter.

The second and third elements—air supply and chimney—are closely related, because as we vary the dimensions of the chimney we vary the supply of air. The air supply is really the most important consideration, for on it depends the development of the maximum amount of light. A rich gas can stand and needs more air than a poor gas, inasmuch as in the rich gas we have more matter to be oxidized. The heated column of air caused by the burning gas creates a current of the surrounding air towards itself. This drawing in of the air is increased with an increase of the velocity with which the gas issues from the apertures; and the increase of the air-supply results in a more rapid combustion of the gas. It is possible to make the combustion too rapid, in which case the gas is overburned. On the other hand, if the combustion is not rapid enough, a loss of light ensues, and we say the gas is underburned. As the combustion becomes more intense (by increasing the air supply) the intensity of the luminous portion of the flame increases, although the extent of the luminous portion is continually decreasing. With a deficiency of air the flame temperature is too low, and when there is too much air, its inert nitrogen is heated at the expense of the flame, and the carbon particles, mingled to a greater extent with the air, pass through the incandescent state too rapidly, or it may be the flame temperature is too low on account of the excess of air. There is a point, then, at which the carbon particles receive just the amount of air necessary to develop the maximum of light, and below and above which the gas suffers.

It is evident that as the chimney is increased in length or width, a greater quantity of air is drawn in on the flame, and so it may be over or under burned, according as the chimney is too large or too small. The flame will give its maximum of light on the verge of smoking.

There never has been a standard burner in the proper acceptance of the term. One burner after another has been adopted in certain sections, because the new comer was supposed to give more satisfactory results than its predecessors. This country has not, and never has had, any one burner which, by general consent, was accepted as a so-called standard. In England much more attention has been paid to the subject, and since the Gas Act of 1868, a certain burner has been adopted which utilizes the power of the gas so far as our knowledge of the principles involved will enable us to construct one. This same burner is not used by all gas corporations in England even, and hence cannot properly be called a standard in the same way that we speak of standards of weight and measure. We have Sugg's "London," the Sugg-Letheby, and many more, each dubbed "standard." It probably never will be possible to decide on any one burner, and, except for the advantage of comparison, it is of little moment. In this country, if every gas company made the same kind of gas, and in the same way, we might settle on some one burner, but variety seems to be the order of the day. Burners were made for gas, not gas for burners, and it is very important to select a burner which is suited to the gas it is used to test. A burner adapted to a 16-candle gas will not burn one of 14 or 18 candles without injury to the gas, though sometimes it is possible to correct the evil by using a chimney of different dimensions.

Such is the case in using the burner prescribed by the Referees in testing the gas of London. If in testing a 14-candle gas by this burner it shows a tendency to tail over the chimney, the latter is changed for one of a slightly increased diameter. It then becomes an interesting question as to how far it is possible to decide on a burner which a majority of gas corporations can use to advantage. If one has always used the Sugg-Letheby burner, he could always continue doing so, and be able to compare the quality of his gas to-day with that of six months or a year previous. But if one company uses Sugg's "London," and another a Sugg-Letheby, there are no means of comparison, except, as we know, in a very general way, the increased illumination given by Sugg's "London" over the Sugg-Letheby.

Further than this, the question arises, and a question of much more scientific interest—How much light can be obtained from a given gas under the most favourable conditions. In these times of close competition, no gas corporation can afford to lose two or three candles illuminating power in the burner.

Every illuminating gas contains elements which, under favourable conditions, will emit a certain amount of light. The burner does not increase this light-giving power contained in the gas, but simply utilizes it to a greater or less extent, according to the adaptability of the burner to the gas.

That the gas company have a right to employ, in testing for illuminating power, the burner which will show their gas to the best advantage, is a fact generally conceded, and one which few, if any of you, will question. The intelligent consumer, on the other hand, has a right to demand that these tests be made with a burner which he can readily obtain. In other words, the company have no right to employ a burner of intricate construction, one likely to get out of order, or one so expensive as not to be within the reach of consumers. In most cases it will be found that the use of poor burners is occasioned more through ignorance than any inability to procure good ones. In England, of late years, great advancement has been made in the use of proper burners by consumers, and burners similar to those prescribed by the Referees can be readily obtained. We hear little of English burners in the hands of consumers in this country, because there is little thought given to the subject, and hence little demand for any other than the most simple forms. They are not so expensive, however, as to preclude their use in photometric work, so far as it may be advantageous to employ them.

The question is—Can a burner be wisely adapted for use by a large number of gas companies, unless there is some approach to equality in the gas manufactured by them? If one company makes a gas of 14 candles, and another company one of 18 candles, certainly no one burner can be used advantageously for both. If there were some standard of illuminating power, say 16 candles, and the different companies endeavoured to keep near this, a burner could be easily selected which, within reasonable limits, would answer for all. If a burner were to be adopted for what are known here as naphtha gases, it would need to be something different from that for coal gas. In England the Referees prescribe an Argand burner for common coal gas ranging from 14 to 16 candles, and a bat's-wing burner for canal gas ranging from 23 to 28 candles.

I have had occasion to make some experiments on the subject in connection with a proposed change of burner in testing the gas of New York City, and, without occupying your time with details, will mention some of the conclusions to which I have been drawn.

New York is especially fortunate or unfortunate in the great variety of illuminating gases offered to the public. At present (and ever since the city has had testing-stations under its control) the Sugg-Letheby burner has been employed for all gases alike. That this burner was not doing full justice to any, and great injustice to some of the gases tested by it, was evident to every one; but, for certain reasons, no change seemed possible at the time. And even now that a change is contemplated, it is a most perplexing question to decide what burner or burners to adopt. To adopt one burner for all would be ridiculous. In the first place, there are gases, like the New York and Harlem, having an illuminating power of 16 to 17 candles (tested by the Sugg-Letheby burner) and the specific gravity of which is that of ordinary coal gas (430 to 480). Then there are coal gases corresponding very nearly or quite to the canal gas of London, with a comparatively low specific gravity and high illuminating power, like the Manhattan—illuminating power 17 to 18.5 candles by the Sugg-Letheby burner, and specific gravity 450 to 500. And, lastly, those gases enriched with naphtha, having a high specific gravity (650 to 750) and high illuminating power. Up to the present time I have limited my experiments more especially to the first class, or common coal gases, as to this class belong the majority of illuminating gases of this country. Perhaps the average gas is more nearly equal to the English coal gas—from 14 to 16 candles illuminating power. For gases of this nature undoubtedly the best results can be obtained with Sugg's "London" Argand adopted by the Gas Referees. It is provided with a chimney, 6 × 1½ inches for 14-candle gas, and another 6 × 1¼ inches for 16-candle gas.

Gases which range from 16 to 17 candles by the Sugg-Letheby burner cannot be tested by the Referees burner without some loss, as in every case I have tried the flame tailed over the chimney. Tests were made with the Referees burner and a chimney 7 × 1½ inches, and good results were obtained; but, as will be seen later on, the maximum of light was not reached.

Experiments were made with Sugg's "E," "F," and "G" burners. Excellent results were obtained with the "E" burner, but with burners "F" and "G" the gas was undoubtedly overburdened, for the illuminating power was below that of the "E." It is to be borne in mind that these burners are designed for a certain consumption of gas (the "E" for 5½, the "F" for 6½, and the "G" for 7 cubic feet per hour), and it is hardly to be expected that they would give the best results when burning smaller quantities.

The following table shows some results obtained, while other experi-

ments are in progress. The gas used in the testings was that of the New York Company. The results given are the average of a large number of tests. The pressure of the gas as delivered to the burner varied from 0.15 inch to 0.30 inch, according as the bushing affixed to most of the burners was left in place or removed. In all cases, however, the pressure was reduced to a minimum consistent with an easy flow of gas. The tests were made with an hourly consumption of gas of 5 cubic feet, no matter what the capacity of the burner.

Burner.	Dimensions of Chimney.	Illuminating Power.	Illuminating Power by Sugg-Letheby Burner.	Difference.
<i>First Series.</i>				
Sugg's "London" Argand, No. 1	6 x 1 1/4	16-83	15-95	0.88 tailed.
"E" burner	7 x 1 1/4	17-02	15-95	1.07
"F" "	7 x 1 1/4	17-60	15-95	1.65
"G" "	7 x 1 1/4	17-40	15-95	1.45
	8 x 1 1/4	17-28	15-95	1.33
<i>Second Series.</i>				
Sugg's "London" Argand, No. 1	6 x 1 1/4	16-38	15-64	0.74 tailed.
" " " "	7 x 1 1/4	17-16	15-64	1.55
<i>Third Series.</i>				
Sugg's "London" Argand, No. 1	6 x 1 1/4	Smoked.	16-22	—
"E" burner	7 x 1 1/4	17-28	16-22	1.06
" " " "	7 x 1 1/4	17-80	16-22	1.58
" " " "	7 x 1 1/4	17-20	16-22	0.98

From these tests it will be seen—1. That Sugg's "London" Argand, No. 1, with a 6 x 1 1/4 inch chimney, gave from 0.7 to 0.9 of a candle more than the Sugg-Letheby. This is low, on account of the tailing of the flame. 2. That the same burner with a 7 x 1 1/4 inch chimney gave from 1.1 to 1.5 candles more than the Sugg-Letheby. 3. That Sugg's "E" burner, with a 7 x 1 1/4 inch chimney, gave from 1.58 to 1.65 candles more than the Sugg-Letheby, while with a 7 x 1 1/4 inch chimney the difference is equal to about 1 candle. 4. That burners "F" and "G" gave from 1.4 to 1.3 candles more than the Sugg-Letheby. 5. That with a gas of 15.5 candles, by the Sugg-Letheby burner, most excellent results are obtained, by Sugg's "London" Argand, No. 1, with a chimney 7 x 1 1/4 inches. 6. That the Sugg-Letheby burner gives results about 1.5 candles below the burner giving the best results.

As to a suitable burner for rich coal gases and naphtha gases, I am convinced, from a number of experiments, that the burner which gives the best results with a rich coal gas will not burn the naphtha gases to the best advantage. A 5-foot bat's-wing is used in testing London canal gas (23 to 28 candles), the gas of Glasgow (23 to 30 candles), and in other places. While this burner gives good results with rich coal gas, it is not suited to naphtha gas. A naphtha gas requires a flat-flame burner, the same as a rich coal gas, but one in which the slit is much narrower, so that the gas may be spread and a more intimate contact with the air offered. At the same time such a burner would over-burn rich coal gas. The simple matter of candle power is not the only element to be considered; the higher specific gravity of the naphtha gases is also to be taken into consideration.

Experiments on this point are in progress, and their results, together with the relations existing between the different burners, Sugg's illuminating power meter, and the jet photometer, will form the subject of another paper.

Mr. NETTLETON said one thought that presented itself to his mind was whether a standard burner or burners might not be established by the action of the Association, and adopted and used by the different companies throughout the country in fixing a standard by which to test the gas made, so that the Companies would be able to make comparisons with each other, and understand each other when the subject of candle power was discussed. There was a further thought, and it was this: The gas interests of the country were at some time, beyond all question, to be the subject of legislation; and if the gas interests of the country could present to the different legislatures and legislators an intelligent knowledge of the conditions necessary to a fair development and a fair standard of the gas made, they might have something in their own hands to guide legislation in the future to a large extent, and to relieve themselves, perhaps, from more or less oppression, by taking the initiative and acquainting the public and themselves as to what was necessary for a fair and just standard between themselves and the public. From the paper just read he saw that Professor Love's opinion was that no one standard could be made, and no one burner could be used; but a series of burners might be used, or some plan be developed by inquiry and investigation by which a standard burner for a 14-candle gas might have one kind of chimney attached to it, and another burner for a 16-candle gas have another chimney attached to it; and so going through with the different qualities and kinds of gas. In this way members would be able intelligently to talk with each other and understand what each other meant when speaking of the respective candle power of the gas they made.

Mr. LITTLEHALES suggested the desirability of gas companies, or the managers of gas-works, taking a little more interest than was often done in the burners used by consumers. There was no doubt a great deal of dissatisfaction caused in the minds of consumers because they did not get good burners. His company had for some time past been getting the best burners they could—not the highest-priced burners, but such as customers could afford to pay for. These were sold at cost price, and he believed it would pay every gas company to adopt the plan. Of one thing he was sure, and that was, that it would be to the interest of gas companies to look into this matter and see what could be done in the direction of furnishing good burners at a reasonable price to consumers. It very often happened, when complaints in regard to poor gas were made, that investigation disclosed the fact that the burners were poor, and thus a change of burners often remedied the difficulty.

Mr. STARR said he had been doing this for the last four years. He gave away the burners, and had altogether furnished about 100 gross to customers. Another thing, in putting the burners in, was to regulate the size of the burners used in the different parts of the house. For instance, where there were bed-rooms, he recommended the use of a smaller burner, and in a sitting-room, where a great deal of light was required, he recommended larger burners.

Mr. SHERMAN hoped the suggestion Mr. Nettleton made, in regard to standard burners, would be carried out by the Association. He (Mr. Sherman) thought a committee ought to be appointed to examine into this question, and therefore moved—"That a committee be appointed by the chair to investigate the subject of standard gas-burners, and to ascertain, if possible, which would be the best burner to be adopted by all the companies."

This motion was carried, and the PRESIDENT nominated Mr. Nettleton, Mr. Sherman, and Major Dresser as the Committee to report on the matter.

(To be continued.)

THE PRICE OF GAS IN PARIS.

It will be remembered that at the meeting of the Municipal Council of Paris on the 24th of November last, it was referred to the Streets Committee to inquire into the advisability, having regard to the improvements that have of late years been effected in the manufacture of gas, and the consequent reduced cost of its production, of applying for a Commission to consider the present position of the gas supply of the city, both public and private. The attention of the Council had been specially directed to the subject by a memorandum addressed to them by the Prefect of the Seine, and a number of petitions had been presented from the Syndical Chambers of various industrial bodies in Paris, who had taken up the matter with considerable activity.

By the 48th article of the treaty at present existing between the Municipal Council and the Paris Gas Company it is stipulated that if, in consequence of the discovery of any improved systems of manufacture, the cost of gas may be reduced, the Council shall have power, in the public behalf, to call upon the Company to adopt such improvements; and even if the Company should have already adopted them, and have thereby effected a reduction in their working expenses, the public are to participate proportionately in the benefit accruing therefrom, in the shape of a reduction in the price of gas. It is further stipulated that in the event of the discovery of a mode of lighting other than by gas, the Administration reserve to themselves the right of granting the necessary authority for the establishment of such new system, without being liable to indemnify the Gas Company in any way whatsoever. These stipulations are to be applicable only in periods of five years from the date of the treaty (Feb. 7, 1870), and no action is to be taken in the matter till one of such periods is drawing to a close, when all the improved manufacturing processes not actually in use are to be examined by a Commission to be appointed for the purpose by the Minister of the Interior, and they are to have an interview with a deputation from the Gas Company, and indicate such of the new processes as in their estimation are capable of practical application in gas manufacture. As the second quinquennial period will close on the 7th of February next, the matter was deemed to be one requiring immediate attention, and hence the reference to the Committee.

At the meeting of the Municipal Council on the 24th ult., the Committee presented their report, in which they stated that having considered the several matters referred to them, and consulted with the Director of Public Works, they were of opinion that inasmuch as, since the treaty of Feb. 7, 1870, came into force, the processes employed in the manufacture of gas have enabled the Company more advantageously to dispose of their residual products for industrial purposes, and that the sale of such products has undoubtedly resulted in a considerable reduction in the cost of gas as now made; and it appearing, from the petitions presented to the Council, that the Company have themselves introduced improvements into their manufacturing operations, by means of which they have very greatly reduced their working expenses—they were of opinion that the Council should, with a view to the public benefit, request the Minister of the Interior to nominate a Commission to inquire into the whole question, in accordance with the terms of the article in the treaty referred to.

The recommendation of the Committee gave rise to a short discussion; but the report was eventually adopted.

THE GREAT EDISON SCARE.

Under the above title the following article, which it is reported was written by Professor Tyndall, appeared in the *Saturday Review* of the 10th inst:—

What a happy man Mr. Edison must be! Three times within the short space of eighteen months he has had the glory of finally and triumphantly solving a problem of world-wide interest. It is true that each time the problem has been the same, and that it comes up again after each solution, fresh, smiling, and unsolved, ready to receive its next death-blow. But this peculiarity of his triumphs, though interesting from a practical point of view, is doubtless of too trifling a character to damp the joy of victory in Mr. Edison's own mind, since it appears in no degree to interfere with the plaudits with which his followers hail each fresh achievement—or, as we should rather say, bulletin—from Menlo Park. And thus not only is Mr. Edison to be congratulated on the happy past, but his friends may look forward to a long and equally happy future, crowned at periodical intervals by similar dazzling and final triumphs; for, if he continues to observe the same strict economy of practical results which has hitherto characterized his efforts in electric lighting, there is no reason why he should not for the next twenty years completely solve the problem of the electric light twice a year without in any way interfering with its interest or novelty.

But all this, we are told, is altered now. We are given to understand, by accounts from head-quarters, that this time Mr. Edison really has done it, and descriptions of the perfection and economy of the light are showered upon us which quite take away one's breath. That the light itself is all that its inventor could by any possibility desire will not surprise any one who has had experience with inventors; but it does startle us to be told that its cost will be only 1.40th that of gas. In the face of such definite assertions incredulity would seem to be a crime, and it would appear to be the duty of all gas directors to make forward contracts to deliver old iron in view of the immediate future when gas will be spoken of as a thing of the past. Curiosity, however, is such a persistent trait of the human mind, that one cannot repress a desire to know the exact details of this all-transforming discovery, and to form one's own opinion of the sources of its transcendent merits. Fortunately, the veil of mystery that has so long hung over the doings of Mr. Edison's laboratory has at last been drawn aside, and we are in full possession of the magic secret. It does not sound very wonderful after all. There is nothing new in the lamp. It is an ordinary incandescent lamp with a slip of carbon as the substance to give forth the light. The sole secret is that Mr. Edison makes the carbon out of burnt paper.

The discovery bears strong marks of Mr. Edison's handiwork. Like all the other so-called discoveries of his in connection with electric lighting (with one exception, of which we will speak presently), it is wholly without novelty, unless there be some unimportant details in the particular form of the connections and regulating mechanism, in which he has chosen to exhibit that ingenuity which he undoubtedly possesses, but which could have been as well arranged in a thousand other ways. The idea of a lamp consisting of a piece of carbon placed in a vacuum and rendered incandescent by the passage through it of a strong galvanic current is at least as old as 1845, when it was patented by King, and similar devices have since been continually proposed and employed by others. Experience, however, taught inventors (as it will probably teach Mr. Edison when he has a little more acquaintance with the subject) that a vacuum is a very awkward thing to deal with, and that much more satisfactory results could be obtained by placing the carbon in a non-combustible gas, such as nitrogen or carbonic acid. Accordingly recent lamps in which incandescent carbon has been used have generally been of that type. Such was the Sawyer and Mann lamp which excited so much attention in New York some twelve months ago, and which consisted of a thin rod of carbon in a receiver full of nitrogen. Of late we have heard nothing of this lamp, and we very much fear that it is another instance

of the fatal gulf between theory and practice, and that its disappearance from public view is due to the existence of some practical difficulties in the application of what seemed to be an ingenious idea. Other lamps are upon similar principles; the most successful one, so far as we can judge by report, is a French one, in which there are three small carbon rods in a closed receiver, the oxygen of which is consumed by the combustion of one of the rods, leaving the atmosphere in the receiver incombustible during the incandescence of the other two. Nor is there any more originality in the idea of procuring the carbon for such lamps from burnt paper or cardboard. That such carbon was very suitable for producing light by incandescence has long been known to electricians. Mr. Swan used it 15 years ago for an electric lamp on the incandescent principle, and, curiously enough, used it in the shape of a horseshoe, exactly as Mr. Edison is now using it; so that there must be something more than a resemblance between the two lamps, seeing that the carbon and the enclosing glass vessel (which may be of any shape) constitute the whole of the lamp proper. The use of this carbon was given up because of its want of durability—a difficulty which, however, Mr. Swan says that he has now got over; and it seems to be tolerably evident from Mr. Edison's own account that he has done little or nothing to remedy this defect, of which he is probably not fully aware. At any rate, it is clear that the carbons he uses are fragile in the extreme, for he says that they must be taken out of the mould with the greatest care, to prevent their falling to pieces.

The general result, therefore, is that Mr. Edison leaves the subject of the electric light precisely where he found it, so far as discovery is concerned. He has added nothing to our knowledge. The next thing to consider is, whether or not his lamp performs the practical service claimed; whether, in short, the method he adopts—by whomsoever invented—will in fact accomplish what is alleged of it. Considered in themselves, there can be no doubt that the tales that have come over to us about Mr. Edison's new discovery are in the highest degree improbable. The use of incandescence as a means of procuring light from electricity, without breaking the continuity of the circuit, has been known from nearly the beginning of the century, and all its advantages and disadvantages have been thoroughly studied. The result has always been to show that it is a very wasteful method of using the electric current when compared with the electric arc or the broken circuit of such lamps as the Regnier and Werdermann, which hold an intermediate position between the two classes. It possesses great advantages, which are obvious at first sight; but so great is the disadvantage of which we have spoken, that its use has been very limited, except for special purposes, as, for example, the little medical lamps for illuminating the cavities of the body to facilitate diagnosis. That this principle should turn out to be the enormous commercial success that Mr. Edison's lamp is represented to be, is in the highest degree unlikely, seeing that, as we have said, his lamp differs but slightly, if at all, from lamps previously known. Nor do the accounts themselves that have reached us tend to reassure us much. They show clearly that this lamp is more fragile and more difficult to handle than any of its competitors. They do not give us the least reason to think that it has any elements of success in it other than the bright character of the incandescence of carbon made from paper; and as such carbon cannot materially differ in its qualities from other kinds, and is even more liable to be heterogeneous and uncertain, this small advantage seems to be a very slight matter to build such high hopes upon. They do not suggest any way of getting over the difficulty which is met with in lamps constructed on this principle, of keeping the glass from getting dulled by particles of carbon coming off from the incandescent mass within it—a difficulty which would be peculiarly fatal to a vacuum lamp like Mr. Edison's, which cannot be cleaned on the inside. But, above all, there is a strong flavour of humbug about the whole matter. Every account—even those which Mr. Edison himself seems to have authorized—is written in a way in which no good electrician could write. We have a sensational account of the supposed discovery, where a thin filament of carbon is represented as having been accidentally tried with a strong current, and we are told, as of a newly-discovered marvel of science, that this carbon filament resisted an intense heat, and "proved in reality more infusible than platinum." As though every schoolboy who has dabbled in chemistry did not already know that carbon was incomparably more infusible than platinum, or indeed than any other substance. Then there are references to other electrical phenomena which have about as much to do with the matter as the processes of electrotyping would have, but all of which are ingeniously identified with the so-called discovery, as though they specially belonged to Mr. Edison's lamp. Thus it is explained that the current can be made to run a sewing-machine; and other potentialities are vaguely shadowed forth which are said to be dependent on a knowledge of the laws of electricity. Of course a continuous current can be made to do work in a thousand different ways; but what have the marvels of electricity in general to do with the question whether Mr. Edison's lamp is a good one? Again, there is the new dynamo-electric machine. Mr. Edison must, of course, come before the public in a state of complete independence of all other inventors; so he must not even get his electricity from the same sources as others. Hence, for a second time, he produces a dynamo-electric machine, which he calls by the pompous title of the Faradaic Machine. It merits this title only in virtue of its representing a state of knowledge more nearly that of Faraday's time than any machine in use at present. It is strange how Mr. Edison's efforts in electric lighting seem cursed with a total absence of originality. This machine, both in its separate parts and in its general arrangement, is the merest copy from other machines. Its principle, its arrangement, and everything about it are so utterly unoriginal, that really it is difficult to understand how Mr. Edison himself can fancy he has any claim to be considered its inventor. It only differs from the machines at present in use in that it is much what they must have been in their early forms, before their makers had learnt how to intensify the magnetic field in which the armatures rotate. He drops hints of machines that utilize 90 per cent. of the power applied to them. The correctness of this figure, if it is intended to apply to this machine, we cannot believe in. Such a percentage is about what is expected from a good machine on the Siemens, Gramme, or Brush principle, and it is simply absurd to suppose that this blundering imitation, which is destitute of all the special improvements which experience has suggested to their makers, can contend with these machines on equal terms.

All these circumstances and many others cause us to regard with utter distrust the glowing accounts of Mr. Edison's invention (if it is entitled to be called such) that reach us from New York. And, added to this, there is the remembrance of what happened some 18 months ago at the beginning of Mr. Edison's experiments on the electric light. Every one recollects how, in October, 1878, there came a telegram from New York that Mr. Edison had completely solved the problem of electric lighting, and how this telegram caused a tremendous panic in gas shares, sending them down to two-thirds of their previous value. Even the instructed, who could detect, in the very language in which the telegram was couched, evidence that it was framed either by or for persons who were ignorant of the subject, scarcely dared to imagine that such a telegram could have been allowed to go forth or to remain uncontradicted unless Mr. Edison had really obtained most important results, and was in a position to practi-

cally effect electric lighting at a reasonable cost. It is fortunate for Mr. Edison that public attention cannot remain very long fixed upon any one subject, and that by the time that a few months had elapsed people had ceased to think of him or his telegram. For we now know in what position he stood when that outrageous telegram was sent. And it is well that we are able to arrive at this from sources directly connected with Mr. Edison himself, for it would otherwise be impossible to convince any one of the true state of the case. Some six or eight months after this telegram, two patents, representing the latest completed results which even then Mr. Edison had obtained, came over to this country, and were made public amid the universal derision of all who knew anything about electricity.

The wonderful secret that was to solve completely the problem of electric lighting was the use of incandescent platinum (or an alloy of platinum and iridium, we forget which) to give light. It would seem that Mr. Edison has an irresistible passion for electrical antiquities. Not only is this one of the very oldest devices known, but it was actually patented in 1848 by Staite, though we doubt whether such a principle could even then have been the subject of a valid patent unless there had been something special in the form in which it was applied. We forget whether Mr. Edison attempted to patent his lamp, or even if he had any lamp at all at the time; but he certainly patented a regulator, which was intended to turn off the current when the heat of the platinum got too intense. This was a simple instrument of little or no merit, and deserving of no notice. We really do not know whether it was able to do its work; we have heard that it failed even to do that; but whether or not this was the cause is of no moment, for, so far as we have been able to learn, both the lamp and the regulator have, for all practical purposes, proved abortive. We have never heard of their being tried on any practical scale, or even of their being used at all outside of Menlo Park; and whatever may be Mr. Edison's love of perfection, we do not believe for an instant that, if he had got a really practical lamp capable of doing a fraction of what that was represented to do, he would have let months pass without its coming into the market.

But these two were not the only precious gifts which were then bestowed on the world by Mr. Edison. There was a third, to which no disparaging remarks as to its extreme simplicity could be applied. The second patent then taken out by him was for a wonderful dynamo-electric machine of a wholly new construction. We willingly give Mr. Edison credit for originality in this machine. Coils were fixed to the vibrating arms of a monstrous tuning-fork more than a yard long, and these, by the vibrations of the fork, were made to approach or recede from magnets, and thus currents were generated. If it were not actually in a patent taken out on Mr. Edison's behalf, all instructed persons would hesitate to believe that such an absurd arrangement could be seriously proposed at a time when such machines as the Gramme, the Siemens, the Lontin, the Brush, and a host of others were in existence, much less that it could be proposed by a man of Mr. Edison's advantages and fame. It is difficult adequately to express the ludicrous inefficiency of the arrangement; but one thing is abundantly certain, and that is that the person who seriously proposed it was wholly destitute of a scientific knowledge of either electricity or the science of energy. It is clear that he was tempted by the hope of getting out of the vibrations of the tuning-forks something more than the force he expended on them. No doubt he thought that vibration was so confirmed a habit with tuning-forks that they would vibrate on the merest hint being given to them. To those who remember the amusement that this wonderful invention excited among English electricians, it will be interesting to read the following passage from the latest authentic American account:—"Mr. Edison's first experiment in machines for generating the electric current did not meet with success. His primal apparatus was in the form of a large tuning-fork, constructed in such a way that its ends vibrated with great rapidity before the poles of a large magnet. These vibrations could be produced with comparatively little power. Several weeks of practice proved, however, that the machine was not practicable, and it was laid aside." We should very much like to know when these weeks of practice (not a very long trial for a new invention) took place. Not before the patenting, or it would never have been patented. Then it must have been after the patent was taken out—a matter which confirms the opinion held by most persons in England who were competent to judge of it, that no such machine had at the time ever been made (except, perhaps, on a small scale), and that the whole matter was a pure speculative suggestion. Remembering the unrivalled opportunities for experiment possessed by Mr. Edison, the fact that he took out this patent without any adequate preliminary trial—and we are convinced that a most superficial investigation would have demonstrated its worthlessness—is a striking lesson as to the reliance that must be placed on the accounts of the extent of the preliminary experiments to which his so-called inventions are subjected. We can assure Mr. Edison that it will require a long list of successes, not only announced but realized, to counteract in the minds of those capable of judging of it the effect of that absurd patent in convicting Mr. Edison of being a man with no scientific knowledge of electricity, and either so incapable of judging of the value of his work or so careless of his own reputation as to be ready to patent a machine which on a few weeks trial proves itself, on his own confession, to be an utterly worthless device.

These petty results, or rather the small fraction of them that he had obtained six months previously to their publication, represent all that Mr. Edison had actually completed when the famous telegram was sent. In other words, he had not the slightest ground for announcing that he had made any substantial advance in the treatment of the electric light, much less that he had completely solved its difficulties. Now we do not suppose for a moment that Mr. Edison would aid in giving currency to a report which he did not believe to be true. The most probable hypothesis is that he is an inventor who is absolutely intoxicated with his own reputation, and who has an unlimited belief not only in the efficiency, but also in the novelty of all that he proposes. In no other way is his conduct comprehensible. The exciting cause of the celebrated telegram could not have amounted to more than that, having thought a little over the difficulties of the rival plans for producing the electric light, he resolved to concentrate his efforts upon the oldest and the easiest—namely, incandescence in the continuous circuit. Having resolved in his own mind that this was the best form, his vanity treated success as so certain that we honestly believe he viewed it as a grand new departure in electricity, whereas it was only what hundreds had done before and hundreds will do again. Then he went on floundering through all that his predecessors had gone through before him; advancing knowledge not one whit, inasmuch as all his results were old, but still pressing on with the profoundest conviction that everything that came upon him as a novelty was new also to the world. It is only by keeping these things in mind that we can judge of the value of the recent reports of his successes, and we can come to no other conclusion about them than that without independent confirmation they are not worthy of credence. It is not that we do not think that Mr. Edison is likely to help in the development of electric lighting. On the contrary, considering his unexampled advantages, it is matter for surprise that so ingenious a man has not discovered something worthy of remark by this time. For he is undoubtedly an inventor of exceptional merit. Independently of the important share he has had in the development of quadruplex telegraphy, his success in the

carbon and loud-speaking telephones shows that he is possessed of great inventive power and remarkable mechanical ingenuity. His other great achievement, the phonograph, would alone go a long way towards justifying his enormous reputation. But these successes seem to have completely turned his head. He allows the wildest reports of his doings to obtain currency. The same account to which we have referred speaks of his having recently invented an air-pump, a method of utilizing mining tailings, a sextuple telegraph, and a specific against headaches. This last child of his fertile brain is old enough to be christened, and rejoices in the mysterious name of Polyform, and the reporter goes so far as to state that Mr. Edison takes it himself. But this must surely be an exaggeration. Altogether he reminds us forcibly of the White Knight in "Through the Looking-Glass," and we expect soon to hear that he has

"Completed his design
To save the Merai Bridge from rust
By boiling it in wine."

It will be remembered that the White Knight also had invented devices for the preservation of his health. All these things make us feel that Mr. Edison is not capable of judging of his own performances, and confirm us in the belief that his latest idea is but a doubtful rival of many lamps that are already in the market. The calculation as to its costing 1-40th the price of gas is an utterly absurd one, even when read by the light of the meagre details on which it professes to be based. The most economical form of electric light is, and in all probability always will be, the arc-lamp, where it can be used on a large scale, and no form of incandescent lamp can approach it in economy of production. Yet engineers are very well satisfied if they can bring down its cost, even under the most favourable circumstances, to between 2-5ths and 1-4th the price of gas. We feel tolerably certain that the cost of Mr. Edison's lamp, even if it is otherwise practicable (about which we have a good deal of doubt), will be many times this. The only good point about the news is that Mr. Edison seems at last to have settled down to the useful detail work of trying various methods of improving the manufacture of carbon for electric purposes. This is much wanted, and Mr. Edison is exactly in a position to do it. But, supposing that a manufacturer of artificial carbons were to discover that it was better to use barley-meal than wheat-flour, or lump sugar than moist sugar, in their preparation, we should be considerably surprised to find him announcing himself to the world by telegram as being the greatest inventor of the age. In our opinion Mr. Edison's pretentious announcements are as little justified by the fact that he has satisfied himself as to what is the best form of carbon to use in the ordinary and well-known incandescent method of electric lighting, as a candle manufacturer would be justified in announcing that he had completely solved the problem of domestic lighting because he had devised a slightly improved candle-wick.

The New York Correspondent of the *Daily News*, telegraphing last Thursday, says: "Mr. Edison is in fresh difficulties, owing to the liability of his carbon horseshoes to break in use. He has stopped making the lamps until he finds the cause, which is supposed to be the admission of air to the globes by the cracking of the glass at the point where the wires enter."

THE WATER SUPPLY AND SEWERAGE OF PARIS.

(Continued from p. 63.)

The fourth and last section of M. Alphonand's work, which deals with the subject of the utilization of the sewer waters of Paris, is divided into four parts, in which the Author treats of the inconveniences attending the discharge of the sewer waters into the Seine; the necessity for their purification; their utilization for agricultural purposes; and the advisability of procuring State aid in carrying out the work.

The refuse waters of Paris, brought down by the large main sewers, flow into the Seine, loaded with all the impurities of a great city, at the rate of about 3 tons per second; so that in the course of 24 hours the enormous bulk of 264,000 tons of liquid is poured into the river. According to the estimates of the Municipal Engineers, each ton of sewage in the two principal sewers contains fertilizing material in the following proportions:—The Clichy sewer contains organic and mineral matters to the amount of 2·327 kilos., or about 5 lbs.; the St. Denis sewer, 3·461 kilos., or about 7½ lbs. The greater amount of fertilizing material in the latter case is due to the fact of the contents of the Bondy sewer mingling with those of the St. Denis sewer at the outlet. Under present arrangements, therefore, the sewer waters of Paris, which are now discharged into the Seine, to its pollution, allow to be lost annually an amount of fertilizing material which for its nitrogen alone might be estimated as being worth not less than 13 million francs, or £520,000 sterling.

In this section also are summarized the labours of the Commission appointed to regulate the Water Supply in France, and, according to M. Alphonand, the public are now in possession, either through the medium of scientific publications or from practically ascertained results, of sufficient data to enable them to determine which will be the best process to adopt for the purification of the sewer waters. These processes may be comprised under the three following heads:—(1) Chemical Purification; (2) Mechanical Purification; (3) Intermittent Downward Filtration. Then there is a mixed system, which would consist in first causing the waters to precipitate their heavy contents, of little fertilizing value, before being employed in agriculture. Having considered the merits of these several systems in great detail, the Author considers that the solution of the problem is to be found in the purification and utilization of the sewer waters for agricultural requirements. This system he considers to be so simple and rational, that he is rather surprised that there should be any opposition to its adoption.

After thoroughly examining the various questions raised in the course of an inquiry into the subject of sewage purification, the Commission already referred to were unanimously of opinion that the system of employing liquid sewage for irrigating land was, among all other processes in use, the one which had given the best results, not only for the purification of the sewer waters themselves, but also for the utilization of the fertilizing materials they contain.

Under the third heading in this section the Author examines the obligations imposed upon the City of Paris to purify her sewer waters, giving a description of the project presented to the Municipal Council in 1875 by MM. Belgrand, Mille, and Durand-Claye, and the opinion of the Council thereon. The inquiry conducted by Mons. H. Bouley; the further project considered by the Municipal Engineers in July, 1878; the objections raised against the proposal to extend the area of land irrigated in the direction of St. Germain, and the refutation of certain allegations as to the deplorable results of the irrigation system employed at Gennevilliers; the results to be anticipated from irrigation by sewer waters, and the researches of M. Marié Davy on the whole question—all these matters are very favourably considered by M. Alphonand. On the other hand, he does not fail to eulogize the ideas and principles which he himself propounded before the Water Commission.

In the concluding portion of the work the whole of this interesting examination of the sewage question is summarized. The Author says he considers that in order to preserve the Seine from pollution by the sewer

waters of Paris, it is necessary that they should be conveyed to a tract of land at St. Germain, which it is proposed to convert into a sewage purifying-ground. This scheme, he believes, will furnish a complete solution of the problem, and will be unattended by any of the objectionable consequences which some people have been led to expect will result from its adoption. In carrying it out, the city will undoubtedly have to make considerable sacrifice, seeing that about 8,000,000 frs., or £320,000 sterling, will have to be spent before operations can be commenced at St. Germain. But the whole city will gain by the work being done. The pollution of the Seine will cease, and this is at least a moral obligation on the part of the city, from which she cannot withdraw; on the other hand, the terrible circle of nightsoil receptacles which now infect the outskirts of Paris will be abolished by the adoption of the system of emptying the cesspools into the drains, the contents of which, after having been purified, will be returned to their natural course, without endangering the public health or causing any inconvenience to the inhabitants of the city.

Having considered in detail all the bearings of the question, M. Alphonand comes to the conclusion that without an abundant supply of water it would be impossible to make the house closets wholesome, even by the adoption of the plan of discharging the excreta into the sewers. If the thorough flushing of the sewers were not guaranteed at all seasons of the year, this system of disposing of the contents of the closets would become a source of great danger to the public health. The completion of the entire drainage system is, says M. Alphonand, the corollary of the conversion of these conduits into receptacles for the sewage of the city, now rendered necessary; and as a result of this it is absolutely imperative that the Seine should be cleansed by the adoption of such a system of treating the sewer waters as would allow of their being discharged either into the stream, or else into receptacles whence they could be withdrawn and employed for irrigation purposes. Furthermore, if the liquid sewage discharged into the sewers were not constantly diluted with a sufficiently large body of water, serious inconvenience might be the result.

The problem of ensuring the salubrity of Paris and its suburbs is, says M. Alphonand, a very complicated one, and the city has already made great sacrifices in order to arrive at its satisfactory solution. She must finish her work by adopting some plan which embodies all the qualities necessary for ensuring the health of crowded populations—namely, the supply of a pure, wholesome water for domestic use, the complete removal of all refuse matters and flood waters by means of an adequate drainage system, and the exclusion of those waters from the river until they have been filtered and divested of every element of corruption.

[We should state that the substance of the report from which we have extracted the foregoing particulars, appeared in the *Journal de l'Eclairage au Gaz*.—Ed. J. G. L.]

SUGGESTIONS FOR DEALING WITH LONDON SEWAGE.

By Major-Gen. H. Y. D. Scott, C.B., F.R.S.

[A Paper read before the Society of Arts.]

In compliance with a resolution passed by the Metropolitan Board of Works in November, 1857, a report was presented to them in the following year, by Messrs. Bidder, Hawksley, and Bazalgette, on the "Main Drainage of the Metropolis." In this report, the Metropolitan Board were told:—

The Referees say (Report, p. 9), "It would also appear that the black mud from the sewage contains a considerable quantity of organic matter, which is most deleterious. An immense mass of this fetid mud has accumulated in the bed and on the banks of the river, and it is continually supplying to the water large amounts of soluble matter in a state of putrescence, and contaminating the atmosphere with most offensive emanations. It is probable that the unhealthy condition of many towns on the sea coast is caused by deposits from the sewers by mud of this character."

And Dr. Hofmann and Mr. Witt, at p. 7 of their report, employ the following forcible expressions:—"We cannot but emphatically insist upon it, that the formation of this mud-deposit in the river appears to us by far the most serious evil which results from the discharge of the London sewage into the river. We cannot too strongly urge this point upon public attention." In these conclusions (say Messrs. Bidder, Hawksley, and Bazalgette) we entirely agree, and although we are not disposed to think that the whole of this noisome mud results from the deposition of sewage matter, yet we are satisfied that a real and increasing evil has its origin in this source, and that this evil has already attained such proportions as to render it essential to the well-being of the Metropolis that means should be taken for its immediate and permanent abatement.

Any person who examines the state of the Thames, especially within the tidal reaches, whether above or below the Metropolis, will be satisfied that the periodical withdrawal of the water of the river from the muddy surface of its bed is, in the hot weather of summer, invariably succeeded by disagreeable emanations, only too plainly indicative of the decomposition of animal and vegetable organisms.

The main drainage of the Metropolis was eventually carried out in accordance with the recommendations of this report, so far as concerned carrying all the sewage to the present main outfalls. Since 1866 these outfalls have been in full operation, and have daily discharged the raw sewage of the Metropolis between the towns of Woolwich and Erith, the results being precisely such as might have been expected from the above evidence. It is true that, inasmuch as the sewage is now discharged into a larger body of water than formerly, and at a point more distant from the great centre of population, the evil effects are considerably mitigated, but they are the same in kind; and in 1877, Captain Calver reported to the Conservators of the Thames, by whom he had been commissioned to examine into the question, that the Metropolitan Board of Works ought "to be called upon at once to dredge away those portions of the accreted matter which interfere with the convenience of navigation;" and he concluded his report with an expression of his "hope that the sanitary and economical difficulties may, ere long, be solved, so that the noble Metropolitan river committed to their [the Conservators] care may be freed from a drawback which is impairing its convenience and usefulness, and which must continue to do so at an increasing rate without an effective remedy is speedily applied." The Metropolitan Board, on the other hand, contend that the discharge of the raw sewage is neither damaging the river navigation nor the health of the dwellers on its banks, and Sir Joseph Bazalgette maintained, at the Institution of Civil Engineers, "That the bed of the river had improved of late; that the improvement was not due to systematic dredging; and that the mud-banks were not formed by sewage."

Without entering further into the arguments adduced on either side, it is necessary, for the basis of my reasonings, to point out clearly that the three Engineers nominated by the Metropolitan Board to report to them on the main drainage of London, laid before them the following conclusions, which, indeed, having quoted the above-recited evidence, it would have been difficult not to have arrived at, viz.:—"That mud, containing much organic matter, derived, in great measure, from the sewage discharged above low-water mark, is deposited on the foreshores of the river, and there putrefies;" and, "That the condition of the stagnant mud is injurious to health." (Report, p. 95). Further argument is not necessary to show that what was true with respect to the admission of sewage into the river at several points, situated in and about London, must be true, though to a minor degree certainly, when the sewage is thrown into the Thames by two outfalls between Woolwich and Erith. It is impossible to believe that the organic matter of the sewage will wholly lose either its tendency to deposit on the bed of the river, or to putrefy when there, whatever changes may be made in the situation of the outfalls.

The liquid and richest portion of the sewage of the 3½ million souls in London, who contribute to the contamination of the Thames, is, in the opinion of all chemists, after its admixture with water, irrecoverable, unless it can be utilized by irrigation; while the solid suspended matters—which all the Royal Commissions on sewage disposal have, one after the other, declared to be the most injurious part of sewage impurities—if they could be recovered, and be made into portable manure, would each year be worth more than a quarter of a million of money. That it is possible to accomplish this object to a large extent, I hope to be able to prove to you, in spite of all that has been said and written concerning the worthlessness of sewage manures. In this matter, as in many others, English people have rushed into extremes. From unbounded and childish trust in the wildest schemes, they have now ceased to put faith in any.

The object of this paper is, then, to show that if the investigations and analyses of the most eminent living chemists are correct, it follows that sufficient value can be recovered from the suspended matters of Metropolitan sewage, obtained by simple subsidence, and unmixed with bulky precipitating materials, to meet all the expenses of keeping such an offensive and injurious matter as solid sewage out of the Thames.

The first point for consideration will be the composition of the suspended matters of sewage, being those which I propose to utilize, and which, however deposited, whether by simple subsidence or precipitation by chemicals, are termed "sludge."

These matters consist, first, of the *débris* of human fæces, mingled with the solid dejections of animals washed from stables, courtyards, and the streets, and also of the *débris* of animal and vegetable refuse from our kitchens; and, secondly, of the mud and sand scoured from the streets. The first-named constituents possess nearly the whole of the manurial value, and it is important for our inquiry to ascertain of what fertilizing elements the fæces of a population consist. By ascertaining the proportion of these elements to the organic matter associated with them, we can arrive at the value of such refuse matters as consist partly of fæcal and partly of other organic substances.

The researches of Lehmann, Wolf, Röderer, and Eichhorn, from which tabular extracts are given by the Rivers Pollution Commissioners (First Report, p. 27), enable us to arrive at the composition of fæces with great certainty; and the analyses and investigations of Professor Way, carried on at Rugby, under the auspices of the Royal Commissioners on the Disposal of Sewage, will, when considered in the light given by the above extracts, assist materially in arriving at a conclusion respecting the valuable elements derived from other sources. With respect to the second class, or the detritus, as this is worse than useless, it may be rightly designated as a "profligate associate," deserving no other consideration than how to lessen it, since it still further degrades the value of a manure already too poor. In Paris, where they are rapidly carrying out a system which allows the solid fæcal matters to be recovered without admixture with detritus, the contractor can afford to collect them for the fertilizing elements which they contain; but we must deal with the matters as they arrive at the outfall, in which state the worthless ingredients greatly exceed in amount those which have a value.

The tables of Röderer and Eichhorn, above alluded to, give the annual weight of the fæces of a mixed population of 100,000 persons as 64,937 cwt., consisting of 957 cwt. of nitrogen, and 1347 cwt. of phosphates, which, reckoning the phosphate as tribasic calcic phosphate, will amount to 622 cwt. of phosphoric acid, and this assumption we may make without important error. From these figures it would appear that the nitrogen is to the total weight of the fæces as 1 is to 67·8; or, deducting the water, which constitutes three-fourths of the total weight of the fæces, the nitrogen is to the organic matter as 1 to 16·9; and the phosphoric acid is to the organic matter as 1 to 26.

At p. 29 of the Third Report of the Commissioners on the Disposal of Sewage, are given the results of Professor Way's experiments at Rugby, extending over 2½ years, samples being taken every two hours out of the 24. This series was divided into three periods; and, subsequently, two sets of samples were collected for five days a year later, and the ratio of the nitrogen to the organic matter, other organic refuse being now mixed with the fæces, will be found to be, on the average, as 1 of nitrogen to about 15 parts of organic matter.

From these results we can conclude, without much danger of error, that the sludge of the Rugby sewage, omitting all mineral detritus, is at least as rich as fæces in that most important element, nitrogen. As respects phosphoric acid, though it was otherwise at Rugby, no great difference exists in the case of London sludge as compared with fæces, as will presently appear. From the above different observations and sets of samples, the ratio of the phosphoric acid to the organic matter was for the Rugby sludge as 1 to 31·6.

At p. 47 of the Report on Metropolitan Drainage by Hofmann and Witt, an analysis is given of the insoluble as well as of the soluble portions of the sewage from Dorset Square, London, from which it appeared that the amounts of the above-mentioned substances per gallon were as 1 of nitrogen to 10 of organic matter, and 1 of phosphoric acid to 14·2 of organic matter.

Again, from some samples of sludge deposits, collected hourly throughout the day at Ealing, which were very carefully analyzed by Mr. Shephard, F.C.S., in the laboratory of Dr. Frankland, the following results were obtained as the ratio of the nitrogen and phosphoric acid to the organic matter:—

$$\frac{\text{Nitrogen}}{\text{Organic matter}} = \frac{1}{26\cdot5} \quad \frac{\text{Phosphoric acid}}{\text{Organic matter}} = \frac{1}{27\cdot7}$$

The foregoing sets of experiments were made under such different conditions as to time and place and length of trials, that it is somewhat difficult to arrive at a fair mean. But an unobjectionable course, perhaps, will be to compare the highest and lowest results with the composition of fæces, as given by Röderer and Eichhorn, and take care to err, if we do err, on the side opposed to that which we are endeavouring to prove. These results are as follows:—

	Highest.	Lowest.	Mean.	Fæces.
Nitrogen	1	1	1	1
Organic matter	10	26·5	18·2	16·8
Phosphoric acid	1	1	1	1
Organic matter	14·2	31·6	22·9	26

Dr. Letheby, after carefully comparing the results of his own analyses, which were very numerous, with those of Drs. Way and Voelcker, and the figures adopted by Dr. Hofmann and Mr. Witt in their investigations, came to the conclusion that in the suspended matters of town sewage the ratio of the nitrogen and the phosphoric acid to the organic matter was—

	From Excreta.	From all other Refuse.	From all Sources.
Nitrogen	1	1	1
Organic matter	15·5	36·6	20·6
Phosphoric acid	1	1	1
Organic matter	16·9	18·7	17·96

It would appear, from a consideration of the foregoing results, that, in

different towns, owing chiefly to the influence of other refuse than excreta, the ratio of the fertilizing elements to the organic matters may vary considerably; but, looking to the results of the examination of the Dorset Square sewage by Professor Way, we may feel some confidence that the chief fertilizing elements in the London sewage sludge will be under rather than over stated, if we assume that—

$$\frac{\text{Nitrogen}}{\text{Organic matter}} = \frac{1}{20} \quad \frac{\text{Phosphoric acid}}{\text{Organic matter}} = \frac{1}{25}$$

The potash is the third and only remaining valuable element found in sewage sludge, and, according to Dr. Letheby, it owes its presence entirely to the fæcal matters. Any potash present with granite detritus is not in a condition immediately available for plant life, and cannot, therefore, be reckoned as of any manurial value. From Professor Way's analysis, the proportion of potash to organic matter in fæces is as 1 to 18·6; but, from the analysis made by Dr. Voelcker, of the precipitated sludges of four towns named in Messrs. Rawlinson and Read's report—viz., Bolton-le-Moors, Bradford, Coventry, and Leeds—all of which, excepting Coventry, are deficient in fæces, the mean ratio is—

$$\frac{\text{Potash}}{\text{Organic matter}} = \frac{1}{61}$$

and from Professor Way's analysis of the sludge of the Dorset Square sewer, already referred to, the potash appears to have equalled the 1·56th part of the organic matter. I therefore adopt 1·56th as the proportion of potash likely to be found in the Metropolitan sludge. Recapitulating the results we have arrived at, we may assume, then, that with each part of the three fertilizers—nitrogen, phosphoric acid, and potash—there will be associated in the sewage sludge of London 20 parts, 25 parts, and 56 parts respectively of organic matter.

We have now to see to what extent these results will be influenced by admixture with detritus—the third, and by far the most variable, as well as the most worthless component of sludge. The detritus should on every account be excluded, as far as possible, from the sewers. At present, however, I shall limit my observations to the separation of the detritus from the more valuable organic matters when the sewage reaches the outfalls, with a view to its exclusion from the manure to be prepared from the sludge, as well as to its exclusion from the river. That this can be effected to a considerable extent will be evident from the valuable report of Captain Calver, from which I have already quoted. Captain Calver gives, at p. 16 of his report, two analyses by Professor Williamson—the first stating the amount, in grains per gallon, of the suspended and dissolved constituents of the sewage as it issued from the northern outfall sewer; the second, the amount, similarly stated, of the suspended and dissolved constituents of the sewage as it flowed from within the apron of the reservoir into the Thames two hours after high tide; that is to say, after the velocity of the current was diminished, and the sewage had deposited the heavier particles.

Contents in Grains per Gallon.

Suspended Matters.	No. 1. One Hour before Low Water.	No. 2. Two Hours after High Water.
Organic matters	37·24	104·97
Sand	44·10	23·52
Iron, alumina, carbonate of lime, &c.	26·67	23·01
Total suspended matters	108·01	151·50

$$\begin{aligned} \text{For No. 1 analysis the } \frac{\text{organic matter}}{\text{mineral}} &= \frac{1}{1\cdot9} \\ \text{For No. 2 } \text{ " } \text{ " } &= \frac{2\cdot25}{1} \end{aligned}$$

The suspended matters in the sewage, when issuing from the sewer into the reservoir, contained only 34 per cent. of organic matter, and as the sewage issued from the reservoir into the river, the suspended matters contained, at one period of their flow, about 70 per cent. of organic matter. To this extent, therefore, it is manifestly possible to effect a separation of the sand from the more valuable constituents of the sewage. We require only, for the purpose of this separation, an additional reservoir for the subsidence of the lighter organic matters, after the heaviest mineral particles have been deposited in the existing reservoir.

From this second reservoir, in which I would propose that the sewage should have a period of quiescence, we might expect the sludge to show the following analysis:—

Organic matter (without nitrogen)	66·50
Nitrogen	3·50
Phosphoric acid 2·80 = tribasic phosphate of lime	6·07
Potash	1·25
Sand and inert mineral matter	22·68
	100·00

a result which corresponds very nearly with the composition of the sludge at Ealing, analyzed by Mr. Shephard, already referred to. It is a little richer in nitrogen, however, as was to have been expected from the analysis of London sludges by Professor Way.

I should here remark that different analyses of London sewage vary considerably in the proportions of the mineral and organic matters. Dr. Letheby determined that the—

$$\frac{\text{Organic matter}}{\text{Mineral matter}} = \frac{1}{1\cdot36}$$

It would appear, however, from the analyses of London sewage given in the First Report of the Rivers Pollution Commissioners, to be—

$$\frac{\text{Organic matter}}{\text{Mineral matter}} = \frac{1}{1\cdot55}$$

and Professor Williamson's analysis, from Captain Calver's report, gives—

$$\frac{\text{Organic matter}}{\text{Mineral matter}} = \frac{1}{1\cdot9}$$

As the detritus imparts no value to the sludge, but has a contrary effect, we shall err on the safe side if we assume, as Captain Calver states, that—

$$\frac{\text{Organic matter}}{\text{Mineral matter}} = \frac{1}{2}$$

And we see that by a period of repose we may easily bring the ratio to—

$$\frac{\text{Organic matter}}{\text{Mineral matter}} = \frac{2}{1}$$

We must next inquire into the values of the fertilizing ingredients of the sludge—viz., the nitrogen, calcic phosphate, and potash.

(To be continued.)

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Business as a rule throughout the coal trade of this district is only quiet, the demand for house-fire classes of fuel being exceptionally dull for the season of the year, whilst for gas-making purposes there is also less being required. The result is that colliery proprietors are not at present able to get rid of all the coal they are raising, and there is a good deal standing in waggons on many of the pit sidings. Generally, however, prices for the better classes of round coal are maintained, but the advances which were in some cases attempted at the commencement of the month are not obtainable. With regard to manufacturing classes of fuel, although there is not yet such an increased demand as would justify any material upward movement in values, the improvement in the iron trade, and the greater activity prevailing amongst the cotton mills, are producing a more hopeful feeling, and there are very few colliery proprietors who will sell forward at present rates. Good classes of forge coal especially are firmer in price, and although there is a good deal of slack in the district, and in many cases stocks are increasing, there is no disposition to push sales, many of the colliery proprietors preferring to hold for the present, in anticipation of higher prices ruling in the market before long. The average quotations at the pit mouth may be given about as under:—Best Wigan Arley, 9s. per ton; second qualities and Pemberton four-feet, 7s. to 7s. 6d.; common round coal, 5s. 6d. to 6s.; burgs, 3s. 9d. to 4s. 3d.; good slack, 3s. to 3s. 3d.; and common, 2s. 6d. to 2s. 9d. per ton.

Business in the shipping trade is tolerably active, and good coal suitable for steamers use is in pretty brisk demand, the better qualities delivered alongside at Liverpool fetching from 8s. 6d. to 9s. per ton.

For coke a good demand is maintained, and gas cokes suitable for forge purposes are moving off pretty freely.

In the iron trade there has again, during the past week, been a strong upward movement in prices, but this has had a tendency rather to check business. As I have pointed out in previous reports, there is not, apart from forge requirements, that increased local consumption to warrant the extraordinary expansion of values which has recently taken place, and it is only the continuance of the demand for exports, and the nervous anxiety of some consumers to cover in anticipation any wants that may arise, which enables producers to maintain the prices they are doing. Local makers of pig iron, who are pretty well sold for the next two or three months, have made a further advance of 2s. 6d. per ton on their list rates, which for delivery into the Manchester district are now quoted at 70s. per ton, less 2½, for both foundry and forge qualities, whilst some of the outside brands have gone up considerably more than this. For finished iron, prices are little more than nominal, as very few makers are at present prepared to quote. For Lancashire crown bars, delivered into the Manchester district, the minimum price may, however, be given at £8 10s. to £9; for hoops, £10; and for sheets, £11 10s. per ton.

Amongst foundries, engineers, and machinists there is not generally very much more doing, although a few of the large firms are busier, and there is, as a rule, a better feeling with regard to the future.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

If anything, trade was a trifle quiet in the North last week. The upward tendency of prices was hardly checked; but coalowners begin to take a more moderate view of the prospective rise in prices in 1880 than they did a month ago. In fact, they cannot be forced. If they were, the reaction would be awkward, or trade might be driven away to other districts. The gas contracts are completed for the half year, or near about, and very much will depend upon the local demand for coals, as to what the prices will be in the second half of the year. At present the rise in the value of manufacturing coal is not excessive. Coalowners are asking an advance of about 1s. per ton upon last year's prices. The price of best steam coal has advanced from 8s. 6d. to 9s. per ton, and the colliery offices anticipate making a further rise of 1s. per ton in March. The upward tendency in the price of coke is checked. A fortnight ago manufacturers were not much inclined to name a price for forward delivery. They are now willing to enter upon business at present rates. At the same time, while alluding to the position of the coal trade, it is only right to state that manufactories which have been closed two or three years are getting to work again, and that all the large chemical and iron works are very fully employed. But there is also something to set against this. A number of small collieries, too, which were closed through bad trade, and new workings which were stopped before seams of coal were reached, will resume when there is a good prospect before them. Very high prices in the coal trade can therefore hardly be expected in 1880. At the same time there will be a substantial rise in values, no doubt.

The freight market, especially coastwise, is somewhat dull; 4s. 3d. a ton being paid to a steamer last week to load coals for London over a period of four years. There are very few sailing vessels in the coal ports. Those seeking tonnage are scarce, but orders are at the same time limited. A deal more gas coal is being shipped for London and the coast by steamers which load regularly at the Tyne Dock. There was a strike amongst the seamen and firemen who are employed aboard the steamers trading to London and the South for an advance of wages, but the dispute was adjusted without any stoppage of trade.

There have been some more rather large sales of fire-bricks on the Tyne for shipment abroad. Prices are advancing in this trade.

The rolling mills and foundries on the Tyne are very busy; in fact, they have as much trade as they can stand to. Some idea may be formed of the improvement which has occurred in the manufacturing iron trade within little more than three months when it is stated that plates for iron shipbuilding were selling in September at £4 17s. 6d. per ton. Conssett plates were disposed of last week at £8 15s. per ton. Chemicals keep firm for early spring shipments. A good business is expected from the United States in March. The price of lead is not quite so firm. The lead merchants are holding back recent arrivals from Spain.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The annual general meeting of the Macduff Gas Company was held a few days ago, when the balance-sheet and report for the past year were submitted and approved of, and a dividend at the rate of 6 per cent. was declared.

Now that the urgent demands upon gas manufacturing plant for the season 1879-80 have been met, it may be worth while to mention two or three facts with reference to the gas supply of Glasgow. The greatest consumption on any one day during the season now rapidly passing away was 11,331,000 cubic feet. That was on the 11th of December, which was one of several very foggy days. A good many industrial establishments were not in full swing, otherwise there would have been a much larger consumption. Then, in connection with the consumption, it may be mentioned that the total storage capacity at the three works now going—Dawsholm, Dalmarnock, and Tradeston—amounts to 11,697,000 cubic feet. The works at the Partick station are entirely at a standstill, and are

by-and-by to be dismantled. The largest number of retorts in use at any one time during the winter was 1455—on the 16th of December.

The Managing Committee of the Forfar Gas Corporation met on Wednesday last, and had under consideration the question of storage accommodation at the gas-works. The members present resolved to recommend to the Corporation to minute that additional accommodation is absolutely necessary; also that the Manager, Mr. D. B. Esplin, be authorized to obtain contracts for extending it, either by erecting a new telescopic gasholder or by repairing and converting one of the three gasholders now in use into a telescopic holder. The Committee were of opinion that should the difference between the cost of erecting a new holder and the conversion of one of the present holders be relatively small, the erection of a new holder should be preferred. They further recommended that the purifying capacity should be about doubled—a step rendered necessary in the interest alike of the Corporation and the consumers.

There are some indications that the Johnstone Police Commissioners and the ratepayers generally are keenly regretting the acquisition of the gas supply undertaking on behalf of the town, at the price which was made imperative by the decree arbitral of Dr. Anderson Kirkwood, the Arbitrer in the case. This came out very prominently at a meeting which two of the Commissioners held with their constituents during the past week. One of them, Mr. Hunter, in his speech, dealt very fully with the purchase of the gas-works, which he characterized as a costly blunder. The works were bought for £22,400, including arbitration expenses on the part of the Gas Company; but they had yet to pay all the expenses with regard to the arbitration on behalf of the Commissioners. Taking the interest which they required to pay for the money borrowed, and the amount necessary for providing a sinking-fund, the annual charge to the burgh on account of the works would, he said, be £1610. But the works, on an average, only realized as profit about £1050 per annum; so that he thought it was impossible to keep the price of the gas, as at present, at 5s. 5d. per 1000 cubic feet; and in answer to a question subsequently put to him, said he thought the price would have to be raised to 8s. 3d. per 1000 feet. Towards the close of his remarks, Mr. Hunter said he anticipated that in the course of a few years they would be able to give good cheap gas, but at present he could hold out no other prospect before them than this, that for the first year or so their gas-rates would require to be raised. It would not be necessary, however, that for all time to come they should pay £1610 per annum, for, by the aid of the sinking-fund, the amount would get less and less every year; and in 40 years both interest and capital would all be paid off, and the gas-works would be the ratepayers own property.

Buckhaven, in Fife, for a long time a benighted place, is now able to rejoice in having its streets lighted up with gas.

The water assessment for the town of Irvine has just been fixed at the rate of 2s. per £1 of rental.

At the statutory meeting of the Police Commissioners of Wishaw, held on Monday, the 12th inst., plans of a proposed reservoir in connection with the water-works, prepared by Mr. James Tait, C.E., were carefully considered and approved; and that gentleman was instructed to procure the necessary plans and statements forwarded without delay to the Board of Supervision, so as to obtain the loan of the required money before commencing operations. As shown on the plans, the works are expected to cost a little over £15,000 (including pipe track), irrespective of land. The reservoir is to hold 62 million gallons.

The completion of a new water supply scheme for the town of Castle-Douglas was formally celebrated with much rejoicing on Friday last.

An excellent water supply scheme has also just been completed for the town of Carlisle, in the Upper Ward of Lanarkshire, from plans designed and carried out by Mr. James Tait, C.E., of Wishaw. The works embrace a reservoir of 10 million gallons capacity, seven miles of piping, 800 yards of a tunnel, and a built clear-water cistern capable of holding 85,000 gallons. It is expected that the assessment will not exceed a rate of 11d. per £1 of net rental, and the cost of the works will be about £7300. It is worthy of note that Carlisle, Wishaw, and Motherwell all derive their water supply from the same parish.

Acting upon the advice given them by Mr. Gale, C.E., of Glasgow, in his report formerly referred to, the Parochial Board of Kilwinning have resolved by a large majority to take a supply of water for the Irvine water supply works, at a charge of 3½d. per 1000 gallons. Of course the Irvine Authorities have yet to consent to the offer; their own proposal being 4d. per 1000 gallons.

A large amount of business was done in the Glasgow pig iron market during the past week, but the speculative buying was less in amount. There was much sharp fluctuation in prices, and as high as 73s. 3d. cash was paid on Tuesday, but the best prices were not sustained, the close on Friday afternoon being 70s. 3d. cash and 71s. one month for sellers, and 1½d. less for buyers.

Local trade in coal is steady and improving. The disputes between the miners and the coalmasters are now practically all at an end, and most of the men that were out have resumed work almost at their own terms. Prices continue firm.

REDUCTION IN THE PRICE OF GAS AT RIBBLETON.—In answer to a deputation of the ratepayers of the township of Ribbleton, who waited upon the Directors of the Preston Gas Company to obtain a reduction in the price of gas, it was stated that the Company would agree to an immediate reduction of 5d. per 1000 feet, and the Directors promised a further reduction of a like amount when Ribbleton became more thickly populated.

NEWBURY TOWN COUNCIL GAS SUPPLY.—At the quarterly meeting of the Newbury Town Council last Tuesday, the report of the Gas Committee, which was presented, was accompanied by a statement as to the gas produced and consumed during the year ending Sept. 25, 1879. The quantity produced was 16,420,500 feet, and the quantity consumed and accounted for 14,862,748 feet, leaving 1,557,752 feet (or 9·48 per cent.) unaccounted for.

STOCKTON AND MIDDLESBROUGH CORPORATIONS WATER SUPPLY.—At a meeting of the Joint Water Board of the above-named Corporations, on the Monday of last week, one of the officials applied for an advance of salary; but it was almost unanimously agreed to reject the application on the ground of the unfavourable state of the finances of the Board at the present time. It was observed by a member that the annual loss the Water Board were sustaining at present was from £3000 to £5000 a year.

NEGOTIATIONS FOR THE PURCHASE OF THE PONTYPOOL GAS AND WATER WORKS BY THE LOCAL BOARD.—The *South Wales Daily News* states that in consequence of a resolution passed at the last meeting of the Pontypool Local Board, a deputation of that body, consisting of the Chairman and the Finance Committee, waited upon the Directors of the Gas and Water Company, at the Town Hall, on Wednesday, the 7th inst. The scheme for acquiring the property of the Company was discussed, the Directors saying they were willing to sell at a fair price, but nothing definite resulted. The matter must now be laid before the various Boards of the district.

THE GAS SUPPLY OF RAWMARSH.—At the monthly meeting of the Rawmarsh Local Board last Wednesday, the Clerk stated that he had received

a notice from Messrs. George Wilson Stevenson and George Livesey, of London, who had decided on their award with regard to the transfer of the gas-mains of the Rotherham Corporation to the Rawmarsh Local Board, under the terms of the Rawmarsh Gas Act passed last session. The letter stated that the award had been placed in the hands of Mr. R. W. Cooper, of Westminster, and could be taken up by either party on the payment of £127 14s. 10d., the costs incidental to the award. On the motion of Mr. Whittaker, seconded by Mr. Goodinson, the Board expressed their willingness to pay half the cost of the award after it had been taken up by the Rotherham Corporation.

SCARBOROUGH WATER SUPPLY.—At the monthly meeting of the Scarborough Town Council, on Monday, the 12th inst., the Water Committee reported that the borings at Irtton for an additional supply of water for the borough had been attended with success. The rock yielding water had been pierced to a depth of 102 feet, and the water now rose to the surface, and flowed away at the rate of 500,000 gallons per 24 hours; but in the opinion of Mr. E. Filliter, C.E., of Leeds, this quantity could be increased to a million gallons daily by aiding the flow by pumping. The water obtained is of excellent quality, and the Borough Analyst says it is "very pure, and thoroughly adapted for drinking and domestic purposes." The Committee recommended that the works should be proceeded with without further delay; and this was agreed to.

LYMM (CHESHIRE) WATER SUPPLY.—At the monthly meeting of the Lymm Local Board, on Friday, the 9th inst., Mr. Hall proposed, and Mr. Thomason seconded, a motion to the effect that it was desirable for the Board to enter into negotiations with the Lymm Water-Works Company for the purchase of their works. Some discussion took place, it being suggested that the Company would not be willing to treat for a sale of their property; and one member said he thought that if a meeting of the ratepayers were called, the majority of them would be found to be in favour of not purchasing the works. Subsequently the following resolution was carried:—"That it is desirable that a deputation from the Board wait upon the Water-Works Company, with a view of ascertaining whether the Company are prepared to sell their works, and upon what terms."

DEATH OF MR. H. SHRUBSOLE.—Many of our readers will regret to hear of the death of Mr. Henry Shrubsole, Mayor of Kingston-on-Thames, who was well known to all frequenters of the committee-rooms of the Houses of Parliament, in connection with the firm of Messrs. Dyson and Co., of Westminster. Mr. Shrubsole was born at Kingston on the 21st of August, 1816, and therefore at the time of his death was in his 63rd year. Yesterday the Examiners of Petitions for Private Bills commenced their sittings for the present year, when the senior Examiner (Mr. Frere) referred, in affecting terms, to the sad event we have noticed. He warmly eulogized Mr. Shrubsole's high character and ability during his long career in practice as a Parliamentary Agent, and said his loss to the authorities of both Houses and to the profession was deeply deplored. Mr. Leslie, as President of the Society of Parliamentary Agents, in a few words expressed the sincere concurrence of all Mr. Shrubsole's professional brethren in every word that had fallen from the Examiner, their sorrow for his premature death, and their gratitude to the Examiner for his public recognition of Mr. Shrubsole's personal worth and exemplary professional character.

BORDEAUX GAS COMPANY.—The annual general meeting of this Company was held on the 18th of December, when the report and accounts for the year ending June 30, 1879, were presented. Although the profits on the year's working had, on the whole, been satisfactory, they did not bear a just proportion to the receipts, in consequence of large outlays having been necessary for the maintenance of plant and for extensions to meet an increasing consumption of gas. In the twelve months reported upon there had been sent out from the Company's works 477 million cubic feet of gas, which had produced a revenue of 2,058,958 frs. (£82,358), being an increase of 106 million cubic feet and 355,256 frs. (£14,210) on the previous year. The increase in consumption had been at the rate of 27·89 per cent., while the revenue from the sale of gas had progressed at the rate of 20·15 per cent. only. This disproportion resulted from an increase in the amount of gas supplied to the public lamps, for which no payment was made, and the reduction in the price charged to private consumers. The number of meters in use on June 30, 1879, had risen to 5543, or 89,961 burners; being an increase of 840 meters, or 8978 burners. The quantity of coal carbonized was 48,000 tons—an advance of 9000 tons on the previous year—and 5440 yards of new mains had been laid. After making all the usual deductions, there was a balance of profit on the year's working of 214,042 frs. (£8561), which it was proposed to divide as follows:—To the Shareholders, 105,000 frs. (£4200); founders shares—one-third of dividend, 35,000 frs. (£1400); balance to be carried forward, 74,042 frs. (£2961). The reserve-fund was increased to 65,296 frs. (£2612), and a dividend of 42 frs. 50 c. (£1 14s.) per share was declared, being an advance of 5 frs. (4s.) per share on the previous year's dividend.

STOKE CORPORATION GAS SUPPLY.—The monthly meeting of the Stoke Town Council was held on Thursday last, when the Mayor (Alderman Turner) referred to the gas undertaking and the profits made therefrom since the works were transferred to the Corporation and the Fenton Local Board jointly. The works are still under the able superintendence of Mr. John McMillan, the Engineer and Secretary to the Gas Committee; and to him, more than to any one else, must the credit of the satisfactory results reported be given. The Mayor said he found that in 1875 the gross profits were £4953; in 1876, £4034; in 1877, £4340; and in 1878, £6687; whilst in their (the Corporation's) year of making gas, the gross profits, after paying all expenses of working and repairs, were £7686, or £1000, in round numbers, above the best year of the Company. Taking the net profits, the figures stood thus: In 1875, £1933; in 1876, £814; in 1877, £940; in 1878, £3267; and 1879 (after paying all interest due), the clear net profit was £3717 6s. This, he thought, must be highly satisfactory to the ratepayers as well as to the Council. There was another point of importance, and that was the gradual increase in the consumption of gas in the district, which, he considered, would enable them to form some idea of the probable increase in the future. In 1875 the consumption was 64 million feet; in 1876, 68 million feet; in 1877, 76 million feet; in 1878, 83 million feet; and in 1879, 89 million feet, showing an increase of 6 million feet for that year alone. The proportion of consumption in the two districts was: Stoke, two-sevenths; and Fenton, five-sevenths; so that, out of a clear profit of £3717 for the first year, Stoke received £2553, and Fenton £1163. He thought that the results of the purchase of the gas-works up to the present time had been very satisfactory, and if they could devote the whole of the profits made from the gas undertaking to the repayment of money borrowed by the Council (taking last year's profits as a basis), they would be able to clear off the whole of their debt in 15 years, if the profits continued the same during those years.

THE LOWER THAMES VALLEY MAIN SEWERAGE BOARD.—As reported in the JOURNAL for Dec. 23, a deputation of persons who considered their property would be injured if the scheme of the Lower Thames Valley Main Sewerage Board were carried out, had an interview with the President of the Local Government Board; and Mr. Selater-Booth promised to

give them his answer in writing. It may be remembered that, among other things, the deputation asked that, when a petition is presented to the Board by the Lower Thames Valley Main Sewerage Board for a Provisional Order to enable them to take compulsorily the lands mentioned in their published notices for the purpose of the disposal of the sewage of the united district, the petition may be dismissed by the Board without a local inquiry into the merits of the proposed scheme. It was urged by the deputation that the scheme is the same as that which was rejected by Parliament in March last, on the second reading of the Bill introduced by the Main Sewerage Board. In reference to this the reply sent by Mr. Selater-Booth's Assistant-Secretary says: "The President desires to point out that one of the principal arguments brought forward in Parliament in favour of the rejection of the Bill was that the promoters should have applied to the Board for a Provisional Order, instead of to Parliament for a Bill, and the Bill having been thrown out on the second reading, no evidence was submitted to Parliament with regard to the merits or demerits of the scheme." Another point urged by the deputation was that the attempt to establish a sewage farm in the midst of the Thames Valley district is a direct breach of representations made in the session of 1877 to the Lords Committee by the witnesses for the Bill confirming the Provisional Order constituting the Joint Board; and concerning this the letter says: "It appears to the President that the main question before the Lords Committee was as to the expediency of a combination of districts for the purpose of the disposal of sewage, and the witnesses who were called in favour of the combination had no power to fetter the action of the Joint Board subsequently constituted. It would have been open to the Committee, by the insertion of a clause in the Bill, to have placed restrictions upon the Joint Board with regard to the scheme to be adopted by them, but it seems evident that the Committee had no intention to limit the discretion of the Joint Board in this matter." "With regard to Colonel Cox's report of January, 1876," the letter continues, "to which reference is made, it is true that Colonel Cox contemplated that more than one outfall would be required, but it must be remembered that this report related to the disposal of the sewage of a district of much greater area than that comprised under the jurisdiction of the Joint Board, and that in his subsequent report of March, 1877, he specially mentioned as one of the advantages of the establishment of a Joint Board that the great difficulty of obtaining sites for outfall works would be minimized, one outfall being required instead of eleven or more. In conclusion, the President desires to point out that it is a mistake to suppose that the Local Government Board are especially charged with the duty of protecting landowners from compulsory invasion of their property. The Joint Board was expressly constituted under the provisions of the Public Health Act, 1875, for the purpose of disposing of the sewage of the united district, and one of the powers conferred upon them by the Legislature, with a view to the discharge of that duty, is that of petitioning the Board for a Provisional Order to enable them to take lands compulsorily for such purpose. The President considers it important that reasonable facilities should be afforded to local authorities to enable them to fulfil the obligations imposed on them by law, and he thinks that any question as to the merits or demerits of the scheme could best be considered at the local inquiry, which would have to be held before a Provisional Order could be issued, and at which all persons interested could appear. Having regard to all the circumstances, it does not appear to the President that he would be justified in refusing to direct a local inquiry to be held into the petition of the Joint Board when it is presented. Such a course would be altogether unprecedented, and might have the effect of completely defeating the object for which the Joint Board was expressly constituted."

Register of Patents.

2695.—MACKAY, G., Edinburgh, "Improvements in the purification of liquids, and in the utilization and preparation of certain waste and by-products of art and manufacture as purifying agents." Patent dated July 5, 1878.

This invention relates to improvements on patent No. 91, dated Jan. 11, 1875, and consists in passing the liquid, after the sludge has been precipitated, through filter-beds composed of the following materials in superimposed layers. For the first or under layer, rough gravel or broken stones; for the second, fine gravel; for the third, sand; for the fourth, pounded, distilled, or roasted shale, technically known as oil-works waste shale; and for the fifth layer, fine sand, perforated tiles, iron, zinc, or other equivalent capable of freely passing the water or other liquid, and at the same time preventing the shale from rising or being displaced.

2700.—TOMLINSON, W. F., and FEARNLEY, G. B., Leeds, "An improved self-acting apparatus for regulating the supply of gas." Provisional protection only obtained. Dated July 5, 1878.

This apparatus consists of a case of brass or other suitable material, inside which is a moveable cap or valve, made to cover the end of a perforated tube passed into the interior of the case at the bottom. The tube is pierced with longitudinal apertures, varying in accordance with the number of lights or size of the regulator. The gas by its pressure lifts the valve more or less in accordance with the pressure required, and it escapes into the chamber above, and thence through pipes direct to the burners.

In front of the valve is a pointer, which indicates on an index plate (by preference in the interior of the case) the rising or falling of the valve, hence the pressure or number of lights for which the gas is supplied. The valve is weighted in accordance with the average pressure required, and is self-adjusting. Such adjustment increases or reduces the area of the passage for the gas, and consequently produces an increase or decrease in the pressure, which is shown by the pointer being raised or lowered to numbers or other marks on the index plate. In order to see the index plate and pointer (these being within the case), there is an opening in the case, covered with glass and hermetically sealed.

2707.—BOULTON, M. P. W., Tew Park, Oxford, "Improvements in combined gas and steam motor engines." Patent dated July 6, 1878.

This invention consists, first, in cooling the cylinder of a gas motor engine, and utilizing the heat abstracted therefrom for the generation of steam by admitting water to the interior of the cylinder on one side of the piston; and, secondly, in an engine in which the combustion of an inflammable gaseous mixture is applied to produce motive power, employing, in conjunction with the products of combustion, steam generated from water applied to cool the cylinder.

2733.—WISE, W. L., Adelphi, London, "Improvements in treating impure water or liquid to purify the same, which improvements are especially applicable to the treating of sewage to obtain certain products therefrom." A communication. Patent dated July 8, 1878.

This invention consists in treating impure water or sewage by mixing with phosphoric acid and subsequent addition of a solution of compositions

of protoxide of iron, of peroxide of iron, of alumina, and of magnesia, and finally lime water. Also in treating the liquid, after removal of solid matters by filtration, with a stream of passing cold or heated air.

2780.—MELLING, T., Aigburth, Lanes, "*Improvements in and relating to apparatus for reducing or regulating fluid pressure, and for measuring and registering the pressures and quantities of water or other fluid flowing in given times through pipes or other conduits.*" Patent dated July 11, 1878.

This apparatus combines a pressure-reducing valve for liquids, the pressure of the liquid in the main being caused to act on a piston moving in a cylinder in front of the exit orifice. The pressure of the liquid in the exit-pipe acts on a piston so as to raise a weighted lever connected both to this piston-rod and the rod of the piston which closes the exit orifice, so that until the pressure in the exit-pipe falls below the pressure required (and which can be regulated by shifting the weight on the lever), the pressure on the main valve will not open the exit orifice. The end of the weighted lever carries a tracer moving over a cylinder revolved by clock-work, thus tracing a diagram which indicates the quantity of fluid flowing through the apparatus in a given time. The pressure in the main is similarly recorded, as it varies from time to time, by means of a self-registering pressure-gauge, which is connected by a pipe to the main, and which draws another diagram upon the same revolving cylinder.

2826.—CARTER, J., Eaton Square, London, "*Improvements in and relating to closed cisterns or tanks for containing water or other liquids.*" Patent dated July 15, 1878.

According to these improvements, the base of the air-supply pipe is expanded into, or securely attached to a conical or other shaped chamber, which in its turn is secured to, or made to form part of the top plate of the cistern or tank into which it opens. Within this chamber is a valve opening downwards, and arranged so as to be readily carried or floated upwards to its seat, and closed by the water as it rises in the cistern or tank and attempts to escape through the air-supply pipe. As the water is drawn off, the valve will fall or open, and thus admit the air through the air-supply pipe, and permit the water to flow out from the cistern or tank as required.

2839.—NEWTON, W. E., Chancery Lane, London, "*Improved apparatus for drawing or exhausting and forcing, injecting, or impelling fluid and liquid bodies.*" A communication. Patent dated July 16, 1878.

In the use of this apparatus, in order to set in motion gaseous or liquid bodies, a jet of steam or liquid under high pressure is made to act as an exhausting or motive agent, like the steam jet in a Giffard's injector. A jet in the form of a long thin film, or of the form of a knife blade, is caused to act on a thin vein or film of the liquid or fluid.

2840.—SPENCE, P., Manchester, and ILLINGWORTH, T., Leeds, "*Improvements in the manufacture of sulphate of ammonia, and in preventing nuisances arising from said manufacture.*" Provisional protection only obtained. Dated July 16, 1878.

In carrying out this invention the ammoniacal water or liquor of gas-works is pumped through coils of pipe or other such apparatus, whereby it may be heated by vapours arising from a part of the process which will hereafter be described. From thence it is carried to the top of a tower, say 6 feet in diameter and 30 feet high, filled with bricks, tiles, or other such materials, so as to leave numerous interstices. The liquor runs down over the surfaces of the materials, and runs out at the lower part into a boiler, and after running therein (say four hours) it passes into a second boiler. The first boiler is now supplied with a charge of milk of lime sufficient to set free the fixed ammonia, and steam (say of 50 lbs pressure) is blown into it, so as to boil and agitate it strongly, which process is continued until it is found by testing that all the ammonia is driven off. The first boiler is then emptied, and the steam diverted to the second boiler, the former being then ready for a second charge from the tower. Each of these boilers while being thus filled has a pipe passing to a condensing coil, and in which during the filling a quantity of crude ammonia is condensed, and is run into the gas liquor well. When the boiler is filled, this pipe is stopped. The steam from the boiler, charged with ammonia from the liquor, is now carried off by a large pipe, and conducted into the tower at nearly its bottom, and passes up through the interstices already mentioned, meeting the descending liquor and taking up its volatile ammonia; and all the vapour or steam so charged goes from the top of the tower to the blower, a leaden vessel containing an acid solution of sulphate of ammonia, and to which sulphuric acid is constantly added, and crystals of sulphate of ammonia are being constantly fished out.

The vapours being deprived of their ammonia by the acid, are carried off into a vessel which contains the coils of pipes above referred to, and in which, therefore, the liquor is heated before being carried to the tower. These vapours are then passed through a series of upright pipes or condensers exposed to the atmosphere until quite cooled, and all the water is condensed. The remaining gases, consisting of carbonic acid and sulphuretted hydrogen, are then passed into a furnace over a coke fire, and the sulphuretted hydrogen is burned and becomes sulphurous acid gas, and is passed into ordinary vitriol chambers to be made into sulphuric acid in the usual manner.

2845.—RICHARDS, W., Stockwell, Surrey, "*Improvements in gas-regulators.*" Provisional protection only obtained. Dated July 17, 1878.

These improvements refer, first, to that kind of gas-regulator in which a bell and fluid are employed, and consist in constructing regulators in such a manner that the fluid necessary for their operation will not escape during transport; consequently the mercury, glycerine, or other fluid can be supplied to the instruments before being delivered to the purchaser. To attain this object the cover of the regulator is hermetically secured to the body, and to the cover is attached a pipe, or its equivalent, which protrudes some distance into the instrument, and serves as the outlet for the gas, as well as to prevent the mercury, glycerine, or other fluid employed, from escaping.

Another part of the invention refers to that very large class of regulator in which a flexible diaphragm and valve are employed. In this it is proposed to make an orifice by preference in the plate which is attached to, and forms a part of the flexible diaphragm, and this diaphragm being weighted to give a certain pressure, the orifice in the plate is made of the required dimensions to deliver any given quantity of gas per hour. The orifice may be in any other part of the instrument where the pressure of the gas is regulated.

Another form of regulator is constructed by means of a disc working on a hinge, or with flexible material, and a fixed plate with an orifice in its centre, both of which are placed within the case of the instrument. Attached to the disc is a plug corresponding with the orifice in the fixed plate, the two forming a valve, which is closed or opened by the action of the gas on the disc, and thus the pressure of the gas is regulated.

Lastly, the improvements consist in the formation of a chamber, which may be combined with any class of street-lamp regulator, and in this chamber is fixed one or more diaphragms of wire gauze, perforated metal, or other porous or fibrous materials, by which any particles of naphthaline or other solid matter that might collect in the valve and impede the passage of the gas are retained in the chamber.

2873.—STURGEON, T., Horsforth, Yorks, "*Improvements in machinery for compressing air or other gaseous fluids, and also for exhausting the same.*" Patent dated July 18, 1878.

In this machinery the seat of the inlet valve or valves is placed in the piston of the air-compressing or exhausting cylinder, and the inlet-valves are applied thereto, so as to move to and fro therewith, in such a manner that the valve may remain stationary while the piston is moved away from it to the extent of opening allowed, thereby opening the valve at the commencement of the forward or discharging stroke. In this case the piston-rod or connecting-rod is directly attached to the piston, the valve being loose and free to move independently to and from its seat therein, but is sufficiently retarded in such independent movement, by its own inertia, the pressure of air against its surface, and the momentum previously imparted to it, to allow the movement of the piston which effects the opening or closing of the valve to take place first, the valve then in its open or closed position accompanying the piston through the remainder of the stroke.

2877.—PASS, E. DE, Fleet Street, London, "*An improved self-acting apparatus for removing or withdrawing air or other gases from water-pipes and other water conduits, in order to regulate the pressure of air therein, and prevent bursting or other injury thereto.*" A communication. Provisional protection only obtained. Dated July 18, 1878.

According to this improvement a vertical cast-iron cylinder is fitted with a cover at one end and a flange at the other to secure it to the water or other pipe. An aperture lined with a metal socket is contrived in the cover, to allow the air which enters the cylinder to escape. Inside the cylinder is a second cylinder of tin open at its lower end, and in its lowest position it rests on a convex plate fitted in the lower end of the outer casing. The inner cylinder is closed at the upper end, and has an india-rubber washer to close the aperture in the outer cylinder, when the inner one, owing to the pressure of air, is forced to rise and come against it, and at the same time prevent the escape of the water in the outer cylinder.

2893.—THOMPSON, W. P., Liverpool, "*Improvements in the generation and production of gas for lighting, heating, and other purposes, and in apparatus therefor.*" A communication. Patent dated July 20, 1878.

This apparatus consists of a generator producing its gas by means of the passage into the middle of the carbonaceous fuel of a mixture of air and water or oil, by means of a blast-pipe, producing an eddying movement of the gases of the same kind as that caused by making them re-pass many times over the fuel and becoming reduced before being conveyed to the scrubber or washer; this gas being afterwards employed in gas-engines, heating, or in other industrial application.

2908.—CLARK, A. M., Chancery Lane, London, "*Improvements in apparatus for exhausting and forcing fluids.*" A communication. Patent dated July 20, 1878.

In carrying out this invention, a horizontal drum mounted on a spindle is caused to revolve, the liquid to be forced being delivered to the drum. A stationary pipe placed parallel to the spindle projects down into the liquid where it is turned over at right angles, and is formed with a peculiarly shaped orifice. In this pipe the fluid is exhausted or forced, according to the direction of motion of the liquid in the drum relatively to the orifice and the construction of the pipe.

2941.—RAVENOR, R., Speenhamland, Berks, "*Improvements in apparatus or appliances for attaching service-pipes to water, gas, or other mains while under pressure.*" Patent dated July 24, 1878.

A convenient way of carrying this invention into effect is as follows:—To the main from which the supply is to be taken, a cramp, which is made to correspond in shape with that of the contour of the main-pipe, is firmly connected; and, to the cramp, a stop-valve and stuffing-box. The main is drilled and the aperture tapped with a thread to correspond with that on the end of the service-pipe. The tool being withdrawn just above the tap or valve, the main is ready to receive the service-pipe, which is inserted in the valve as the boring-tool was. The upper end of the service-pipe is stopped by a plug screwed thereon, and the stop-valve is removed. A back-nut is now screwed on, and then a diminishing T connecting-piece with the house or premises; the plug is then withdrawn sufficiently far to allow full water-way, and a top back-nut placed on to keep the parts secure.

Where the pressure is excessive, means are provided for resisting the same on the tools and pipe by means of screw-cramp, jack, or other suitable appliance or tackle.

3045.—CLERK, D., Glasgow, "*Improvements in gas motor engines.*" Patent dated Aug. 1, 1878.

In this engine the power is developed in one single-acting cylinder, having combined with it a second cylinder used as a compressing pump, the two pistons being connected by rods to cranks on a first-motion shaft, which also carries eccentrics for working the valves. The air and gas are admitted to the pump by a valve, formed by a plate sliding between a port face and a cover, the air entering by a port formed through the cover, and passing into a passage leading to the pump, whilst the gas finds its way from an inlet port in the port face by a shallow cavity on the inner face of the valve into the passage leading into the pump. The air and gas pass into the pump when the piston moves outwards, and on the return stroke the mixture passes through a lift-valve into an intermediate chamber forming the back end piece to both cylinders. The mixture is then admitted to the main cylinder by a valve in the form of a plate sliding between a port face and a cover, the mixture passing first from a port in the port face through one port in the valve into a passage in the cover, and thence by a second port in the valve into the passage leading into the cylinder. Between the cylinder passage and the cover passage is a bundle of platinum heated sufficiently to explode the mixture. The platinum is heated by a cavity in the port face supplied with the mixed air and gas from the reservoir, which issues through wire gauze and is ignited, its flame playing on the platinum, which is lined with asbestos. When the platinum is not in position to ignite the charge, the valve communicates, on the inner side, with cavities in the port face communicating with the exhaust-pipe.

3051.—CALDERWOOD, J., and M'CUTCHEON, W., West Calder, N.B. "*Improvements in or connected with the furnaces or heating apparatus of retorts and stills for obtaining or treating mineral oils or gas, and also applicable to steam boilers and to other boilers or evaporating vessels.*" Provisional protection only obtained. Dated Aug. 2, 1878.

This invention has for its object to obtain increased efficiency from the fuel employed for heating retorts, and consists in leading the gaseous products of combustion, after operating on the retorts, through flues, so as to utilize a large part of the heat remaining in them in the heating of fresh coal.

3056.—LEICHSENRING, H. R., Grossenhain, Germany, "*Improvements in and relating to engines worked by gas or other fluid, partly applicable to apparatus for compressing fluids.*" Patent dated Aug. 2, 1878.

In this improved form of engine, so as to prevent irregularity in the action of the gases in the engine, arising from their being badly mixed, they are conducted from the reservoir by two pipes, one leading from the highest,

and the other from the lowest part of the reservoir. The pipes are united before reaching the engine, thus obtaining a second mixture of the gases. For controlling the admission, ignition, and emission of the gases, a cock is employed having a particular combustion space filled at every revolution with gaseous compounds to be ignited in it. The regulation of the engine is effected in such a manner that in the highest position of the governor the outlet port of the cylinder will be held open, and the admission of the gases into the cylinder prevented until the engine has regained its usual velocity. In order to effect equilibrium in the slide, it is pierced on its side towards the cover, and the areas of the openings made equal to those on the other side.

3068.—KENNELER, C., Berlin, "Improvements in self-regulating gas-burners." A communication. Patent dated Aug. 3, 1878.

This invention relates to a self-regulating gas-burner provided with a special valve-adjusting piece or seat, whereby the valve is lifted, according to the different pressures of the gas, to different heights, this adjusting piece also allowing the whole top surface of the valve to be invariably presented to the inner pressure of the gas. The burner is further provided with a regulating or set screw, in order to adjust the consumption of gas from the outside.

3153.—SUGG, W. T., Vincent Street, Westminster, "Improvements in gas-regulators." Patent dated Aug. 9, 1878.

This invention relates to that class of gas-regulators in which a disc is used to carry a regulating valve, and by its rise and fall under the varying pressure of the gas to determine the rate at which the gas shall be delivered to the burner.

The regulator may be described as consisting of a shallow cylindrical chamber, pierced with holes at the bottom for admitting gas from the supply-pipe, and closed at top by a cover, which is formed with a central hole through which the supply of gas passes to the burner. Standing up from the centre of the chamber is a guide-pin, upon which works a disc that fits the chamber loosely. From the centre of this disc projects a stem carrying a conical valve, which, as the disc is forced up by the pressure of gas on its under side, will rise and throttle the escape opening in the centre of the cover. The disc is pierced with holes which will permit of a given discharge of gas per hour through the disc to the burner. When, however, the pressure is in excess, the disc will rise and the throttle-valve be set in action as explained.

In order to ensure the efficiency of this gas-regulating apparatus, it is necessary so to fit the disc in its chamber as to prevent the gas passing round the periphery of the disc, and so giving an undue supply to the burner. To provide for this, the disc is made of a sufficient depth at its periphery to allow of a ring groove or ring grooves being turned therein to receive a fluid packing; or recesses that will answer the purpose of the groove may be adopted. To the periphery of this disc glycerine, almond oil, or other equivalent non-adhesive liquid is applied, the action of which will be to close the space between the disc and the inner periphery of the chamber gas-tight, leaving the disc free to move under the varying pressures of the gas. By maintaining a supply of this liquid packing to the contact surfaces, the maintenance of the efficient action of the gas-regulator for a long period is ensured, and at the same time the necessity of accurate and costly workmanship in the regulator itself is avoided.

3168.—KINCH, T., Heaton Norris, Lancs., "A new or improved valve for making connections to water and gas mains under pressure, and method of operating the same." Provisional protection only obtained. Dated Aug. 10, 1878.

This invention consists in the application of a ball-valve for making a connection to a gas or water main whilst under pressure, when using apparatus constructed according to Penney's patent, No. 101, of 1878 [see JOURNAL, Vol. XXXIV., p. 443], or other like apparatus.

In the present invention a screwed spigot is employed, terminating in a valve chamber, which is arranged to contain a loose ball made of gutta-percha, india-rubber, or other suitable material. This valve closes self-actingly against a seating by the pressure of the gas or water, and so acts as a valve, and the valve chamber is provided with a union joint.

The invention further relates to a method of opening the ball-valve against the pressure and in the act of connecting the service-pipe to the valve chamber, and consists in prolonging the "ground-in" nose of the male portion of the union (the tail of which is connected to the lead or other service-pipe in the ordinary manner) so as to project through the seating of the valve into the valve chamber, the prolongation being perforated or formed with passages therein to allow the gas or water to pass through, and terminating preferably in a shallow cup or socket which is designed to force the ball off its seating as the union joint is being screwed together, and thus to open a thoroughfare between the main and the service-pipe.

3202.—KIRKHAM, T. N., Abingdon Street, Westminster, and CHANDLER, S., jun., Newington Causeway, "Improvements in valves." Patent dated Aug. 13, 1878.

This invention consists in constructing valves of a tubular form with lateral apertures, which form the outlet from the interior of the body. The upper part of the casing forms an annular recess, in which the mechanical arrangement for opening and closing the ports is placed. This consists of a tangent wheel and screw, by means of which a plug that fits accurately to the inner face of the valve, is caused to rotate, and thus opens or closes the egress passages. The tangent wheel is carried in a recess formed on the external casing, and the wheel is actuated by a cranked handle or other equivalent. The upper part of the valve casing is enclosed by a cap, by removing which the interior of the valve may at any time be readily inspected.

In a modification of the above arrangement, the arrangement for actuating the plug consists of a bevel pinion, fast on a spindle, which projects through a lateral gland. The bevel-wheel gears with an annular rack formed on the upper part of the plug, so that by giving motion to the spindle, the ports are opened or closed as desired.

These valves are applicable to many purposes, but they are particularly suitable, the inventors state, for relieving retorts from pressure; as, if the valve is arranged so as to form a portion of the dip-pipe, a clear and unobstructed passage is provided for the rapid egress of the gas to the hydraulic main, and without interfering in any way with the general working.

3225.—BOYNTON, L. W., Hartford, Conn., U.S.A., "An improved liquid-meter." Patent dated Aug. 15, 1878.

This invention relates to a liquid-meter constructed with a cylinder having a double piston, with a space between its heads, operating in the cylinder in connection with a slide-valve and a valve-case containing a main valve placed within a chest connected with the cylinder. A lever pivoted below the valve-case extends down through the exhaust port into the space between the heads of the double piston in the cylinder, and is connected at its upper end with the slide-valve. By means of this valve and the arrangement of ports in the cylinder and valve-case the valves and piston are operated.

3257.—HILLS, F. C., Deptford, "Improvements in the manufacture of sulphate of ammonia and apparatus to be used in the said manufacture." Patent dated Aug. 17, 1878.

These improvements consist in causing the ammonia so to combine with the sulphuric acid used, that at one stage of the process there may be an excess of ammonia in the liquor, and at other stages an excess of acid, so that the iron or arsenic, or both, that may be contained in the acid will be precipitated.

One form of apparatus for carrying out the invention consists of a combination of three vapour-tight vessels or saturators of any convenient size, lined with lead, and set at different levels, and so connected by pipes that the liquor may run from the first saturator into the second, and from the second into the third, the pipes being so arranged that the liquor in each saturator may be kept at a convenient height. When the ammoniacal liquor is being distilled, the ammoniacal vapour is conveyed by pipes from the still into the first and second saturators. The ends of these pipes, which should be perforated with small holes, dip into the liquor in the saturators, and are covered by it. The pipe from the still into the second saturator is provided with a valve or stopcock, for the purpose of regulating the quantity of ammoniacal vapour to be admitted from the still, and the gases escaping from this saturator are conveyed by a pipe into the first saturator. The end of this pipe should be perforated with small holes, and be covered by the liquor in the saturator, and the liquor, being acid, will take up any ammonia that may pass into it. The first saturator is connected by a pipe with the reservoir of acid.

The apparatus acts as follows:—At starting, the first and third saturators are charged with acid, or with sulphate of ammonia liquor having an excess of acid in it, and the second saturator is charged with liquor having an excess of ammonia in it. The ammoniacal vapour from the still is then caused to pass into the liquor in the first and second saturators, the quantity passing into the second being so regulated that the liquor in it shall continue to have an excess of ammonia kept in it in order that any iron or arsenic held in solution by the acid may be precipitated. While the ammoniacal vapour from the still is so passing into the saturators, sulphuric acid from the reservoir is admitted into the first saturator to neutralize the ammoniacal vapour passing into it, and to keep the liquor therein with excess of acid. As the sulphuric acid flows into the first saturator, the sulphate of ammonia liquor formed flows therefrom into the second saturator, and thence into the third, in which the liquor is kept slightly acid by a regulated stream of sulphuric acid. From this saturator the liquor flows into settling-tanks, and is allowed to settle, after which it is evaporated to obtain crystallized sulphate of ammonia. The waste gases generated in the still and in the first and third saturators may be conveyed away by pipes in any way desired; and liquid ammonia may be used in the second saturator instead of ammoniacal vapour from the still, to keep an excess of ammonia in that vessel.

For distilling ammoniacal liquor or gas liquor it is preferred to use a modification of the tower still or column still, the modification consisting in the substitution, for the plates or diaphragms ordinarily used, of troughs placed in the still side by side in rows, one set being placed above the other, and spaces being left between them, through which the steam and vapour rise, and the liquor being distilled descends. Or instead of using either plates or troughs alone, both plates and troughs may be used in the same still, the plates being placed between the rows of troughs.

3264.—PRITCHARD, E., Great George Street, Westminster, "Certain improvements in joints for earthenware and cast-iron pipes for sanitary, drainage, and other like purposes." Patent dated Aug. 19, 1878.

This improved joint consists substantially in moulding, casting, or otherwise permanently attaching upon the spigot end of the pipe two or more half threads, the inside of the socket of the pipe to which it is to be attached being moulded or cast with corresponding grooves. There is also provided a collar upon the spigot end. A complete joint is formed by covering the spigot and socket ends of the pipe with a layer of cement or other equivalent material, or substance of a like character, and screwing the two pipes together. By a slight turn or rotation of the pipes or either of them on their axes the connection is made.

Instead of attaching the threads upon the spigot end of the pipe, the pipe may be moulded or cast without any threads on it, and instead it may be provided with suitable grooves, in which threads are afterwards placed and secured.

APPLICATIONS FOR LETTERS PATENT.

117.—ROBINSON, H., Manchester, "Improvements in gas motor engines." Jan. 10, 1880.

135.—RODGER, W., and COCHRANE, A. L., Selkirk, N.B., "Improvements in treating impure liquids, and in separating or removing solids and impurities therefrom, and in apparatus to be employed for these purposes." Jan. 12, 1880.

139.—BOUGHTON, R., Queen Victoria Street, London, "Improvements in lighting." Jan. 13, 1880.

171.—LAKE, W. R., Southampton Buildings, London, "An improved apparatus for regulating or controlling the flow of gas or other fluids." A communication. Jan. 14, 1880.

179.—YATES, C. D., Margate, Kent, "An improved apparatus for heating water, and an improved atmospheric burner in connection therewith." Jan. 15, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

2946.—MORGAN-BROWN, W., Southampton Buildings, London, "Improvements in water-meters, also applicable to measuring steam." A communication. July 19, 1879.

2978.—DAVIDSON, S. C., Belfast, Ireland, "Improvements in rotary engines, pumps, and meters." July 22, 1879.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

4967.—STORER, J., and PUGH, C. H., "Improvements in retort-lid fastenings." Dec. 23, 1876.

4988.—HALLEWELL, R., "Improvements in gas and water motor engines, and in gas motor engines." Dec. 23, 1876.

97.—COLLINGS, T. A., and PATERSON, T. O., "Improvements in the production of material for and method of purifying coal gas, and in apparatus used for that purpose." Jan. 9, 1877.

PATENTS WHICH HAVE BECOME VOID

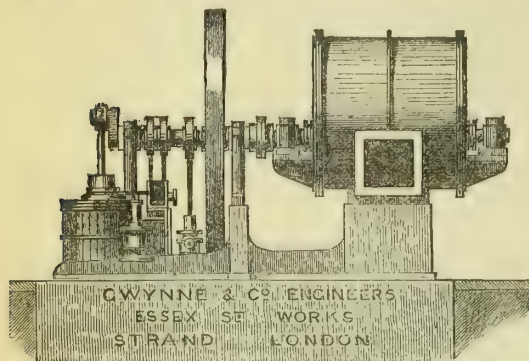
BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

38.—BISCHOF, G., "Improvements in the purification of water and in the means and apparatus employed for that purpose." Jan. 3, 1873.

45.—CROLL, A. A., "Improvements in means or apparatus for the distillation of ammoniacal liquors, which improvements are also applicable in the distillation of other liquids and in the concentration of soluble salts." Jan. 4, 1873.

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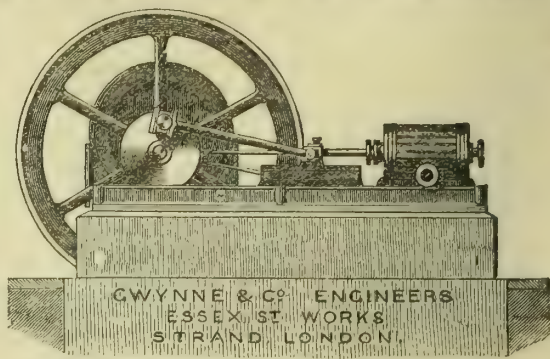
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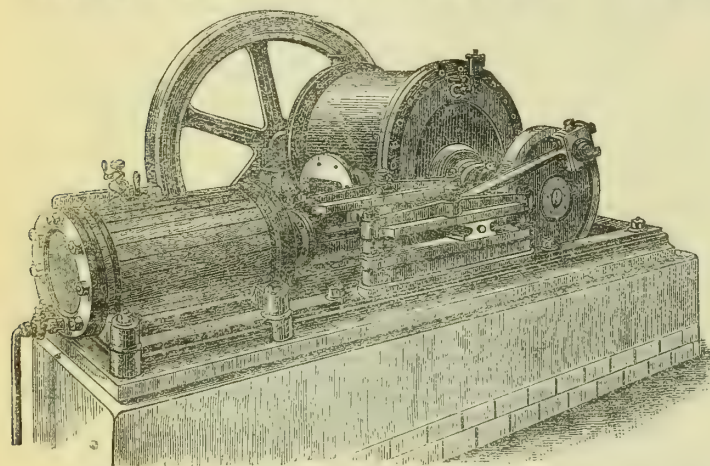
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[SEE ALSO ADVERTISEMENT, PAGE 110.]



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WANTED, by the above Company, a Steady Sober man as **STOKER**, and to make himself generally useful at the Works. One accustomed to a Boiler and Steam-Engine preferred. Wages 26s. per week. Apply, with references as to ability and character, stating age, and whether married or single, on or before the 26th of January inst., to

RICHARD HOLMES, Secretary.

Arun del, Jan. 15, 1880.

WANTED, by the Hindley Local Board, a **GAS MANAGER.** Make about 28 millions. Salary £120 per annum, with house, coal, gas, water, and rates free.

Applications, stating age, &c., with recent testimonials, to be sent in not later than Monday, Jan. 26th, 1880, addressed to the Chairman of the Gas Committee, Local Board Offices, Hindley, and endorsed "Gas Manager."

By order,
STEPHEN HOLT, Clerk to the Local Board.

LOUGHBOROUGH GAS COMPANY.

WANTED by the above Company, a **CLERK** who has been accustomed to the routine of a Gas Office. The person appointed will be required to assist in the Taking of the Meters, and likewise the Collecting of the Gas Accounts. Office hours from 9 a.m. to 6 p.m. Salary £50 per annum.

Applications to be sent in to me by Monday, the 26th of the present month.

Jan. 12, 1880.

J. B. BALL, A.I.C.E., Manager.

WANTED, an Engagement, by a young Man, aged 27. At present and for the past four years Manager of a medium-sized Gas-Works, the profit of which during that time he has increased threefold. First-class **DRAUGHTSMAN** and **ACCOUNTANT.** Thoroughly conversant with all matters appertaining to the Manufacture and Distribution of Gas. Well up in the Manufacture of Sulphate of Ammonia. Twelve years experience. No objection to go abroad. Excellent testimonials, and references to present and past employers. Address No. 619, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Manager and Secretary of the Totnes and Bridgetown Gas Company, Limited.

The duties, which will occupy the whole of the Manager's time, consist of the General Superintendence of the Works and the Manufacture of Gas, Surveying and Supervising all Public and Private Works and Services, Giving Orders for all Stock and Goods required, Keeping the Books, Attendance at all Meetings, and such other duties as from time to time may be determined by the Directors.

Applications, by letter, stating salary, to be made on or before Friday, the 23rd inst., to

FREDK. BOWDEN, Secretary pro tem.
6, High Street, Totnes, Devon.

FOREMAN Wanted, at once, in a Provincial Gas-Works making between 40 and 50 million cubic feet of gas per annum. Must be a competent Retort-Setter, and well acquainted with the general routine of a Gas-Works. A good cottage, fuel, and light provided.

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TO CORRESPONDENTS.

A. T., and C. R. J. PEPPYS, Aix-la-Chapelle.—Your letters were received too late for them to appear in the present number.

ENQUIRER asks: Would some of your readers kindly inform me if it is an infringement of the Aitken and Young patents to re-heat by any means the products of distillation after leaving the ascension pipes, other than by volume of gas in course of manufacture?

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 27, 1880.

Circular to Gas Companies.

WE hope that the authentic reports which have arrived from New York of the complete failure of Mr. Edison's latest invention will reassure the possessors of gas property, and induce them to retain their holdings. A "scare" such as that produced by the announcement of Mr. Edison's last pretended discovery was perfectly unreasonable. We last week expressed an opinion that, after all, but few shares had changed hands; but that one should have been transferred in consequence of the flimsy reports which reached us from the other side of the Atlantic, is to us a wonder. Are the owners of some of the most substantial property in the kingdom so nervously sensitive to every rumour, that they must rush into the market with shares the moment some new discovery in the use of the electric light is alleged to have been made? We can well understand the anxiety which may prevail among small investors whose whole savings are engaged in gas manufacture, and to these we would to-day expressly address ourselves. We will admit the possible perfectibility of the electric light for both public and private illumination,

but when will perfection be arrived at? In the course of the next half century it may be conceded that great improvements will be made in the generation and distribution of the electric force, but will they affect the consumption of gas? Certainly not. Each illuminant will have its special function, and the part played by gas will, of the two, be the more important. It lends itself to household purposes in a marvellous manner. Is heat required for cooking or warming, it is only necessary to turn a tap, apply a light, and the thing is done. Heat and light can be continued as long as they are wanted, and can then be shut off. Electricity, at all events so far as at present developed, offers no such advantages. If light be required, it must be distributed over a whole establishment, or cut off entirely; if heat be wished for, the coming inventions are still *desiderata*. In any case, gas shareholders have but one course to pursue. They must adhere to their holdings, notwithstanding whatever sensational telegrams may come from America. We may very safely prophesy that ten per cent. will, for long years to come, be the divisible profit of all the Metropolitan Gas Companies.

The Corporation of Dublin are not making much by their unreasonable opposition to the Gas Company. The Corporation requested the Company to continue the supply of gas to the public lamps for three months; but, for so short a time, the Company reasonably object to do so at old rates. They do not propose to increase the charge for gas, but as the whole of the plant is their property, and the use of it has hitherto been given gratuitously to the Corporation, the Company now announce their intention, if a contract for less than twelve months be entered into, to make certain charges for meters, lighting and extinguishing, repairs, &c., which in the aggregate will amount to £1 2s. 6d. per lamp per annum. It cannot be denied that the Company are perfectly justified in standing out for their undoubted rights. They have behaved with great liberality, and have been the victims of base ingratitude. The wild talk of some members of the Council, who suggest that application should be made to Parliament for power to light the city, at all events within the municipal limits, is pure bravado. Parliament would never give them such powers. The Corporation may, if they please, go to arbitration as to the charges of the Gas Company; but one member of the Town Council shrewdly remarked that he did not know where arbitration might land them. It seems to us, however, that to arbitration the Corporation must go, or agree at once to pay the new terms announced by the Company. As regards the purchase of the Company's undertaking by the Corporation, we imagine very few indulge in dreams of the kind. Comparisons are said to be odious, and to some they must be. When Corporation affairs in Belfast are made a topic of discussion in the Town Council of Dublin, the different conditions of the one thriving and the other decaying Municipality cannot fail to be recognized. If the Corporation of Dublin really wish to do the best they can for the ratepayers, they will immediately offer to make terms with the Gas Company, and seek no longer to enter into an unwise and impossible competition. The undertaking of the Alliance Gas Company can, of course, be had at a price; but what that price may be we shall not hazard a conjecture.

The Town Council of Hanley are wisely endeavouring to come to terms with the British Gas Company respecting the Bill which the Company will presently introduce to Parliament. So far as we can see, the objects of the Corporation are not of a revolutionary character, and probably a friendly colloquy between the Town Council and the Company would set all matters straight. It would, we feel satisfied, be useless for the Council to attempt the purchase of the undertaking without the preliminary consent of the Company; and this, we gather from a letter read at the last meeting of the Council, they are not likely to obtain. However, everything and everybody has its or his price, and we should not be surprised if the Town Council offered sufficiently good terms for the Etruria undertaking of the British Gas Company, which might be passed into their hands.

The Local Authority of Stone and the Gas Company are at loggerheads. So far as we gather, the Company supply very good gas, and do not charge an exorbitant price for it. The Local Board would, nevertheless, appear to be anxious to purchase the gas undertaking, and the Company are not undisposed to sell at a fair price; but this the Local Board are not willing to give. They have, therefore, applied to the Local Government Board for a Provisional Order to authorize them to set up competing gas-works; although probably the real intention of the Board is to use the Order, supposing they get it, as a lever in compelling the Company to sell their works. Such tactics rarely, if ever, answer, and we think they are certain to fail in this case. Whether the Order will be granted

or not we cannot say; but we imagine that its issue would be a manifest violation of the Public Health Act. Stone, it must be admitted, is now supplied with gas of a good quality, and at a not excessive price; so that there are very sufficient reasons for refusing permission to set up competing works. The only other question is that of purchase. The Local Board are well acquainted with the terms on which the Company propose to sell. Let them set to work and strike a bargain.

The Midland Association of Gas Managers held, on Thursday, the 15th inst., their third annual meeting, under the presidency of Mr. P. Simpson, of Rugby, whose Inaugural Address will be found in another column. It cannot be questioned that these provincial Associations are doing much useful work, but we are free to confess that their relationship to what is called the parent Association is not quite clear to us. If we regard them as Committees of the parent Association, we do not find that they provide much for what we may call the great parliament of gas managers, which meets once a year in London or elsewhere. In our opinion, the object of the local Associations should be to prepare and elaborate communications to be presented at the annual meetings of the parent Association. This would not, of course, prevent discussion, but would, indeed, encourage it. We welcome, therefore, with the highest satisfaction, the multiplication of these provincial Associations, not the least useful of which is the Midland Association of Gas Managers.

Water and Sanitary Notes.

WE understand, although no specific statement to the effect has been made, that all the Metropolitan Water Companies have come to an agreement with the Government valuers. The information is at present unsupported, but it may be considered as correct. The terms which have been agreed upon have not yet been made public, and are not likely to be until the Bill which will embody them is laid before Parliament. We, who have so often speculated as to the value of the Metropolitan water undertakings, shall not here again make any remark upon the matter. It was a question, in the first place, for the Government to consider, and that consideration appears to have been given. In such decisions as have been arrived at it must be inferred that the Directors of all the Companies have concurred. But now will come the crucial test—will the Shareholders, backed up as they certainly will be by a powerful party in the House of Commons, support the policy of their Directors? The Government valuers have, no doubt, given full heed to all the circumstances which affect the financial position of the undertakings. They have at this moment a value represented by expended capital, and they have, further, a prospective interest in a continually increasing business. The valuation of the expended capital is a very simple business; but the sum to be paid for prospective profits is a matter which must engage serious consideration. Mr. Cross, in the answer he gave to Mr. Fawcett, obviously intended to insinuate that no consideration would be given for prospective profits. The position taken up by the Home Secretary was clearly untenable; and whatever may be the terms arranged, we may feel satisfied that, in estimating the value of the separate undertakings, prospective profits have entered into the calculation. Further than this, we may assume that due consideration has been given to the value which attaches to the undertakings to-day. If the Companies do not obtain the terms to which they believe themselves entitled, they alone will be to blame. United action on the part of all the Companies could have effectually defeated any measure which the Government might have brought against them. We are far from saying that the action the Government will take must necessarily be antagonistic to the interest of the Water Companies. All we wish to insist upon is that due recognition must be made of all the elements of value which attend the purchase of such undertakings.

The Liverpool Town Council have held a final statutory meeting, at which they decided to go on with the Vyrnwy scheme and its accessories. A little misunderstanding has occurred, inasmuch as it was in the first place announced that the execution of the scheme would cost only a million and a quarter sterling. This was the amount put before the ratepayers when they voted for the promotion of the Bill. But in the Bill power is sought to borrow three and a quarter millions, and some of the Council affect to believe that the ratepayers were deceived. The fact, however, is that the works planned for the Corporation will be executed in three sections, the first of which will cost the million and a quarter

which the Council announced would be necessary. When the scheme in its totality is proceeded with, the cost will be brought up very nearly to the sum which the Council seek power to borrow. We may take it, however, that much of the money will not be required for years to come, and that before the second and third sections of the work are put in hand, the first will have become remunerative. In the meantime it seems inevitable that some burden must fall upon the ratepayers in order to provide interest on the capital borrowed. So far, then, as Liverpool is concerned, we may take it that the Vyrnwy scheme is now perfectly safe. What opposition the Bill will have to encounter when it gets into Parliament we do not know. We have a strong suspicion, however, that external opposition to it has collapsed, and that it will meet with complete success.

The Corporation of Bradford do not appear to have made the best use they could of their water undertaking. Years ago they left a good portion of their limits without a supply. To provide for the wants of those districts, a limited liability Company came forward, who, taking water in bulk from the Corporation of Bradford, distributed it amongst several out-townships. Among these was that of Idle, which, it seems, lies rather high, and great complaints are made that the works of the Company are altogether inadequate to furnish an efficient supply. The Company had from the Corporation of Bradford a lease for fourteen years, which has just run out, and here the Local Board of Idle step in with a proposal to purchase the plant of the Company, we presume at a valuation. The Company, however, object to sell, and contend that under their arrangement with the Corporation of Bradford they are entitled to a renewal of the lease. The latter body, however, now themselves propose to supply water direct, and in all probability we shall hear of litigation between the three contending parties. Without a knowledge of the precise details, we may hazard an opinion that the right lies with the Calverley Company, who are now in possession.

MICROSCOPIC EXAMINATION OF SEWAGE AND SEWAGE MUD.

QUITE independently of the direct bearing of the result in reference to the arbitration now pending between the Metropolitan Board of Works and the Conservators of the Thames, as to the origin of mud-banks in the river, there is one leading feature, in the evidence lately given in the case by Dr. Tidy, which is interesting to all who wish to know the state of our rivers, and especially to the dwellers in the Metropolis, whose water is derived from the Thames. We allude to his minute and exhaustive microscopic examination of sewage and of mud taken from various parts of the river. We are not aware of any investigations in this direction, and certainly, if there be any, they fall very short of these in completeness and interest. Dr. Tidy's evidence was illustrated by a series of beautiful drawings, showing, with singular clearness and definition, all the main facts observed. It may be well to state that the microscopic powers used were generally high, and sometimes the highest available for such work.

The nature of the suspended matter in true sewage, as determined by the microscope, was established by the examination of nine samples, five of them fecal, three from sewers, and one from the sewage mud-bank at the northern outfall at Barking. In each case a small piece of the mud was taken, and well stirred with a glass rod in a conical glass. The mixture was left at rest for a considerable time, varying from one to three days, and then a drop of the topmost layer was taken off with a pipette, and placed under the microscope. This method was adopted throughout, in all the experiments, both on sewage and sewage mud. The first point noticed in fecal matter and sewage was the invariable presence of a quantity of brownish-yellow flocculent matter in patches or irregular-shaped masses. This amorphous material Dr. Tidy attributes to the presence of animal matter that has undergone or is undergoing putrefactive change. It corresponds with decomposing animal matter derived from disintegrated muscle obtained from the dissecting-room. Examined with the highest power obtainable (the fiftieth of an inch), it never loses its amorphous character, it never reflects light, and it presents no indication whatever of mineral origin. It differs from decaying vegetable matter in the total absence of fibrous structure or fibrous texture. Vegetable cells are recognized as having always a clear pellucid outline, and becoming lost entirely when they suffer disintegration. They do not appear to approach this flocculent state under any conditions of change.

The next thing observed in these specimens was the presence of vegetable cuticle marked with small dots in the cells,

and of spiral vessels, the spiral remaining intact after the cell wall had been destroyed. This condition is believed to be a proof that the vegetable matter has been partly digested, and therefore has passed through the alimentary canal. It is peculiarly characteristic of sewage. The presence of diatoms is common; but these are not specially characteristic of the origin of the material, as they occur in all river mud, though more abundantly in sewage.

Portions of muscular fibre come next under notice. Dr. Tidy says: "In all the specimens, without a single exception, of true sewage I have examined, I have found pieces of striated muscle, generally very small, sometimes somewhat large." There were also pieces of animal structure somewhat granular, of yellow colour, which, by repeated observation, have been proved to be striated muscle converted more or less completely into adipocere. Specimens were found in which the two structures were combined.

The following, then, are the conditions characteristic of fæcal matter and undisputed sewage:—(1) Vegetable cells in small clusters; (2) spiral vessels, with or without investing membrane; (3) striated muscle; (4) muscular tissue passing into adipocere; and, lastly, perhaps chiefly, yellowish-brown flocculent patches.

Applying the knowledge thus obtained of the microscopic features of sewage, Dr. Tidy examined in succession mud from the Thames banks near the sewage outfall, mud from the banks and bottom of the river at various points up to Westminster, other specimens from the river between Westminster and Teddington, and others from the bed of the river from Teddington to Windsor. He also examined the alluvial deposit forming the banks of the river at various points, and technically known as "saltings."

The specimens for examination were numerous. Five were taken between Erith and Bugsby's Reach (a distance of nine miles), and eight between Blackwall and Hammersmith (sixteen miles). Beyond Hammersmith, as far as Windsor, others were taken, and a few from the Rivers Wey and Mole. In this way the whole history of the river mud from Erith to Windsor may be said to have been investigated in the course of the inquiry. The mud taken from the lower reaches near Erith contained much granular amorphous matter of a yellowish colour, spread somewhat uniformly through the whole. Amongst it were dispersed imperfect vegetable fibre and spiral vessels, the whorls being loose, some yellow masses closely resembling portions of fascia, and disintegrated muscle, and many diatoms. In a specimen from Woolwich Reach there were the same yellowish amorphous and granular deposits, and several yellow masses, one of which was undoubtedly composed of muscle. There was also vegetable matter consisting of fibres in process of disintegration, and perfect vegetable cells, but no spiral vessels. Diatoms were present, but they were mostly of small size and fusiform. In the next sample, taken higher up the stream, the flocculent yellow matter remained, the vegetable matter consisted only of fibre, and was in small quantity, the diatoms were large and varied, and there were very many yellow masses distinctly animal. Still higher up the river another specimen showed a very similar condition. As far up the river as Woolwich Reach, Dr. Tidy states that he found in every specimen of mud that was taken all the characteristic products of sewage except muscle. He found a small piece of muscle in one; but, as a whole, the muscle in that bank had become entirely converted into yellowish masses. Farther up the river, from Blackwall to Hammersmith, all the eight samples taken showed distinct evidence of sewage; but, in the absence of large pieces of striated muscle and fibrous tissue, and also of spiral vessels, this series presents a marked difference from that collected in the river below Blackwall.

Proceeding farther up the river, Dr. Tidy noticed results which he attributes to a sorting process constantly going on. It is quite certain that when the mixed products conveyed through the sewers into the river enter the stream, the heavier bodies will be the first to sink, but those of which the specific gravity is little above that of water will long remain in suspension, undergoing change, while much of the heavier animal matter may be long retained in a buried state under water, comparatively unchanged. The muscular tissue thus buried will be gradually converted into adipocere, while the lighter portions floating will become disintegrated and oxidized. It may be assumed that wherever the inflowing tide of salt water meets the downward flow of fresh water of the river, and checks its progress, there will be comparatively still water, in which the floating matter will sink. The position of this belt of dead water must be constantly changing with every tide, and approaching the bottom, which it reaches at Teddington. Thus there may be expected to be a deposit of

organic matter due to the sewage that is poured into the river at the sewage outfalls, the amount of the deposit gradually diminishing in quantity up to this point, and the nature of the deposit changing to some extent. Such a deposit appears actually to have been observed. Above Deptford Creek the quantity of amorphous granular matter is diminished, and that of grit or mineral matter increased. Within the limits of London, in a sample taken opposite the Houses of Parliament, the deposit was found to consist chiefly of angular fragments of mineral, though with some yellow amorphous deposit and a few diatoms. Higher still, between Chiswick and Teddington, all evidence of sewage, except the yellow amorphous matter, disappeared. Above Teddington there was scarcely any yellow flocculent matter, no distinct organic matter, but a few diatoms, and only one or two vegetable cells; and at last, as we go farther on, no traces of organic matter and no diatoms were found.

The disappearance of the indications of sewage in the mud at the bottom of the Thames from Erith upwards is gradual, regular, and very striking. At first there is everything that the sewers themselves contain. By degrees the more distinct, the heavier, and the more evidently animal products become fewer, and at last disappear. Above Chiswick the yellow amorphous matter alone remains. To use Dr. Tidy's words: "First we lose muscular tissue, next we get no yellow masses, and at last we get nothing at all. The last vestige of sewage matter in the mud, which is the yellow flocculent matter, altogether disappears." We may add that the examination of the alluvial matter forming the banks of the Thames was found by Dr. Tidy to be absolutely free from any indications of sewage.

It is extremely satisfactory to find from this investigation that the Thames water above Teddington is free from any taint of sewage as indicated by the presence of sewage mud at the river bottom. That sewage matter enters the river as it flows through the land and passes towns and villages there is no doubt, and we know the water holds in solution a certain quantity of organic matter. But this is not in itself injurious, and it is clear that whatever be the distance and time required to oxidize organic matter thrown into the water as it passes the towns on its banks, and held in suspension, it has been oxidized and got rid of before the Thames reaches Hampton. The absence of all sewage indications in the mud is the best possible proof—perhaps the only satisfactory proof—that whatever distance and time may be required for this change, they exist and have done their work. In this respect there is no doubt that Dr. Tidy's investigations are of great value, and confirm what had been otherwise proved by analysis.

The presence of distinct fragments of muscular tissue buried in the mud of sewage-banks, and passing into adipocere when they do not undergo a second putrefaction and become decomposed, is another fact of great interest. Once converted into adipocere, it is difficult to imagine anything more harmless; but preserved, as they appear to be, for a considerable time subject to putrefactive fermentation, and only half converted, they are certainly sources of great danger. In cold weather putrefactive change is retarded, and the sewage mud is inert and unchanged; but when hot, dry weather occurs, and the mud-banks are exposed during certain times of tide, it is well known that the smell is powerful and offensive. There can be little doubt that in such a state there will be malarious emanations involving much danger to health. When it is known that such mud-banks consist to a certain extent of half-decomposed muscle, and are full of what are called blood-worms, characteristic of sewage, the danger of allowing them to accumulate must be evident.

Thus from every point of view, both as regards water supply and sanitation, the microscopic investigation of sewage and sewage mud is eminently worthy of our close attention, and we have to thank the Conservators of the Thames for causing this part of the inquiry now going on to have passed into the hands of one who is so competent to do justice to it as Dr. Tidy has proved himself to be.

YESTERDAY'S PRICES OF GAS AND WATER SHARES.—Mr. A. G. Prater, Stock and Share Broker, of 23, Cornhill, gives the following as the closing prices yesterday of some of the principal gas and water shares:—

Gas Companies.		Phoenix	
Commercial	179 —182	South Metropolitan	192 —197
Continental Union	17½ —18½	Do. "B"	180 —185
Do. 7 per cent. pref.	22½ —22¾	Water Companies.	
Crystal Palace District	170 —175	Chelsea	184 —188
Crystal Palace 6 per cent.	120 —123	East London	193 —196
Do. 7 per cent.	124 —127	Grand Junction	114 —116
European	17½ —18½	Kent	260 —265
Gaslight and Coke "A"	179 —181	Lambeth	194 —197
Imperial Continental	178 —180	Southwark & Vauxhall	187 —190
London	175 —180	West Middlesex	172 —175

THE PROPOSED BRITISH STANDARD WIRE AND PLATE GAUGE.

We have received a copy of the Report of the Committee of the Society of Telegraph Engineers on the Birmingham Wire Gauge;* with which is bound a reprint of the paper on the unit of the B. W. G. by Mr. C. V. Walker, F.R.S., and the two papers of Mr. Latimer Clark, M. Inst. C.E., read by him before the British Association at Dundee in 1867, and at Exeter in 1869, the whole forming an exhaustive summary of the existing state of knowledge of the B. W. G. itself, and of the most promising methods of rectifying it, or supplanting it with some other form of gauge which shall have a distinct basis, and therefore be capable of reference to fixed data, and be suited also to the requirements of the workmen, traders, or men of science of all countries. The arbitrary progression of the numbers of the B. W. G. must have been remarked by every person who has had to deal with it, either for wire or plate metal. The reasons for their existence must have been puzzled over in a more or less desultory fashion by numberless observers, and are a mystery to the great majority of those who have the numbers themselves constantly in their minds or on their lips. And, as will be seen, on perusal of the pamphlet under notice, the mystery is one that does not tend to diminish when examined closely.

The first question that would naturally arise in the course of a discussion on the B. W. G. would be—What is the B. W. G.? And that is apparently a question to which no satisfactory reply is now possible. Of course, it may be generally answered that the B. W. G. is a system of numbers by which it has been customary to describe the relative thicknesses of iron or copper sheets and wires. But such an answer is only shifting the difficulty one stage backward, for nobody knows what the numbers mean, or how to replace the existing gauges if they should all be destroyed. We know exactly what is meant by a yard or a metre, and if every existing standard were to be destroyed to-morrow, the inconvenience would only be temporary; but in sheet ironwork the important third dimension is stated in terms which no two persons could be compelled to read alike. As a matter of fact, the only legal measure of thickness for sheets or wires in England is the standard measure of length; but that system of measurement would frequently be cumbersome in such cases, and is rarely used in ordinary transactions. Wire is frequently described in terms of standard weight per standard unit of length; but sheets are known only by their number of the B. W. G., except when they can be measured by some simple subdivision of an inch.

The diversity of opinion respecting the true value of the numbers of the B. W. G. is well shown in several tabular statements given in the pamphlet before us. In a list of thirteen authorities, the equivalent measurement of such an ordinary gauge as No. 10 is different in nine cases; and, as one authority omits it, only three are in precise agreement. The measurements vary from 0.140.6 in. to 0.126 in., which is about equal to an average No. 29 B. W. G. in this size alone. Other examples of glaring discrepancy are common; notably, the common No. 16, which only appears in its ordinary acceptance of 1-16th of an inch in two out of the thirteen lists, while it is as hard to determine whether No. 10 or No. 11 should be considered as equivalent to what is known as 1-8th plate. In the report itself, it is stated that "four or five different gauge plates have been made for one maker—some by which the workmen are paid, and others by which the wire (or plate?) is sold."

The use of half or quarter sizes has not come into use among consumers, but they are not unknown to makers, who, however, in their dealings generally forget to mention the fractional quantity. In wire for electrical purposes, some of which is necessarily extremely fine, and in which exactness of diameter is of the first importance, the uncertainty of the ordinary B. W. G. is, as we have said, of sufficient moment to necessitate the use of terms of weight in proportion to length; but this is a clumsy expedient. In sheet iron, with the measurement of which Gas Engineers are more particularly concerned, the variations of thickness are chiefly of interest for the differences of weight and value which arise from them, and as the ratio of weight to area cannot conveniently be used in the determination of the third dimension, the inconvenience of an uncertain standard becomes very obvious.

The conclusion respecting the origin of the B. W. G. to which the report gives credence—viz., that the original gauge was the outcome of the practical necessities of wire-drawing in the last century, No. 1 being the original rod, and the following numbers signifying the number of "draws" to which the iron had been subjected—is possibly the most reasonable origin to which it can be referred, and the practical element in such a standard was doubtless the cause of its universal adoption. The general indifference displayed to accurate measurements at that period, or the difficulty of making them, with any degree of exactness, of such minute objects as the diameters of small wire, is sufficient to account for the fact that no authoritative record of the average or correct equivalents of the numbers is known to be in existence. The discovery by Mr. C. V. Walker of the occurrence of the constant denominator 640 in the fractional equivalents of a gauge made by Messrs. Johnson and Nephew, led Mr. Latimer Clark to the belief that some such determination was at one time made by some practical mechanic, who started with multiples of 64ths of an inch for the gradations of the larger sizes down to No. 12 or No. 13, and then, this being too great, the denominator was multiplied by 10, and the same system of reduction was carried on. This would bring the adjustment down to the 640th part of an inch, or No. 39 B. W. G. on that system. Unfortunately, there is no adequate ground for believing

that the actual gauge referred to is any more an exact presentment of the original draw-plates than any of the others, which differ from it in a conspicuous manner, although it preserves intact the simple fractional values of the fundamental gauges, Nos. 11 and 16 and others. But at its best there are discrepancies in it which destroy its claim to uniformity, and its dependence on the standard inch as to its basis would be a grave obstacle to its adoption in countries whose standards of length differ from our own. True, the conventional B. W. G. is used in countries where the standard is the metre, but that is merely because of the persistency with which we have ourselves adhered to it. It is doubtful, however, whether they would be equally willing to adopt a new gauge which, with a few improvements, still retained what to them must be an objectionable feature. And it is not probable that we shall always retain our old standards of length, to the exclusion of the more simple metric system. Hence the thing to be sought appears to be a gauge of which the gradations shall proceed in regular progression, independently of any arbitrary unit of length for the diameters or thicknesses, but based upon a regular increment or diminution of weight, which will hold good under all circumstances. If such a gauge can be constructed sufficiently near to the existing gauges to supplant them, without much disturbance of the experience of mechanics and traders with the old numbers, it is evident that a great element of uncertainty, annoyance, and loss will be in a fair way of removal. Fortunately Mr. Latimer Clark is able to speak positively on these points, and he has proposed a new standard British gauge for all kinds of wire and sheet metal, which has been approved by the Committee of the Society of Telegraph Engineers, and is recommended by them to the consideration of all persons interested in the matter, with a view to its ultimate adoption by the Board of Trade.

The report has the following paragraph on Mr. Clark's gauge, and we cannot do better than reproduce it in substance:—

In 1867, Mr. Latimer Clark proposed a geometrical gauge, in which the intervals are so arranged that each size is exactly 20 per cent. less in weight than the preceding size. By a slight modification of the starting point, making the No. 0 size equal to 1 centimetre in diameter, this gauge follows very closely the sizes of the ordinary B.W.G., while it has the advantages, common to all geometric gauges, that it can be extended indefinitely in either direction for larger and smaller sizes; that a person knowing the weight of any one size can readily calculate the others; that the differences are perfectly uniform throughout; that the half and the quarter sizes can be defined with perfect precision; and that it is equally suited for English and foreign systems of mensuration. Its objections are that, even when defined in mils (thousandths of an inch), it requires in practice at least one decimal place; that the larger and the smaller sizes are both larger than the ordinary B.W.G., frequently differing from them by more than a whole size, though the middle sizes coincide pretty closely.

Further, after expressing in general terms the advantages of a geometrical gauge for a universal standard over any attempt to correct the inequalities of the conflicting empirical gauges at present in existence, the final preference is given to Clark's gauge, on the ground of its special agreement with the B. W. G., from which "it differs scarcely more than the existing gauges differ among themselves."

From No. 5 to No. 18, within which range lies the great bulk of sheet numbers used for gasholders, "the variation is never equal to a whole number." The report says:

By the use of half or quarter sizes, we have a series of great uniformity, varying about 2½ per cent. in weight of plate or diameter of wire, and about 5 per cent. in weight of wire, and the gauge would, therefore, appear to be well suited for a plate gauge, and especially in the cases of very thin sheets, as there are no sudden jumps in any part of it. Tables of weight of wire and sheet for different metals would become possible, and would enable any of the sizes to be bought and sold by weight, or the thickness checked by the weight. Concurrently with this the system of measurement by thousandths of an inch will be available as heretofore.

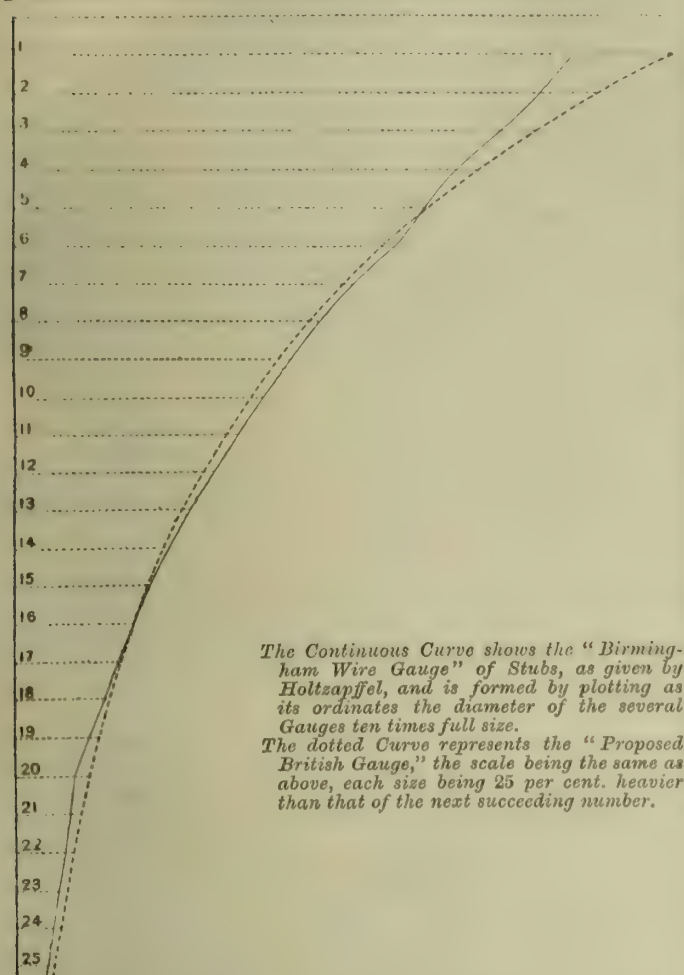
The following table, constructed from data furnished chiefly by the report, shows the principal numbers of sheet iron in common use in gas-works in the usually received equivalents in mils, or thousandths of an inch per B. W. G., and for the proposed British Standard Gauge, or B. S. G., which is also given in millimetres:—

Table of Sizes of Wire and Sheet Iron.

B. S. G.			B. W. G. in Mils, or Thousandths of an Inch.			
No.	Millimètres.	Mils.	Stubs.	Molesworth.	Spon's Tables.	Whitworth.
0	10.00	393.71	340	—	340	—
1	8.94	352.14	300	310	312	300
2	8.00	314.97	284	280	284	280
3	7.16	281.71	259	260	261	260
4	6.40	251.97	238	240	239	240
5	5.72	225.37	220	220	217	220
6	5.12	201.58	203	200	208	200
7	4.58	180.30	180	187	187	180
8	4.10	161.26	165	166	166	165
9	3.66	144.24	148	158	158	150
10	3.28	129.01	134	137	137	135
11	2.93	115.39	120	125	125	120
12	2.62	103.21	109	109	109	110
13	2.35	92.31	95	95	94	95
14	2.10	82.57	83	83	80	85
15	1.88	73.85	72	72	72	70
16	1.68	66.05	65	65	63	65
17	1.50	59.08	58	56	55	60
18	1.34	52.81	49	49	48	50
19	1.20	47.26	42	42	42	40
20	1.07	42.27	35	35	35	36
21	0.960	37.81	32	32	33	32
22	0.859	33.82	28	28	29	28
23	0.768	30.25	25	25	28	24
24	0.687	27.05	22	22	25	22
25	0.615	24.20	20	20	21	20

* "Report of the Committee of the Society of Telegraph Engineers on the Birmingham Wire Gauge," &c., &c. London: E. and F. N. Spon.

The following is a graphic delineation of the same numbers, showing at a glance wherein the proposed B. S. G. departs from the equivalent dimension of the B. W. G., as given by Stubbs. It should be remembered that this measurement of the B. W. G. is the one in general use in America, and differs from the others in the table.



The Continuous Curve shows the "Birmingham Wire Gauge" of Stubbs, as given by Holtzapffel, and is formed by plotting as its ordinates the diameter of the several Gauges ten times full size.

The dotted Curve represents the "Proposed British Gauge," the scale being the same as above, each size being 25 per cent. heavier than that of the next succeeding number.

It will be seen that the exact equivalent of 1-8th of an inch for No. 11 B. W. G., which is preserved by Molesworth and in Spon's tables, is wanting in the B. S. G., which makes this gauge much lighter; but the general regularity of the new gauge is very apparent.

There can be no valid objection to the proposed gauge as a standard, at all commensurate with the manifold advantages which it presents, and its convenience if it should be legalized. It certainly requires a number of figures to express its equivalents in decimals of an inch; but that drawback is more apparent than real, for the only occasions when the equivalents are required—for example, when the strength of sheets is to be computed—are comparatively infrequent, and in such cases the use of an additional decimal place or two is unimportant, or, from the smallness of its practical value, may be neglected. The weight of sheets rolled in accordance with it will be taken from tables, as with the present system, and the transition period, when some little confusion might be expected, would not be a very long one. In every way, as offering regularity for chaos, rationality for empiricism, and universality by right for acceptance by force of custom, this British Standard Gauge appears to deserve the approbation of the public and the sanction of the Government. But if it is to be finally adopted, let it be imposed compulsorily or not at all. There is already too much confusion for any new system, however good, to be introduced with any hope of ultimate sanction by the action of the "survival of the fittest" principle, for in that way the existing perplexity will only be aggravated. It is not advisable that any ill-considered action should be taken in such an important matter. Let it be well sifted in all possible ways now, while it is in nubibus, and when its sponsors may combat any objections that can be raised, or modify it in any manner that may be considered advantageous—when independent authorities, with other applications of it than for wire in their minds, shall have had time to analyze it carefully; so that when it becomes law there may be a sufficient consensus of opinion to support it, and to ensure its propagation from the stand-point of a British measure, into the universe of commercial and engineering enterprise, in connection with which its greatest utility will have to be shown.

It is stated that, subject to audit, the accounts of the Chartered Gas Company for the half year ending on the 31st ult. show profits sufficient to justify the Directors in recommending a dividend on the ordinary stock at the rate of 10½ per cent. per annum.

SALE OF GAS AND WATER STOCK AT PRESTON.—On Monday last week Mr. H. C. Walton offered for sale £537 worth of B stock, fully paid up, of the Preston Gas Company; and £350 worth of consolidated A stock and £463 B stock of the Fylde Water Company. The Gas Company's stock realized 137 per cent.; while the A stock of the Water Company was disposed of at par, and the B stock at the rate of 92 per cent.

WATER BILLS FOR 1880.

IN noticing the Water Bills which will be presented to Parliament in the ensuing session, we leave out of consideration the works they are intended to authorize. "Limits of deviation," too, are no concern of ours. As regards rates and charges, we mention them whenever they present any novelty; but, as a rule, they are now so universally established that scarcely any new feature presents itself.

The two following Bills are promoted to incorporate Companies for the supply of water in the districts mentioned in the Bills:—

The *Deerne Valley Water Bill* proposes to incorporate a Company with power to supply with water Hoyal and a number of other parishes in the Valley of Deerne, in the West Riding of York. The source of the water is to be a well or wells in the parish of Bromhill, presumably in the sandstone. The capital of the Company is to be £30,000, with power to borrow to the customary extent. This power is to be exercised rateably as the capital is issued. The charges for the supply of water are about what are commonly levied, but we notice that extra closets, &c., are to be charged for at the annual rack-rent, not, as usual, at a fixed rate. The limits of the undertaking are closely surrounded by those of some corporate bodies, so we are not surprised to find that the Company propose to restrict themselves from supplying water in bulk beyond their boundary.

The *Portmadoc Water Bill* is to incorporate a Company to supply water to several Welsh townships, the names of which we might transcribe, but would not presume to pronounce. The Company obtained a Provisional Order from the Board of Trade in 1871, but as the wants of the neighbourhood are constantly increasing, the Company are seeking incorporation, with power to add considerably to the works originally belonging to them. The capital of the incorporated Company is to be £16,000, of which £8500 is to be called "original." The usual borrowing powers are prayed for in respect of both classes of capital. The Company have selected as the source of supply a lake, the waters of which they propose to impound by extensive works. The ordinary rates for a domestic supply are much as usual, but the charges for extras are higher than those which generally obtain. Power is asked to supply water in bulk.

The *Sea Water Supply to London Bill* has already been noticed in our columns, and need only be briefly referred to now. A number of gentlemen propose to start a Company who will erect a pumping-station at Lancing, in Sussex, and then by a conduit, following a rather devious route, will bring the water of the English Channel to Fulham, from which place it is intended to distribute it among the aristocratic inhabitants west of Charing Cross. Sea water in London will no doubt be considered cheap at 10s. per thousand gallons. How many thousand gallons will be required to supply a West-end mansion for the time it is occupied in the season we shall not undertake to say; but supposing the water to be supplied by meter, we may take it that the consumption will be small. The capital proposed for the Company is £184,000, with borrowing powers to the usual extent. It is a remarkable fact that the Company have not limited themselves to a ten per cent. dividend. The mystification of preferred and deferred half shares is here put forward, but with what intention nobody can tell.

The Bills promoted to confer further powers on Water Companies already incorporated are as under:—

The *Cardiff Water Bill* is intended to correct certain oversights in the Corporation Water-Works Act of last year, which concerned the division of the purchase-money.

The *Exmouth and District Water-Works Bill* is to confer further powers upon the Exmouth and Budleigh Salterton Water-Works Company. The Company were formed in 1864, with a capital of £8000, with power to borrow £2000. By the Bill authority is sought to raise a further sum of £17,200 by the issue of shares and stock. The Bill also asks for power to borrow £5000.

The *Great Yarmouth Water-Works Bill* is to extend the limits of the Company, and to authorize them to raise further capital. The Company were incorporated in 1853, and by the Act of that year, and by subsequent enactments, they have been authorized to raise capital to the amount of £120,000, with borrowing powers to the extent of £26,000, nearly all of which has been called up and expended. By the Bill authority is sought to raise a further sum of £80,000 by the issue of shares or stock, with power to borrow to the usual extent.

The *Southwark and Vauxhall Water Company's Bill* has been repeatedly noticed in our columns. It seeks ambitiously

to obtain for the Company power to amalgamate with any one or all of the Metropolitan Water Companies, and further to raise additional capital to the amount of £650,000, with corresponding borrowing powers. Perhaps, however, the amalgamation proposals have now been abandoned. It is intended, under the powers of the Bill, to construct some new works. But water affairs in the Metropolis are in such an uncertain state, that it is scarcely necessary to speculate upon the results which will ensue from the presentation of the Bill to Parliament.

The *Wrexham Water-Works Bill* is to enable the Company to construct additional works and raise further capital. The Company were incorporated in 1864, with a share capital of £15,000, carrying the usual borrowing powers. The Act we mention authorized the Company, in the event of the capital not being found sufficient, to raise a further sum of £6000, and to borrow £1000. By a subsequent enactment, passed in 1874, the Company were empowered to raise a further sum of £20,000, and to borrow to the usual extent. By the Bill, power is sought to obtain £60,000 additional capital, with corresponding borrowing powers, and the Company ask for authority to supply water in bulk.

There is only one Bill—the following—in reference to the purchase of a Water Company's undertaking by the Local Authority; of course, excepting that for the acquisition of the London Companies works, which will be introduced as a public measure:—

The *Rochester Corporation Water-Works Bill* is to enable the Rochester Corporation to acquire the undertaking of the Strood Water-Works Company. The Corporation seek authority to borrow £6700 for the purpose of purchase, and a further sum of £7700 for additional works. The rates and charges proposed for the supply of water for domestic purposes are much as usual, although some of the items are lower than ordinary.

The following Bills are promoted in order to obtain for Local Authorities further powers in respect of water undertakings:—

The *Birkenhead Borough Bill* is an improvement measure, which, among other things, is to authorize the purchase by the Corporation of Birkenhead of the undertaking of the Wirral Water-Works Company, now supplying a portion of the borough. The terms of purchase are to be settled by mutual agreement.

The *Cork Improvement Bill*, so far as it relates to water, is simply to empower the Corporation to borrow £30,000 for the improvement of their water supply. The only novelty proposed, if it can be called one, is the issue of coupons with the mortgages, representing one half year's interest. The money borrowed is, of course, to be paid off by means of a sinking-fund. Beyond these provisions, the Bill only seeks some ordinary powers of inspection, &c.

The *Doncaster Corporation Water Bill* is to empower the Corporation to acquire, by compulsion or agreement, additional lands, described in a book of reference, and take for the purposes of their undertaking all water found in, on, or under such lands. No borrowing power is asked for, the Bill simply seeking authority to apply to the purposes of the Act money the Corporation already have power to raise.

The *Edinburgh and District Water Bill* is to authorize the Edinburgh Water Trustees to borrow a further sum of £120,000 for the completion of the works for which parliamentary power has already been granted. The Trustees have been in Parliament for several years, and have raised large sums of money, and by the Bill they seek power to raise money to pay current expenses.

The *Huddersfield Tramways and Improvement Bill* is, *inter alia*, to authorize a considerable extension of the water limits of the Corporation, and to sanction the borrowing of an additional sum of £150,000 for water-works purposes. A power, now commonly granted, is asked, which will give the Corporation the right to inspect wells, pumps, tanks, &c., within their limits, and, whenever it is thought desirable, to close or cleanse them.

The *King's Lynn Corporation Bill* offers the unusual spectacle of a Corporation making an endeavour to contract their limits of water supply by releasing them from a duty imposed by their Act of 1859.

The *Lancashire County Justices Bill* is to authorize the Justices to construct works for the supply of water to the County Lunatic Asylum at Whittingham. The source is to be a spring in a quarry, known as the Mountain Delph. The Justices by the Bill seek power to borrow to the amount of £20,000 on mortgage, and a further sum of £25,000 on security of the county rates. This latter loan probably does not

concern the water undertaking, inasmuch as the Bill is intended to find the Justices money to erect courts and lock-ups, which, happily, do not concern us.

The *Liverpool Corporation Water-Works Bill* is promoted by the Corporation of Liverpool to enable them to carry out what is known as the Vyrnwy scheme. This scheme has been so repeatedly noticed in our columns, that it is not necessary to refer to it further in this place. We shall not attempt to describe the works that will be needed to take the water of the Rivers Vyrnwy, Marchnant, and Afon Cowny through the country which lies between their source and Liverpool. Much discussion will yet arise when the Bill comes before a Parliamentary Committee; but we have a strong belief that the Corporation will succeed. To carry out the entire scheme the Town Council seek power to borrow three and a quarter millions sterling, which sum is to be paid off by means of a sinking-fund in the course of 100 years—a period which will give the Corporation ample time, always supposing the borough continues to develop at its present rate, to pay off their liabilities, and realize an ample profit.

The *Oldham Improvement Bill*, so far as regards the supply of water, is to extend the limits of the Corporation so as to include the district of Royston. The Corporation also seek power to borrow £100,000, for the construction of additional works.

The *Rathmines and Rathgar Townships (Vartry Water Supply) Bills* are to confer powers on the Rathmines and Rathgar Townships Improvement Commissioners and the Corporation of Dublin on the one side to take, and the other side to sell, Vartry water. The substitution of the new supply for the old will be a blessing to all interested in the change.

The *Sligo Borough Improvement Bill* is, among other things, to revive the powers for the construction of water-works, authorized by the Act of 1869, which apparently have never been exercised. In 1869 the Corporation obtained power to borrow £25,000. It would seem, however, that they never raised any of the money, and now they wish to borrow £30,000 to do the work for which, in 1869, £25,000 was thought sufficient. Possibly some day Sligo will get a good supply of water; but, at the rate at which the Corporation are now proceeding, it may be a long time first.

The *Stafford Corporation Bill* is, among other things, to authorize a considerable extension of the water limits of the Corporation, and, at the same time, to empower them to abandon certain works which they were authorized to make by their Act of 1876, and construct others better suited to the supply of their borough and limits.

The *Wakefield Corporation Water-Works Bill* is to authorize the Corporation to contract their limits of supply, and construct new works. The limits of the old Company are considerably lessened, and the Corporation will content themselves with furnishing water over a narrower area. The new source of supply is to be an impounding scheme, which is to collect water from the Booth Dean Clough, and certain streams upon the Rishworth Moors. When these works are completed, we hope we shall no longer have the opportunity of seeing the unfiltered water supplied to Wakefield used as writing ink. The works that are now contemplated by the Corporation are evidently extensive, for power is asked to borrow a sum not exceeding £300,000 to put them into execution. The Bill stipulates that the works shall be completed within ten years, and at the same time proposes to authorize the supply of water in bulk to other Local Authorities within or without their limits, and to furnish fittings, &c.

The *Wigan Improvement Bill* proposes to give the Corporation of the borough extensive powers of inspection over both the gas and water supply, the propriety of which we can honestly endorse.

THE GAINSBOROUGH GAS-WORKS AND THE LOCAL BOARD.—An adjourned meeting of the Gainsborough Local Board of Health was held on the Monday of last week—Mr. Bladon presiding—when the question of the propriety of purchasing the local gas-works was again under discussion. Mr. Marshall said the Finance Committee had considered the matter, and did not think it at all expedient to entertain the purchase. He therefore moved—"That it is inexpedient for the Board to purchase the gas-works, on the terms offered, at the present juncture." He said that as it would be necessary to borrow so large an amount of money he did not think the Local Government Board would entertain the purchase, as it would be saddling a future generation with the payment. Mr. Newmarch agreed that it was inexpedient to proceed with the negotiations, and stated that many of the mains had been down many years, and he knew several were out of repair. The Chairman said the question to be decided was whether it was advisable for the Board to go to the full extent of their borrowing powers for what was at most a doubtful speculation. Mr. Marshall said the town had opposed the purchase before, and most probably would do so again. The resolution, having been seconded by Mr. Newmarch, was then carried; so all negotiations will now cease.

Communicated Article.

THE HYDRAULIC MAIN.

By Mr. R. H. PATTERSON, F.S.S.

POSTSCRIPT.

In relation to my articles on this subject, I have been favoured with several communications from gentlemen well known in the gas world, and who have given their attention to improving the Hydraulic Main, &c. Among others, I have received a letter from my able and esteemed friend, Mr. G. Livesey, to whom gas manufacture of late years has been so much indebted; and as he permits me to make use of his statement "in my next article or otherwise," I gladly do so, and I am sure it will be read with interest and profit. Mr. Livesey writes to me as follows:—

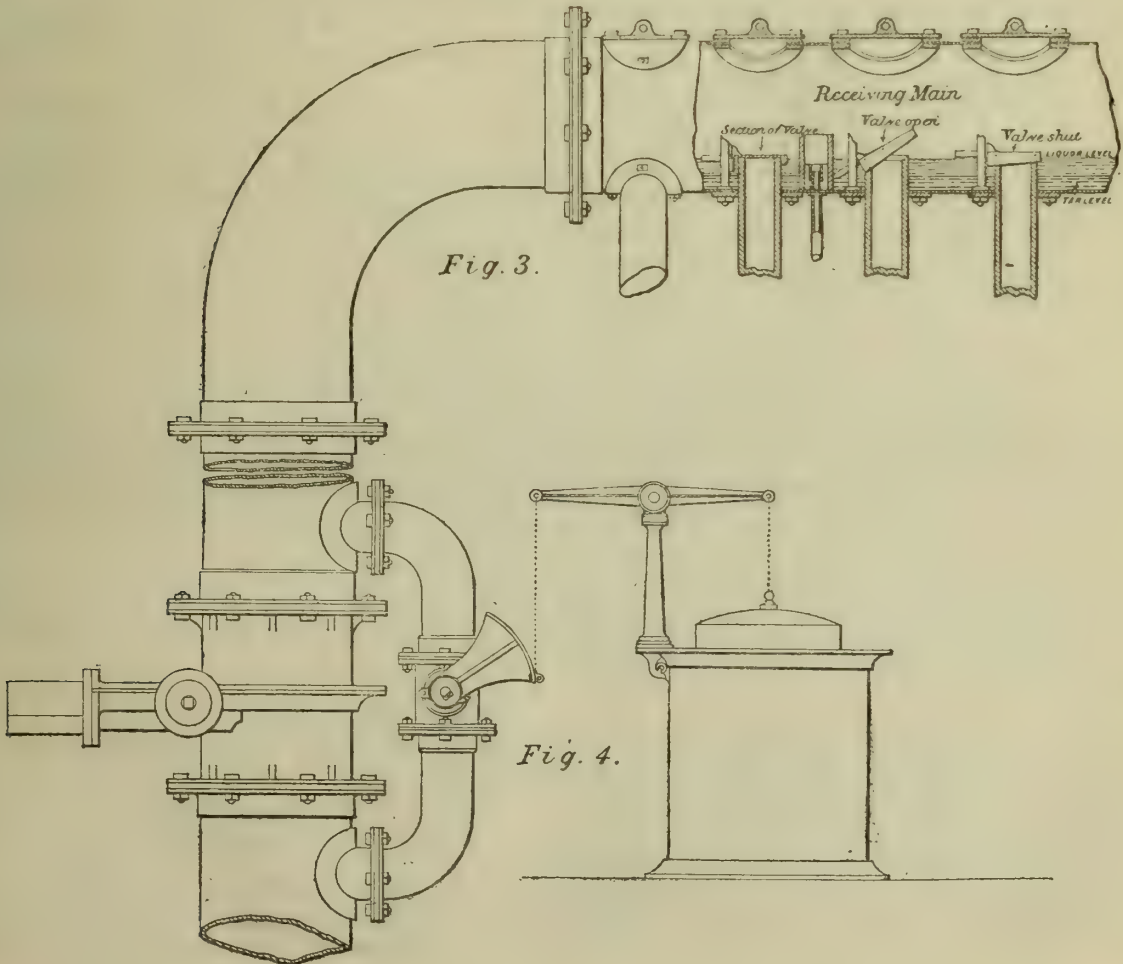
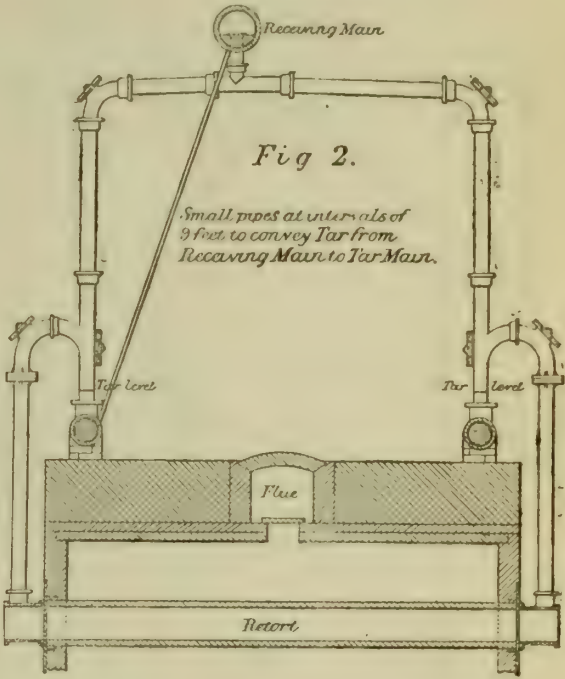
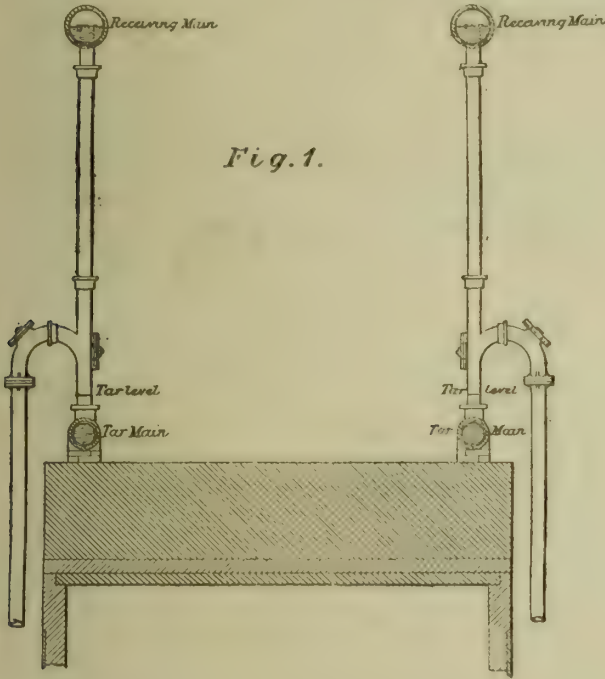
I read with great interest your articles in the JOURNAL OF GAS LIGHTING, because of their great intrinsic value, and my object in writing to you is to say that if you care to come to the Old Kent Road, you can see the idea recommended by you in this week's JOURNAL [Jan. 13] carried out in such a manner that any one twelve months hence seeing it would say: "You have acted on Mr. Patterson's suggestion."

The hydraulic main is abolished; a self-acting valve is employed; and

the gas is conducted into the "new receiving main." The tar is separated from the gas before it reaches the receiving main, and provision is made at intervals of 9 feet in that main for the separation of the tar from the liquor, and its removal from the main. The tar is thus always kept from contact with the gas, being covered with a stratum of liquor which flows with the gas.

The accompanying sketches show the whole arrangement. Fig. 1 shows two receiving mains, one for each side; fig. 2 shows one main and one valve only for each through retort, as an alternative plan; fig. 3 shows the valves; and fig. 4 the bye-pass arrangement for regulating vacuum and checking oscillation.

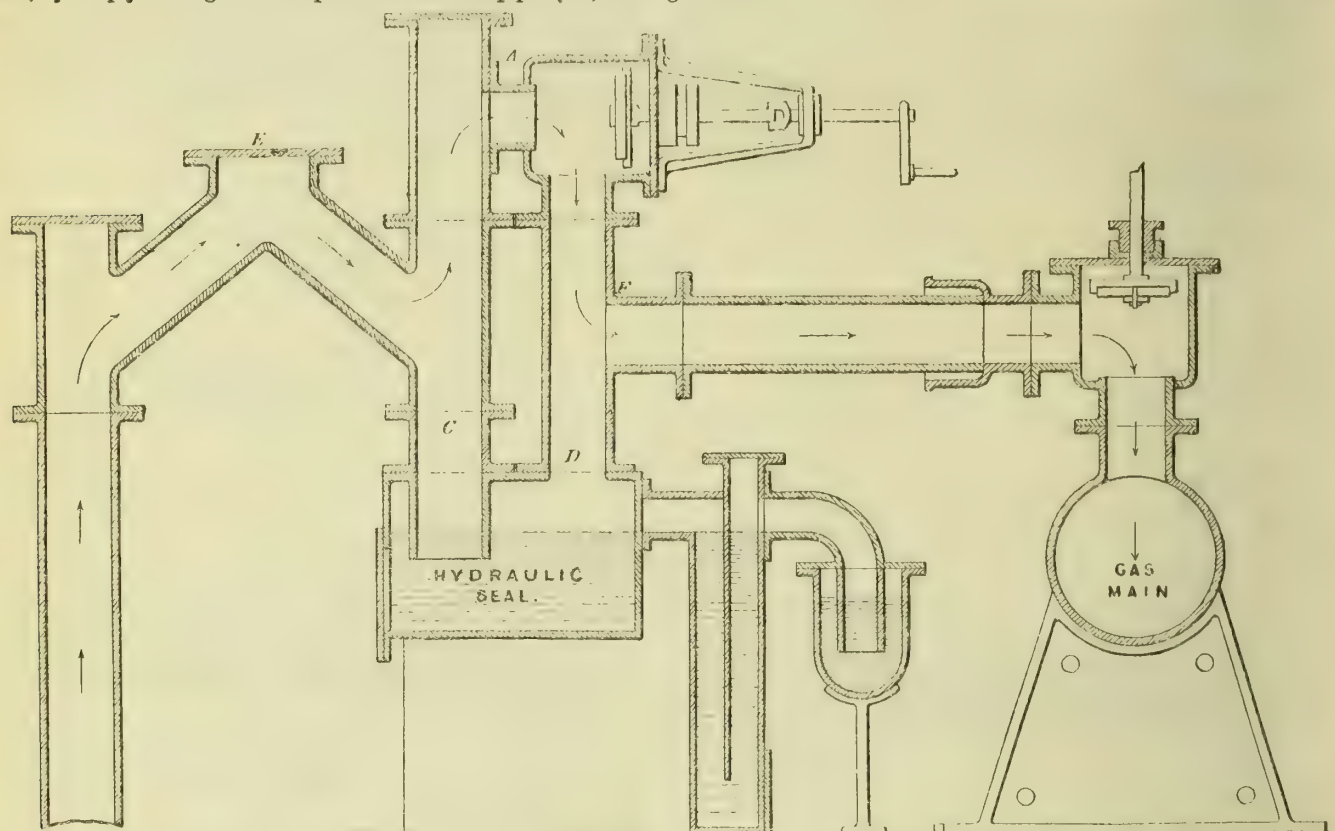
The thing looks well, but as it has only been at work a week or two I cannot say much about it at present. The self-acting valve, however, I have had at work for three months or more, and it answers perfectly; the valve can be adjusted to lift at any pressure. I prefer working at about 1-10th to 2-10ths in the retort; on no account at a vacuum, as air would be drawn in, to the great detriment of the gas. In order to work with a level gauge in the receiving main, I use at its inlet to the general main a bye-pass throttle-valve exactly the same as is used for the bye-pass of the exhaustor to prevent the vacuum getting too high. This also acts so well that I think of applying it to every retort-house, because the vacuum varies according to the distance from the exhaustor, giving more in one retort-house than another, and this governor bye-pass enables the vacuum to be kept constant in the hydraulic, whatever it may be elsewhere. The governor is actuated by a small gasholder in the ordinary way.



As will be seen, Mr. Livesey's arrangements, in some interesting points (as in his mode of applying the force of the Exhausters), go beyond the subject to which I must confine myself—namely, improvements on the Hydraulic Main. From the drawing which Mr. Livesey gives, it will be observed that all the tar formed between the summit of the Ascension-pipe and the top of the pipe which thence leads upwards into the Receiving Main must drain down into the Tar Main, and thereafter is entirely separated from the gas: and this is usually by far the larger portion of the tar. In the Receiving Main, however, the tar and liquor are kept at a fixed depth, as in the ordinary Hydraulic Main; and the pipes at 9-feet intervals are simply so many overflow-pipes. If the plates, or whatever it be that keeps the condensed matter at a fixed height in the main, were removed, so as to allow it all to flow down the present overflow-pipes, this would be, I shall not venture to say an improvement, but more in accordance with what I have suggested in these columns. Indeed, by simply cutting off the tops of the overflow-pipes (*i.e.*, the

portion which projects up within the main), the whole tar, &c., would be withdrawn at intervals of 9 feet; but, as it seems to me, it would be still better if a narrow trough, say about a foot in depth, were affixed to the bottom of the main, so as to keep the tar out of direct contact with the gas stream. This would very nearly correspond with what I have ventured to suggest.

I have also been favoured with some papers from Mr. White, of Abersychan, descriptive of his Anti-Dip Valve and concomitant arrangements, the value of which, I believe, is becoming recognized by gas engineers. The valve is thoroughly efficient, and as simple as possible—in fact, it is just what Nature adopts in the arteries and veins—opening forwards at the slightest pressure, yet insuperably resisting any back-flow. The gas and tar are allowed to flow together in his Main, which, as already said, I consider is a point to be (and may be easily) remedied; but, I believe, the pipe or main beyond the valve is short, and also ascends, so that the tar is quickly got rid of.



While mentioning these improvements of recent date, I must not omit—or, rather, I must recur more fully to the Anti-Dip arrangement patented and adopted in 1851 by Mr. T. N. Kirkham, of which he has kindly favoured me with a drawing. It will be observed that there are two large openings or pipes (C and D) through which the tar can descend, out of the way of the gas; and when the bye-pass, A, is open (as is the case when the retorts are in action), all the tar and other condensable matter deposited between the summit of the bridge-pipe, E, and the point F is entirely withdrawn. But from that point forward the gas and tar travel together. The object of this invention was simply to lessen the back-pressure occasioned by the hydraulic seal; nevertheless, as it happens, it is one of the very best arrangements, even at the present day, for lessening the contact between the gas and tar—a matter not thought of in 1851, or till long afterwards.

I cannot conclude without repeating my regret that the actual effect upon the illuminating power of the contact between the gas and tar as it occurs in gas manufacture should still remain so little investigated and ascertained. Mr. White maintains that the results obtained from his Anti-Dip Valve and concomitant arrangement demonstrates the absorptive action of the tar upon the illuminating elements of the gas. And comparing his own works with those in the same locality, where the same kind of coal is used, but where the old "dips" are retained, he says that he finds no difficulty in turning out 15-candle gas, while their gas is only of 13-candle power. So large a gain as this (*viz.*, fully 13 per cent.), and obtained from so simple and costless an arrangement, certainly calls for the investigation and consideration of gas managers. White's apparatus is employed at Maidstone and also at Tunbridge Wells. Will either Mr. West or Mr. Spice favour the readers of the JOURNAL with his experience of it?

THE MANCHESTER CORPORATION SANITARY WORKS.—Last Friday the members of the Manchester Scientific and Mechanical Society, to the number of about 30, paid a visit to the sanitary works of the Manchester Corporation at Holt Town, where some 1600 tons of refuse closet matter are dealt with weekly. Mr. Whaley, the Superintendent, conducted the members over the works, and explained the various processes of dealing with every description of refuse material, and stated that 240 tons of manure, which was sold at £3 per ton, were manufactured weekly, the expenses in connection with the manufacture and sale amounting to about 30s. per ton. From the clinkers a large quantity of mortar was made, but the depression in the building trade had of late rendered this difficult of sale.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

SAFETY LAMPS IN GAS-WORKS.

SIR,—Owing to my being from home for a day or two, I was unable to reply in your last issue to the letter signed "W.," which appeared in the JOURNAL of the 13th inst. "W." says: "I shall be glad to know if an explosion has ever been caused by a Davy lamp when properly attended to."

Now, it seems to me "W." has the notion that gas managers have the option of arranging the circumstances when an explosion may be imminent, or, rather, that the Davy lamp, when surrounded by peril, can be so "properly attended to" as to prevent an explosion. Nothing of the sort.

Our Armstrong-made Davy lamps are good lamps, cleaned, trimmed, and examined carefully twice daily; yet it is my opinion that when the moment of peril arrives, the Davy lamp may be termed either a "Jamie" or "Mikey" lamp, so far as safety by its use is concerned. When 130,000 cubic feet of gas per hour are being manufactured, should the purifiers get so hard or clogged as to cause the back-pressure to rise suddenly during the hours of night, the men in charge at once turn off the foul purifier to prevent the lutes from blowing. But, while they are engaged cleaning the purifier so turned off, and getting light from four or six Davy lamps, the extra high pressure has caused the valve to loose its seal, and the gas gets into the empty purifier; a breeze of wind is blowing, an explosion occurs, the men inside on the sieves are landed outside right over the edge, and the sieves take fire; I get the cover on, and the valve watered up again, and all is once more quiet. I have seen from 50,000 to 80,000 cubic feet of gas escape thus. If a quiet night or morning, no explosion would occur, and I believe a lamp lowered into gas would go out. Not so, however, when a current of air strikes against the side of the lamp; then the flame lengthens, leans towards the lee side of the lamp, the wire-cloth gets red-hot, and the gas is ignited; unless by the force of wind the gas was driven through the gauze, when an explosion of the lamp would occur.

This occurred here while a purifier-cover was being lifted, and the men in charge of the lamp had not time to remove it before they were enveloped in pure flame, but without explosion, caused by the breeze blowing towards the lamp. They frequently go out in a dull, heavy atmosphere charged with gas, and it is my impression that when a lamp is surrounded by a dangerous atmosphere, to hurry the lamp (which shows signs of danger being at hand) too quickly away might thereby

only increase the risk of explosion, as it induces a current of air and gas to strike against the lamp, and thereby act as if a current or breeze of wind was doing the same thing; and in all probability the lamp would either explode or the gas would be ignited through reddening of the wire-cloth.

Narrow escapes have occurred by being able to remove the lamp in danger in time to prevent an explosion; but, as often as not, when a moment of danger occurs, it might not be possible to remove the lamp in time.

As a rule, I treat the Davy safety lamps quite as gingerly as "W." does; but I cannot agree with him as to the expression "eventually," used in his letter. "W." says: "The wire would become red hot, and eventually cause an explosion." The word "eventually" may mean instantaneously; but I think the word generally denotes "after a time," "by-and-by," or "after an effort," whereas the explosion may then occur as quick as thought. When Davy lamps are required on a breezy or windy dark night, and a large volume of gas is escaping, I have no hesitation in saying that the use of them is highly dangerous.

Davy lamps supplied by gas would be preferable to oil-lamps. The light could then be instantly extinguished, and thus an explosion or an ignition of gas would be prevented, which, if oil-lamps were used, it might be impossible to get away from in time to avoid an accident.

The lamp which caused one of the fires I alluded to in my former letter was carefully examined, and found to be in perfect order, and the only sign of the ignition was that the wire gauze was burnt red on one side.

Gas-Works, Tradeston, Glasgow, Jan. 20, 1880.

WILLIAM KEY.

GAS-ENGINES.

SIR,—Owing to an oversight of mine, an error crept into my letter on "Gas-Engines," which you published last week. The fraction $\frac{1.663}{1.000}$ lb. correctly represents the quantity of coal per horse power per hour that the steam-engine would require, if all the heat of combustion were converted into power; but, by a mistake, this fraction is made equivalent to 0.081, or 1-12th of a pound, instead of 0.18, or a little over 1-6th.

The abbreviation H.P. was, in *Engineering* (from which you reprinted), misread "high pressure," instead of "horse power." I will therefore ask you to repeat the table of percentages of steam-engines, as the following is somewhat more correct than that previously given:—

Steam-engines using 2 lbs. of coal per horse power convert 9.0 per cent.

"	3	"	"	6.0	"
"	4	"	"	4.5	"
"	5	"	"	3.6	"
"	6	"	"	3.0	"
"	7	"	"	2.6	"
"	8	"	"	2.3	"
"	9	"	"	2.0	"
"	10	"	"	1.8	"

A correspondent has expressed his opinion that no gas-engine has worked with so low a consumption as 10 cubic feet. I have given only the manufacturers' statements. Allowing even 20 feet consumption, which has certainly been proved, the gas-engine converts twice as much as the best steam-engine, and ten times as much as some small ones. If, as is frequently the case, the gas-engine is tested by the friction brake, and the steam-engine by the indicator, the former is unfairly over-weighted to the extent of 20 or 25 per cent.

Cork, Jan. 22, 1880.

DENNY LANE.

Parliamentary Intelligence.

GAS AND WATER BILLS, 1880.

Up to Friday last, the final day for lodging memorials complaining of non-compliance with Standing Orders in the case of the remaining Bills on the list of petitions, no memorials had been received in relation to either the Hyde Gas Bill or the Sligo Borough Water Bill, the only two Bills having reference to gas or water; they will, therefore, go before the Examiners as unopposed.

The sittings of the Examiners commenced on Monday, the 19th inst., and continued during the week. Up to Saturday last the following unopposed petitions relating to Gas and Water Bills had been examined, and the Standing Orders declared to have been complied with:—

British Gaslight Company (Staffordshire Potteries) Bill; Burton-upon-Trent Corporation Bill; Cork Gas Bill; Cork Improvement Bill; Dagenham and District Sewage Bill; Denton and Haughton Gas Bill; Eastbourne Gas Bill; Exmouth and District Water Bill; Gaslight and Coke, Commercial, and South Metropolitan Gas Bill; Hinckley Local Board Bill; Huddersfield Improvement Bill; King's Lynn Corporation Bill; Lancaster Corporation Bill; Liverpool Corporation Water Bill; London Gaslight Company Bill; Oldham Improvement Bill; Portmadoc Water Bill; Prescott Gas Bill; Sea Water Supply to London Bill; Wrexham Water Bill; Yeading and Guiseley Gas Bill.

In the cases of the Rathmines and Rathgar Township Water Bill, Rochester Corporation Bill, and Southwark and Vauxhall Water Bill (opposed petitions), the allegations of non-compliance with Standing Orders were not sustained.

The consideration of the petition for the Phoenix Gas Bill was adjourned until the 9th of February.

ODESSA GAS AND WATER SUPPLY.—Last Thursday's St. Petersburg *Golos* publishes intelligence from Odessa, stating that in consequence of the frequent discovery of excavations and fissures in a number of houses, causing damage to the gas and water pipes, it is believed that the city is undermined and threatened with serious danger. A Commission has consequently been formed to conduct investigations underneath the town.

THE LOWER THAMES VALLEY MAIN SEWERAGE BOARD.—The Local Government Board have remitted surcharges, amounting to £1672 1s. 7d., recently made on members of the above-named Board. The only surcharge upheld is a small item of £4 0s. 6d., for a luncheon for witnesses at an inquiry held by Colonel Cox, at Kingston. The action in the Rolls Court to make the Board liable for the expense, amounting to about £500, of going to Parliament for a Bill last session, is, however, still undecided.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

THURSDAY, JAN. 22.

(Before Vice-Chancellor MALINS.)

CORPORATION OF BOLTON v. BOARD OF GUARDIANS OF THE BOLTON POOR LAW UNION.

In this case the plaintiffs prayed a declaration that the scheme for the sewage and outfall works of the defendants for their No. 1 special drainage district, and the loan contracted by them in respect thereof, were *ultra vires* and illegal, and an injunction to restrain them from proceeding with the works.

Mr. HIGGINS, Q.C. (with him Mr. FREEMAN), who appeared for the plaintiffs, said the real question in the case was whether, the defendants having obtained the sanction of the Local Government Board to their scheme of drainage upon a mis-statement of an important fact, and having obtained a loan of £15,000 from the Public Works Loan Commissioners really by virtue of the same mis-statement, they were entitled to go on with the works, which the plaintiffs said were prejudicial to them, not only as ratepayers, but as the Urban Authority in the borough of Bolton. The mis-statement to which he referred was simply this: The Local Government Board, before consenting to any scheme, required an answer to be sent to certain questions, one of those questions being, whether any of the works in respect of which the application was made were to be constructed beyond the limits of the applicants sanitary district; and to that question the answer "No" was returned.

Mr. GLASSE, Q.C. (with him Mr. RUSSELL ROBERTS), who appeared for the defendants, said it was a pure mistake.

Mr. HIGGINS said the excuse for the mistake, as given by Mr. Cooper, the Clerk of the defendants, was this, that by misapprehension on the part of the Engineer who filled up the form, the reply "No" was inserted in the draft of the printed form, and was forwarded to the Local Government Board without the error having been noticed. Upon this mis-statement they had obtained a loan of £15,000.

Mr. GLASSE said the amount obtained on loan was only £5000.

Mr. HIGGINS said that another point to be considered was whether the defendants were to be allowed to go on with any part of their scheme, having regard to the fact that a necessary part of it was within the plaintiffs district, because it would be a mere waste of money to go on with the scheme in their own district if they could not do without the part in the plaintiffs district. The proper thing for the defendants to do was to connect their sewer with that of the plaintiffs.

The VICE-CHANCELLOR said he understood the case had stood over for some time in order that the parties might come to a settlement, but they had not been able to do so. He would now suggest that they should refer the whole matter to a third person, to say what ought to be done, as it was plain they both wanted to arrive at the same point.

Mr. HIGGINS said he wanted the defendants to keep out of his district. The plaintiffs system of sewerage had cost about £50,000; the sewer was large enough to carry off the sewage of both districts, and a connection between the two ought to be made, instead of the defendants being allowed to make a sewer running parallel with that of the plaintiffs for some 2000 yards.

The VICE-CHANCELLOR inquired whether it would not be for the common benefit of all that there should be one sewer instead of two.

Mr. HIGGINS thought it would. His clients were perfectly willing to give a guarantee that their sewer was large enough for both.

The VICE-CHANCELLOR asked whether the defendants had constructed their sewer.

Mr. HIGGINS said they had been prevented from doing so. He had a right to object to their coming within his district, except they complied with section 28 of the Public Health Act of 1875 (which provided for the mode of communicating with a sewer), or had the sanction of the Local Government Board for so doing.

Mr. GLASSE said the Local Government Board having the matter before them, his lordship had no power to interfere. After the mistake which had been referred to was discovered, his clients gave a new notice, and upon the expiration of the prescribed three months Colonel Ponsonby Cox had been sent down to inquire into the matter.

Mr. HIGGINS said the defendants did not discover the mistake until they were before Colonel Cox.

Mr. GLASSE said they discovered in February that they were going out of their district, and thereupon fresh notices, as required by the 32nd section of the Public Health Act, had been duly served upon all persons and bodies entitled to receive the same. An inquiry had been held, but the decision of the Government Inspector had not yet been communicated to the defendants, and until the necessary sanction had been obtained they did not intend to proceed with the execution of that part of the scheme which fell within the district of the plaintiffs.

The VICE-CHANCELLOR said if so, there was no occasion for an injunction. Mr. HIGGINS said the defendants had advertised for tenders for the execution of the work.

Mr. GLASSE was willing to undertake not to go out of his district without first obtaining the consent of the Local Government Board.

Mr. HIGGINS could not be satisfied with the undertaking. As a ratepayer, he was entitled to stop the scheme altogether.

Mr. GLASSE said he could prove that the defendants system of drainage would be cheaper than the plaintiffs. They intended to proceed with the works within their own district, as they had a right to do, without obtaining any consent.

The VICE-CHANCELLOR inquired whether the £5000 lent by the Public Works Loan Commissioners would be expended by the defendants upon the works in their own district.

Mr. GLASSE said certainly, and they had the consent of the Board so to do.

Mr. HIGGINS thought it reasonable that this part should be left to the Local Government Board. It was the first time he had heard that the defendants had submitted themselves to the Local Government Board; but as it turned out to be so, his clients, as ratepayers, were willing to submit to the decision of the Board. Now that things had been discussed, he thought both sides might allow the motion to stand over generally, upon the understanding that the defendants would not attempt to proceed with the works in the plaintiffs district, without first giving ten days notice.

Mr. GLASSE did not see any harm in that, as he could not proceed without the sanction of the Local Government Board. Without prejudice to any question as to the propriety of the suit, and so forth, the motion could stand over upon the terms stated.

The VICE-CHANCELLOR said from what he had heard on both sides, it seemed to him to be pretty clear that inasmuch as the works were being constructed in a continuous district, it would be greatly to the advantage of both parties that only one sewer should be constructed, and he would strongly recommend the parties, if the two Engineers could not agree, to call in a third, to advise how one sewer might be made to drain both districts.

Mr. GLASSE said if it was possible of course it would be done.

Mr. HIGGINS thought the suggestion a very reasonable one. The VICE-CHANCELLOR said it seemed to him to be rather absurd to construct two parallel sewers.

The motion was ordered to stand over upon the terms stated, liberty being given to apply to advance the hearing in case the parties could not agree.

Miscellaneous News.

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Third Annual Meeting of this Association was held at the Midland Hotel, Birmingham, on Thursday, the 15th inst. There were present—Messrs. P. Simpson (Rugby), President; C. Hunt (Birmingham), ex-President; J. Tindall (Walsall), Treasurer; W. North (Stourbridge), Honorary Secretary; and a good attendance of members.

The HONORARY SECRETARY read the minutes of the last meeting, which were confirmed and signed. He also read the following report:—

In laying before you their second annual report, your Committee again desire to express their satisfaction at the progress made by the Association. The total number of members is now 37, being an increase of 4 during the year.

During the past year four ordinary meetings were held, with an average attendance of 20 members.

At the first meeting in the year, the President (Mr. Hunt) delivered an Inaugural Address, which has been printed and circulated among the members, after which a paper on "Meter-Rents" was read by Mr. Layton, of Redditch. The subject being such an important one, the paper was listened to with more than ordinary interest, and the discussion which followed was of a most interesting character.

At the second meeting the following subject was brought before the members:—"Public Lighting, with special reference to Streets, &c." An able and exhaustive paper on this subject was read by Mr. C. E. Jones, of Chesterfield, and a most interesting and profitable discussion followed.

At the third meeting an interesting and practical paper was read by Mr. Darwin, of Longton, on "The Manufacture of Gas from Coal Slack." The paper was thoroughly discussed by the members present, full particulars of which may be found in the quarterly reports.

At the last meeting, held in October, by the kind permission of the Gas Committee of the Corporation of Birmingham, their Windsor Street and Salford works were thrown open for the inspection of the members, who fully appreciated their kindness. Afterwards, Mr. J. Annan, of Wolverhampton, introduced the subject of Condensation; and opinions on this most interesting subject were freely given by the members present. Mr. Peaty, of Longport, then gave a lucid description of "Hislop's Patent Process for Converting Spent Lime of Gas-Works into Quick Lime."

Your Committee consider the work of the Association during the year to have been fairly satisfactory. They would again appeal to the members for their practical sympathy, and hope to have offers of papers or of subjects for discussion.

The TREASURER read the statement of accounts, as under, for the year ending Dec. 31, 1879:—

Dr.			Cr.
Balance brought forward	£4 19 10	Printing, stationery, postage, and reporting	£9 10 4
Subscriptions received during the year	17 6 6	Incidental expenses	0 2 6
			£9 12 10
		Balance in Treasurer's hands	12 13 6
	£22 6 4		£22 6 4

Examined and found correct.

JOHN STORER, } Auditors.
WILLIAM CROSS, }

Mr. C. E. JONES (Chesterfield): The statement of accounts is very satisfactory, but I should like to see an increase in our numbers, and I hope every member present will try and bring a new member, or candidate for membership, before the next meeting. The fact of having £12 13s. 6d. in hand points to great economy in administration, and it is a matter for much congratulation. I hope we shall not suffer any reverse with regard to our financial position, but go on prospering, and prosper likewise with regard to the number of members on our list. I beg to move—"That the report and statement of accounts as read be adopted, and entered on the minutes."

Mr. R. MORLAND (Gloucester) seconded the motion, which was put and carried.

NEW MEMBERS.

The HONORARY SECRETARY read the following minute from the Committee meeting:—"That Mr. H. S. Pike (Hinckley), and Mr. J. E. Palmer (Malvern), be elected members of the Association;" and on the motion of Mr. TINDALL, seconded by Mr. HUNT, the minute was adopted.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—Although I highly appreciate the honour which you have conferred upon me in placing me in this chair, I feel the duty of addressing you to-day (if it be a duty) is one which usage alone has created, and whether it would be "more honoured in the breach than in the observance" on the present occasion has troubled me not a little; but rather than shrink from any work which might be regarded as belonging to the honourable position to which you have elected me, I have ventured upon a task, my fitness for which I very much question. I am, however, much cheered and encouraged by the kindly feeling which pervades this Association at all our meetings. They have seemed to me to partake more of the character of family gatherings, where we have met to discuss the common good, and to advance the individual interests of each member of that family; and it is my earnest wish that such kindly feeling may long continue to be a marked feature of the Midland Association of Gas Managers. By cultivating such feelings we shall add much to the pleasure of our meetings, and also contribute largely to the knowledge of each of its members.

I take upon myself to say that, as an Association, we have done a fair share of useful work. Our papers and discussions have been of a practical and instructing character, and have done much to give information on the subjects under notice; and I cannot allow this opportunity to pass without again thanking our Past-President, Mr. Charles Hunt, for the great pleasure he provided for us all in arranging for such a complete examination into all the details of the electric light as most of us had the privilege of making at the Curzon Hall in this town. That examination, I believe, convinced most of us that there was yet a great deal to be done before the electric light wholly superseded gas light, and we are still of the same opinion. But let me say what I believe to be true—that gas managers are not the men to say that it will never be, but would rather rejoice to see the hard-working, anxious searcher after the missing link rewarded with success. It seems to take a long time to adapt this light to the wants of the public. I was rather surprised, on looking over my old copies of the JOURNAL OF GAS LIGHTING the other day, to find that in the very first number of that JOURNAL, published in February, 1849, a Mr. Staite had exhibited the electric light from the portico of the National Gallery, and was then forming a Company to bring the light into general use; and so it has gone on making slow progress up to now. There might be a great deal said about the different patents in use for producing the electric light, but as I must plead great ignorance on the subject, and am afraid I must be one of those who, when the light is brought into general use,

will have to retire into private life without a pension to cheer their declining days.

With gas it has been somewhat different. In 1792, Mr. Murdoch first used gas in his own house and offices; in 1797 that gentleman lighted Boulton and Watt's manufactory at Soho, near this town; and so it went on—every year some large factory or building was lighted up, till, in 1807, part of London was lighted with gas-lamps, and from 1810 to 1820 Parliament was literally deluged with Bills for lighting the large towns in this country. And so it has progressed till now, when there are in existence over 1700 companies formed for the purpose of supplying gas; and if we add to that number the private works for the lighting of mansions and factories, we may fairly say that there are over 2500 gas-works in Great Britain and Ireland.

Now let us for a little while consider the duty of those who have the oversight of the great amount of capital that is expended in gas lighting, in relation to their employers and to the public. And first as to their employers. In my opinion, success in the management of gas-works depends very much on the amount of attention that is paid to details; and the younger members of this Association will pardon me if I impress that fact on their notice. Much depends on the regularity and punctuality with which every duty is attended to, and the most trifling thing, if neglected, may be the forerunner of some serious inconvenience, or perhaps some disaster that will disturb the whole works. I believe I am correct in stating that although gas-works are more liable than most other manufactories to break down and become disarranged, yet we rarely hear of a town being in darkness through such misfortune; and this, in my opinion, says very much for the men chosen to manage these undertakings.

To go through the improvements made in the different apparatus used in the manufacture of gas would take up too much of your time. I should like to call your attention to the setting of retorts, and to any appliances that will improve those settings and reduce the fuel account. A great deal of our profits must come from economy in the retort-house. Let us see, therefore, that all the coal taken over the machine finds its way into the retorts. Then, again, our products become more valuable, and it is our place to see that the most is made of them, and that we send nothing out of the gas-works which should be kept at home; in fact, to use our best endeavours to cheapen the production of gas, so that the consumers may have it delivered to them in a condition fit for use, and as cheap as possible consistent with a fair return for the money expended in construction. Although much has been done in this direction, we have by no means reached the end of the chapter; so we must go on doing our utmost to reduce the cost, in order to increase the consumption, and be the better able to meet any rival that may try to take our place. This part of my subject may be summed up in a few words: Let us see that we gather up the fragments, so that nothing be lost.

Now a few words on our duty to the public. They have a right to be supplied with a good article, and in return for the monopoly that it is necessary for us to possess, we have not only a right, but it is to our interest that it should be as cheap as possible, taking into consideration the different circumstances under which we may be placed. I am aware it is difficult to convince the public that there are any circumstances in the case; but it is our duty to show them clearly and plainly that there are circumstances which must be considered in fixing the selling price of gas in different towns. I believe it is a fact beyond dispute that those gas companies who have taken the most trouble in educating their customers in the best modes of consuming the gas, either as to lighting, heating, cooking, or using it as a motive power, have been the most successful in keeping their customers satisfied, and in increasing their consumption. I am of opinion that we are only in our infancy as to the application of gas for heating and cooking purposes, and as a motive power. At first we were content to have engines of 1, 2, or 3-horse power driven by gas; but now we go in for 16-horse power, and I have no doubt that we shall have still larger ones.

I should like to say a few words on our relations to the parent Association, the more so as I believe that my early connection with that Association weighed somewhat with you in conferring upon me the honour of occupying this chair. The British Association of Gas Managers has grown far beyond the most sanguine expectations of its friends, and we all hope that it will still continue to grow until the name of every qualified person is placed on its roll. I feel quite certain that the Association would have been established and carried on by the combined energies of the men who started it, yet we are much indebted to Messrs. Thomas Hawkesley, T. G. Barlow, E. Goddard, and W. Esson, the first four Presidents of that Association, and to the indefatigable Secretary, Mr. James Blackburn, for its rapid growth and the strength which it acquired in such a short time. It has grown much since then, under the able successors of those gentlemen, until it now numbers nearly 700 members; and to me it appears that the numbers on the roll have to some extent altered its position. It must now take a higher platform than heretofore; it must now be the place where all the leading subjects under discussion must come up for settlement. Hence, in my opinion, the great need for such branch associations as this, where we can calmly and carefully consider the details of our manufactures, where every one can have an opportunity of expressing his opinion freely among his brethren of the district, which will greatly help him, and give him courage—and, let me say, it requires a great deal of that—to stand up and explain his views in the presence of the great numbers assembled at the annual meeting of the parent Association. I quite agree with the views expressed by the last President, Mr. W. J. Warner, at Newcastle, with reference to the annual meeting of the British Association, which, in his opinion, should be occupied in the discussion of some leading subject of interest, or that some new invention should be exhibited and explained, or statistical information gathered from the different localities where branch associations had been formed; and if, after due consideration, such work is thought not to be the best for the parent Association, it will still be our place, as a branch association, to supply at least one paper for the annual meeting of the parent Association, and in this way relieve the Committee of a great deal of labour.

There is one part of Mr. Warner's address at Newcastle to which I have not yet given my approval, and I think it would be well for district associations to consider the subject—namely, the classification of our members. It might not affect the parent Association, but I am of opinion that such classification would have a tendency to disturb that free and brotherly feeling that is such a marked feature in our Association. While I am free to acknowledge that the hard and careful worker should be honoured and have his reward, I feel assured that his energies will bring him to the front; but I am rather in doubt whether would be most appreciated by such members the honour, which merely consists in the fact that their efforts are recognized and have the full approbation of the rest of the members, or some more substantial honour, as would be the case if examiners were appointed to carefully weigh and consider the respective merits of such members. This subject is worthy of our careful consideration, and I should like it to be the subject for one of our meetings during the year.

I might have taken up more of the time of the meeting by giving my opinion on the various improvements connected with gas manufacture

introduced during the last year, and as to what we might be looking forward to for this year; but I would rather that such subjects should be brought before the Association when they can be discussed by the members.

I have only further to thank you for the kind manner with which you have listened to me, and to apologize for the crude remarks I have made. By your aid, and with what little energy I can put into the Association for this year, I hope at the end of it we shall be nothing worse, but stand in a better position. We ought to grow in numbers, and I hope this will be the case during my presidency.

Mr. C. HUNT said they had all listened with pleasure to a most excellent address, and he moved that the very cordial thanks of the meeting be given to the President for it.

Mr. JONES seconded the motion. He said that the address was fraught with practical knowledge. It did not deal with the abstruse problem of electricity, nor with such questions as were probably more interesting to the metaphysician than to gas managers; but it did deal with such questions and such matters as every gas manager, whatever might be the extent of his responsibility, must undoubtedly take to himself. Personally, he thanked Mr. Simpson for calling his (Mr. Jones's) attention to the necessity of dealing with details. It was of the utmost importance, to his mind, that all persons in charge of gas-works should attend to detail, and unless proper attention was bestowed upon the details of the establishment, nothing like successful management could result. There was only one point to which he took exception in the address. Mr. Storer said the Midland Association was a branch of the parent Association. He (Mr. Jones) maintained that the shortcomings of the parent Association necessitated the formation of minor associations or district associations in various parts of the kingdom. He was not for a moment endeavouring to disparage or depreciate the value of the parent Association; he should like to see every gas manager a member of the Association, believing that "unity is strength," and that if a man had any pretensions whatever to call himself the manager of gas-works, he had no right to withhold his public support to the business he called his own, but that he ought to join the parent Association. The parent Association, however, had not supplied a free and easy means of intercourse and for the interchange of opinion, which was so desirable among gas managers who wished to unravel the mysteries of their profession; and therefore it was district associations had sprung into existence with more or less success, and supplied the want before alluded to. That such an association as the Midland Association of Gas Managers was requisite, and indeed was imperatively demanded in the district, was, he thought, evidenced by the fact that, though this was but the third annual meeting, they had, comparatively speaking, maintained their position, both with regard to the scientific bearing and value of the discussions, and also with regard to numbers. He did not consider the Association was at all indebted to the British Association of Gas Managers for its formation, but to the public spirit of the members, and the necessary intercourse which all felt to be requisite in order to exchange views upon an ever-varying industry. He most heartily and thoroughly endorsed every word that the ex-President had said with regard to the President's address.

Mr. HUNT said it was not customary for them to discuss the matter of the President's address, and he trusted it never would be. Mr. Jones had, however, referred to one point in it, and it seemed to him (Mr. Hunt) desirable that this reference should not pass without observation. Mr. Jones appeared to attribute the formation of district associations to shortcomings on the part of the British Association, whereas it seemed to him (Mr. Hunt) that it was the very success of the latter which rendered the formation of the former not only desirable, but almost necessary. The large annual gatherings of the parent Association necessitated the observance of strict formalities in the conduct of the meetings, rendering them less adapted for what he might term elementary work; whereas at the gatherings of district associations the members met in a semi-private manner, and were able to discuss matters fully and freely amongst themselves. In this way the district associations performed most useful work, preparatory, as it were, to the advanced school in which they were all more or less ambitious to shine.

The motion was then agreed to.

The PRESIDENT, in acknowledging the vote, said it was perhaps right that he should defend himself with reference to what Mr. Jones had said regarding the parent Association. What he meant was, that the parent Association, by its numbers, was stopped in its usefulness, and he tried to express that the district associations nearer home were just the things that were wanted, where one could express an opinion freely; but he thought the day was distant when they would say they had no connection with the parent Association. If that was what Mr. Jones meant to infer from what he (the President) had said, he misunderstood him, as he referred to the parent Association taking a higher platform, where the district associations could bring their quota to make it worthy of the British Association.

Mr. JONES explained that what he meant was that the parent Association never did supply to its members the same facility as was supplied by the district associations; and hence the necessity sprang up for the district associations. That they had so sprung up and been so useful was, he considered, a matter for great congratulation. As he said before, he did not wish to disparage the parent Association in any shape or form, but he certainly believed in the district associations as being calculated to confer considerable benefit on all gas managers who joined them.

Mr. ANNAN (Wolverhampton) said it would be quite impossible for the parent Association to carry out what Mr. Jones required, seeing it only met once a year. It, therefore, could not do what the district Associations did, meeting oftener. If he modified his statement, it might be sent forth, but it would never do to send it forth unexplained.

The PRESIDENT said he had belonged to the parent Association since its formation, and it was only when the number of members was smaller that they were able to go into the details of an argument as at their (the Midland Association's) discussions. When the number of members was less, he enjoyed it as much as ever he enjoyed the district meetings; but it was quite impossible to have quarterly meetings when the members had such long distances to travel.

[A paper on "A New Form of Washer," was then read by Mr. W. North, of Stourbridge. This, and the report of the subsequent proceedings at the meeting, we reserve till next issue.—ED. J. G. L.]

ONGAR GAS COMPANY, LIMITED.—This Company, which was registered on the 17th inst., with a capital of £8000 in £5 shares, proposes to purchase the private gas-works and apparatus at Ongar, Essex, now used for lighting the place.

EXTENSION OF THE LEEDS CORPORATION GAS-WORKS.—Last Saturday's Leeds Mercury states that, at a meeting of the Gas Committee of the Leeds Corporation, held the previous day, it was resolved to proceed with an extension of the gas-works at New Wortley, for which there is vacant ground available; and Mr. Henry Woodall, the Gas Engineer, was instructed to prepare plans with that view.

THE PUBLIC LIGHTING OF DUBLIN.

An Adjourned Meeting of the Corporation of Dublin was held on Monday, the 19th inst.—the LORD MAYOR (Mr. E. D. Gray, M.P.) presiding—when,

The TOWN CLERK said that he had received a further letter from Mr. W. F. Cotton, Secretary and Manager of the Gas Company, as to the terms on which gas could be supplied for the public lamps. The Committee on Public Lighting had nothing to propose in reference to the letter, and so had merely asked him to read it. It was as follows:—

Dear Sir,—I beg to acknowledge the receipt of your letter of the 3rd inst., in which you state "that the Committee infer that, though the Company state they cannot reduce the price, the charge proposed in the letter referred to for the gas supplied is the ordinary price charged for gas within the city." In reply, I am directed to state that it was by arrangement with the Corporation, made over three years since, that the gas supplied to the public lamps was charged at the ordinary price to consumers—a system similar to that in London and elsewhere.

Referring to the question of discount, the Committee have evidently overlooked the fact stated in my letter of the 24th ult. [see ante, p. 18]—viz., that the Company have invested a large amount of capital in the public lighting plant, and have given the Corporation the use of same, free of charge, whereas in London and other large towns the plant has been supplied at the expense of the Local Authorities. The interest upon the capital invested by this Company in said plant, added to a portion of the cost of repairs, painting, &c., with meter-rent, is equal to a discount of about 40 per cent. on the gas consumed in the public lamps. Although present circumstances will not admit of any change in the price of gas, my Directors will take the first opportunity for making a general reduction, in which the Corporation will participate. They have embraced every occasion for doing so, notwithstanding that they were not bound by agreement, in evidence of which I may mention that they adhered to the terms of the arrangement made with the Corporation three years since, the price of gas for public and private consumption within the city could have been maintained at 4s. 6d. per 1000 cubic feet, instead of which they reduced the price to 4s. 3d. from January, 1879.

Your letter implies that in mine of the 24th of December my Directors proposed arbitration. Such, you will find, is not the case; but having submitted terms which they considered most reasonable, and the Committee being of the contrary opinion, the course open to the Corporation for ascertaining whether the terms were excessive or otherwise was simply pointed out.

Referring to the last paragraph in your letter also, you notice, under the 34 & 35 Vict. c. 41, if the Committee deem fit to vary the terms of my letter of the 1st inst., my Directors will offer no objection; but it is to be distinctly understood that for any term less than one year the charges will be as follows:—For gas, 4s. 3d. per 1000 cubic feet; meter-rent at the rate of 3s. per meter per annum; repairs, painting, &c., at the rate of 9s. per lamp per annum; rent for the use of lamp-columns, lamps, and other public lighting plant, 10s. 6d. per lamp per annum.

(Signed) W. F. COTTON.

Alderman HARRIS said the Council ordered the Committee to request the Gas Company to continue the lighting of the city for three months. They did so, and the Council had now before them the reply of the Company. The Committee were not prepared to offer any suggestion in the matter.

Mr. MAYNE said that matters looked much worse on this question now than when the Committee commenced their negotiations; and, but for the electric light scare, there would be only one course open to the Council—namely, to go to Parliament and obtain power to make gas for the citizens, within the municipal boundaries at all events. The Gas Committee had gone carefully into this matter. They had found that the Corporation of Belfast were supplying gas to their Municipality at 2s. 9½d. per 1000 cubic feet, and were putting by a large profit. They had accumulated a surplus since 1874, which amounted to between £70,000 and £80,000. They were doing this although they had had to pay every farthing that had been invested in gas plant in Belfast since 1823; they had paid in round numbers £196,000. If the Dublin Corporation were to obtain parliamentary powers for the manufacture of gas, they could supply it for 2s. 6d. per 1000 feet, giving as good a quality of gas as was at present supplied. He thought they would be fully justified in trying to save the citizens the difference between this amount and 4s. 3d. per 1000 feet. The question would come before the Council much sooner than the Gas Company thought. In the paper of business there was a communication from electrical engineers in London, who, of course, made the best case they could; but what they alleged was that for the illumination of large spaces the electric light was much better and more economical than gas. The question would come before the Council in a few weeks, for one of the largest spaces they had to light was Sackville Street. A few experimental lamps had been put up by the Gas Company in Lower Sackville Street; and, up to the present time, the Company had not charged for the extra gas that was consumed in these; but they had now called on the Paving and Lighting Committee to decide whether they would retain these lamps or not, as they (the Company) were anxious to remove them, and return to the burners that were there before. The Committee asked for particulars, and found that each of the new lamps consumed four times as much gas as one of those constructed on the old principle. The cost of the large lamp in the centre of the street, next Carlisle Bridge, was 4d. per hour, or £57 15s. 10d. per year. Before the alteration in the lamps, there were 83 lamps in Sackville Street, the cost of lighting which was about £290 a year. That multiplied by four would bring the cost of lighting the street with the new lamps above £1000 a year. They could hardly afford to spend so much on a single street. The difficulty, however, the Committee were in, was that the citizens liked the improved lighting.

Mr. McEVoy moved that the letter should be inserted on the minutes, and the Committee requested to report at once respecting the question of reference to arbitration under the Gas-Works Clauses Act, 1871.

Mr. J. P. BYRNE seconded the motion.

Alderman HARRIS said the arbitration clauses of the Act were very dangerous, and he did not like reference to arbitration. He would like to know where such a course would be likely to land them, and suggested that a contract should be entered into for twelve months, and in the meantime the gas question should be referred to a Committee.

Alderman GREGG said he had been induced to obtain a report of the Belfast Corporation Gas-Works, and he did not think it was any use instituting a comparison between the Gas Company in Dublin, who were working upon commercial principles, and in existence avowedly for making a profit, and the Belfast Corporation, who had borrowed their money at 4 per cent., while the Shareholders of the Gas Company received 10 per cent., or a difference between the two of 6 per cent., or 8d. per 1000 feet of gas sold. He had been, in the days of the old Gas Company, in favour of buying their works; but he was afraid that the present Company's works would not be offered on the same terms. He might state that the Belfast Corporation carbonized 50,000 tons of coal annually, and the Dublin Gas Company 109,000 tons. Taking the capital of the Company at £737,000, and taking the capital of the Corporation at £500,000, they found the capital of the Company 50 per cent. in excess of the capital of the Corporation. Each million cubic feet of gas, however, cost the Belfast Corporation £1080; and in Dublin, although the capital was much higher, it only cost £815. This showed that there was either a great amount of economy, a much better method of carbonization, or less leakage. He did not think, therefore, it was a business or common-sense way to approach the Gas Company as if they were a set of schemers. The Dublin lamps cost £3 8s. each for lighting, cleaning, and everything else. The price paid by the Corporation of London, and other Corporations, was from £3 19s. to £4 7s. apiece; and, in addition, the Local Authorities had to pay for plant and everything else. If the Dublin Corporation went to

arbitration, they would find they would have to pay for every single thing connected with public lighting, which they did not do now.

Mr. MAYNE said the paid-up capital at Belfast was £200,000, and the old Company borrowed £50,000 at the time of purchase. They were working the whole gas business of Belfast upon an area of 7000 acres, while the municipal area of Dublin was only 4000 acres. On a capital of £250,000, the Corporation had to pay, in order to get the works, £196,000 for goodwill. They borrowed all this money—£450,000—and Alderman Gregg said they were only paying 4 per cent., but they were paying 6 per cent., paying off the capital and interest together, and in a certain number of years the people of Belfast would have gas at less than half the present prices. Alderman Gregg's figures proved his (Mr. Mayne's) case, that the Corporation were bound to step in and save the citizens.

The resolution was passed.

THE BRITISH GAS COMPANY AND THEIR POTTERIES STATION.

A Meeting of the Hanley Town Council was held last Tuesday—the Mayor (Mr. J. Bromley) in the chair—when the General Purposes Committee reported that they had received a letter from Mr. F. L. Linging, the Secretary of the British Gaslight Company, Limited, stating that the Directors had no intention to part with their gas-works at Etruria. Also that the Town Clerk had submitted to them a Bill to be brought before the ensuing session of Parliament by the Company for empowering them to enlarge their works and to expend further capital to the amount of £75,000. The Committee stated they were of opinion that the Bill would prejudicially affect the interests of the ratepayers of the borough, and they recommended that immediate steps be taken to oppose the Bill in its present form.

Alderman GILMAN moved the adoption of the report.

Alderman RIDGWAY said that, in order to enable the Committee to oppose the Company's Bill, it would be necessary that a special meeting of the Council should be called. The Company sought to extend their capital to a considerable amount, and at a high rate of interest, without giving security for the public audit of their accounts. There was no guarantee that there would be any diminution of the present charge for gas; but perhaps, by negotiations, better terms than those contained in the Bill to be submitted to Parliament might be obtained, failing which they would have no alternative but to oppose the Bill. He seconded the motion for the adoption of the report, with the addition that a special meeting of the Council be convened for the purpose of passing a resolution for opposing the Bill.

Mr. HAMMERSLEY directed attention to the provisions of the proposed Bill. The Company, he said, wished to raise capital, and pay a dividend of 7 per cent., while the Bill contained none of the redeeming features of recent legislation on the subject—the auditing of the accounts by the Corporation, the reduction of the price of gas on a sliding scale, and the sale of shares by auction. He contrasted the accounts of the Company with those relating to the gas-works at Stoke and Fenton, and argued that if the Hanley Corporation obtained the works on the same terms as those for which the Stoke and Fenton works had been obtained, the profits would enable the Council to save 1s. in the pound on the borough-rate.

Mr. BEBBINGTON moved, as an amendment—"That the General Purposes Committee be requested to open negotiations with the Gas Company with a view to prevent going to Parliament to oppose the Bill," and gave his reasons for doing so, which were mainly that the past experience of the ratepayers going to Parliament on the gas question was such as would not make it advisable to again take such a step, if by other means the Corporation could obtain the protection they would seek.

Alderman POWELL seconded the amendment, and said he should not be satisfied until the Corporation had the gas-works in their own hands. He felt sure they would have them, and that possession of them was only a question of time.

The CHAIRMAN said the letter the Company had sent stated that they had no intention to sell.

Alderman CARTLEDGE said the main question which the Corporation would have to fight in reference to the Bill was the rate of interest to be allowed on the borrowed money. They should direct their efforts to prevent the Company paying more than 4 per cent. on the money proposed to be borrowed.

Two resolutions were afterwards submitted to the meeting and carried—the first being that a special meeting of the Council be convened to consider the Bill, and the second that the Committee be requested to enter into negotiations with the Company with a view of securing the desired alterations of the Bill without the necessity of going to Parliament to oppose. The report of the Committee was also formally adopted.

THE GAS SUPPLY OF STONE.

Among the notices of applications for Provisional Orders, which appeared in the JOURNAL for the 2nd ult., was one by the Stone Local Board, who intend applying to, and have lodged with the Local Government Board for approval and confirmation, an Order to empower them to construct gas-works within the district of the Board and the townships of Stone and Meaford, and to manufacture and supply gas within this district and the townships of Aston, Darlaston, Meaford, Oulton, and Walton.

At the meeting of the Local Board on Monday of last week—Dr. E. FERRIE in the chair—a letter was read from the Local Government Board, stating that a memorial had been received from the Stone Gaslight and Coke Company with reference to the application. A copy of the memorial was enclosed, and the Central Authority requested to be furnished with any observations the Local Board might make in regard to it. Among the grounds urged by the Gas Company against the granting of the Order were (1) that the town and villages surrounding are amply supplied with gas of more than the average quality, and no complaints whatever are made; (2) that when the Company bought the old works the price of gas was 7s. 6d. and 6s. 8d. per 1000 feet, but it now stands at 4s. 2d. net, with the exception of the brewery and town lights, which are charged 3s. 9d. per 1000 feet; (3) that when coals were dear, during the years 1872 to 1876, the Company did not raise the price of gas, but charged the usual price, which was not done in other towns; (4) that the present works are capable of making gas for double the present population of Stone, the make for the last year having been about 12 million feet; (5) that the Road Surveyor (prior to the foundation of the Local Board) never made any complaint against the Company for breaking the roads; and it was further submitted that the sewage scheme should be carried out before the Local Board interfered as to gas-works, and even then the rates would be so heavy that numbers within the district would be unable to pay them.

In support of the objections, copies of letters were sent from Mr. J. M. Darwin, of the Corporation Gas-Works, Longton, and Mr. John Storer, of the Stafford Corporation Gas-Works, stating that after going through the accounts of the Gas Company they had made the following valuations of the plant and works:—Mr. Darwin, upwards of £20,000; Mr. Storer, from £20,000 to £25,000. Certificates had also been received by the Local Government Board from certain residents of the town and immediate neighbourhood, stating that the quality, quantity, and efficiency of the

supply of gas by the existing Company were in every way satisfactory; also that additional gas-works were unnecessary and uncalled for.

After considerable discussion in committee, it was agreed to instruct the Clerk to reply to the letter from the Local Government Board that they consider (1) that the Stone Gas-Works are badly situated, being close to the principal street of the town, and the gasholders placed within 50 yards of a large population; (2) that the works have hitherto been unskillfully managed, an explosion having occurred in July of the last year which alarmed and endangered the lives of all residing in the neighbourhood; (3) that in spite of repeated complaints from the inhabitants, and from the Local Board, the Company continue the use of lime as a purifier, instead of oxide of iron, thus creating an intolerable nuisance, which has seriously deteriorated the value of property in the vicinity of the works; (4) that the price charged for gas is exorbitant, considering the profits that have been derived from the works, as proved by the fact that on the incorporation of the Company in 1877, with a capital paid up of £9000, divided into 1800 £5 shares, 600 only of the shares had been subscribed for, the remaining 1200 having been manufactured out of the profits, and distributed *pro rata* as a free gift to the Shareholders. He was further instructed to state that the Company have, ever since their formation, paid a dividend of 5 per cent., and for many years past 10 per cent. The half-yearly balance-sheet published in March, 1879, showed that, in addition to paying a dividend at the rate of 5s. per cent. on the trebled capital, the earnings would have justified a division of more than double that amount, which surplus, instead of being utilized by the Directors to reduce the price of gas, was put on one side to pay for the cost of further improvements and extensions. The Local Board having only recently obtained this information, and having been already told by the Directors that they could not afford to lower the price of gas to private consumers, proposed to purchase the undertaking, which, it was then discovered, had no statutory powers attached to it. This proposal had elicited from the Secretary of the Company the reply that the Directors would advise their Shareholders to sell the works for £20,000, but he was instructed to add that it would be of no use for the Local Board to offer a less amount, thus effectually barring the way to any valuation and purchase by arbitration. The Local Board then submitted the following resolution to the Gas Company as a way out of the difficulty, since the price would then be fixed by Act of Parliament, and the Local Board would be able to obtain the necessary powers of control as to the quality, quantity, illuminating power, and pressure of the gas supplied to them:—"That negotiations be suspended until the Gas Company have obtained either an Act of Parliament or a Provisional Order to legalize their undertaking, when the Local Board will be willing to purchase the works by valuation; but, that there may be no further delay, the Clerk be instructed, in case of a refusal, to serve, before the 1st of November, upon the Company, the notice required of the Board's intention themselves to apply for a Provisional Order, but to explain that an application for a Provisional Order by the Gas Company will be accepted as satisfactory." The Gas Company took no notice of this request, though ample time was allowed them, hence the present application by the Local Board, as the only way to relieve the ratepayers of the overcharge in the price of gas. The Local Board were aware that the district could not sustain two gas undertakings, but they ventured to think that the undertaking which had statutory powers would be the only successful one. Extraneous matters introduced as objections by the Gas Company did not appear to the Local Board to require any answer from them.

SALE OF SHARES IN THE GRAND JUNCTION WATER-WORKS COMPANY.

On Thursday last, Messrs. Edwin Fox and Bousfield offered for sale at the Cannon Street Hotel 1000 £50 shares in the Grand Junction Water-Works Company, being the first portion of the additional capital of £300,000 authorized to be raised by the Company's Act of 1878. The shares are entitled to a dividend not exceeding 7 per cent. per annum, and were submitted to public competition under the auction clauses in the above-named Act.

In opening the sale, Mr. BOUSFIELD briefly referred to the financial position of the Company, the capital of which, he said, amounted to £1,248,465, the income from water-rents last year having been £135,289. The Company's available profits applicable for payment of dividend and interest had increased year by year for many years. In 1871, the profits were £59,202; in 1878, they amounted to £83,353. The dividend paid on the ordinary share capital of the Company was in each half year of 1878 at the rate of 7 per cent. per annum; in the first half year of 1879 at the same rate, and in the second half of the year at the rate of 7½ per cent. The debenture debt of the Company was small, there was no preference stock, and all the works were in good order. There was great scope for increase in revenue, as the district over which the Company had the monopoly was now being opened up by additional railway communication with all parts of London. In his opinion, therefore, the shares offered one of the best investments in the market. The dividend would accrue as from the day of sale, and though the shares were not entitled to a higher dividend than 7 per cent., yet by the increased interest on other shares they partook practically of a preferential character. A reserve price had been placed on the several lots, but it was a purely nominal sum, and the highest bidder would become the purchaser. The shares were offered singly, and in lots of two, three, and four, and buyers of any lot had the option of taking any or all of the next four lots at the same price per share.

The biddings then commenced, and the following prices were realized:

2 shares at £91 each	£182	0	0
188 " " 90 "	12,420	0	0
22 " " 89 "	1,958	0	0
28 " " 88 "	2,464	0	0
63 " " 87 "	5,742	0	0
10 " " 86½ "	865	0	0
38 " " 86 "	3,268	0	0
11 " " 85½ "	910	10	0
39 " " 85 "	3,315	0	0
3 " " 84½ "	253	10	0
21 " " 84 "	1,764	0	0
22 " " 83½ "	1,837	0	0
4 " " 83½ "	333	0	0
27 " " 83 "	2,241	0	0
20 " " 82½ "	1,655	0	0
35 " " 82½ "	2,897	10	0
36 " " 82½ "	2,961	0	0
27 " " 82 "	2,214	0	0
53 " " 81½ "	4,319	10	0
39 " " 81 "	3,159	0	0
41 " " 80½ "	3,563	0	0
135 " " 80½ "	10,867	10	0
180 " " 80 "	14,400	0	0

1000 shares Total amount realized . . £83,599 10 0

METROPOLIS WATER SUPPLY.

Lieut.-Col. Bolton, in his report to the Local Government Board, on the water supplied by the Metropolitan Water Companies during last month, says: "The state of the water in the Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated) was good throughout the month, except on the 30th and 31st of December, when it was very turbid and bad. The highest flood state of the river at West Molesey during the month was 1 ft. 8 in. above summer level, and the lowest the summer level, the rainfall being 0.54 inch. The water in the River Lea was generally good during the month. [These remarks refer to the condition of the water previous to filtration.] The water at all the intakes was generally in a good condition during the month of December, and the filtration was efficient, the water supplied by the whole of the Metropolitan Water Companies having been clear, bright, and properly filtered."

THE LIVERPOOL CORPORATION (VYRNWY) WATER SCHEME.

TOWN COUNCIL MEETING TO APPROVE THE BILL.

A Special Meeting of the Liverpool Town Council was held last Wednesday—the Mayor (Alderman Hall) in the chair—for the purpose of confirming the propriety of promoting the Bill in Parliament, of which notice has been given, for carrying out the Vyrnwy water scheme. The meeting was held in compliance with the Borough Funds Act, which requires that the resolution voting the necessary expenses out of the funds or rates in the hands of the Council should be carried by an absolute majority (33) of the whole number of the Council.

A communication from the Liverpool Land and Householders Association was read, urging the Council to postpone the promotion of the Bill.

Mr. WILSON, Chairman of the Water Committee, formally moved the following resolution:—"To consider and, if thought expedient, to confirm the propriety of promoting a local Bill in Parliament, intitled 'A Bill for enabling the Mayor, Aldermen, and Burgesses of the borough of Liverpool, in the county of Lancaster, to obtain a supply of water from the Rivers Vyrnwy, Marchnant, and Afon Cowny, in Montgomeryshire, and for other purposes,' and to authorize and empower the Water Committee of the said Council to take such proceedings and incur such costs and expenses of and in relation to the promotion of the said Bill as shall be necessary, and to determine and direct that the same shall be defrayed out of the funds or rates in the hands of the Council, or hereafter to accrue to them on the Liverpool water account."

Alderman RIGBY seconded the motion.

Alderman SAMUELSON asked what amount had so far been expended in promoting the Vyrnwy scheme. He said he made the inquiry because he understood the financial question was likely to be raised; and as very large figures would no doubt be named, they ought to know what amount had been expended before they came to a determination.

Alderman FORWOOD asked if the Chairman would explain the following clause in the Bill:—"And whereas estimates have been prepared by the Corporation for the purchase of lands for, and for the execution of the said works, and the same amount to the sum of £3,250,000," &c.; and whether that sum was not largely in excess of the sum stated in the estimates brought before the Council.

Mr. WILSON said the money already expended on the scheme, including the cost of surveys and experiments to ascertain the foundation of the embankments of the Vyrnwy, amounted to £15,000 or £16,000. This included also £1200 for the poll under the Borough Funds Act. With reference to Mr. Forwood's question as to the difference between the estimate which they now asked the Council for, and the sum originally mentioned—namely, £1,250,000—it arose in this way. The Vyrnwy scheme was estimated to produce about 40 million gallons of water per diem. This was being divided into three sections, and the cost of the first of those sections, including filtration, was estimated at £1,250,000 sterling. When the Town Clerk went up to London, he was appraised by the Parliamentary Agents that, in the interests of Liverpool, it was most desirable that the Corporation should take powers to execute the whole scheme when the occasion arose, and that the difficulties of the contest would be quite as great with the first section as they would be with the whole. Therefore it was thought better that the Corporation, when the time came, should avoid the cost of two contests. It might be desirable in some part of the works to lay down the three sets of pipes so as to avoid further expense. Therefore, for these reasons, the Town Clerk and the Parliamentary Committee were proceeding for power to execute the whole of the works. But even assuming that they obtained power from Parliament to go to the Vyrnwy, they must come to the Council for power to raise £1,250,000 to carry out the first section. It would be gratifying to the Council to know that Mr. Deacon's estimates had been carefully gone over by Mr. Hawksley, and to a certain extent by Mr. Bramwell, and it had ended in their increasing his figures only 8 per cent. With this small increase Mr. Deacon's estimate was considered a full and fair one. The amount arrived at in round terms was—the first instalment, £1,250,000; the second, £750,000; and the third rather more. To that had to be added the cost of filtration if required, and also the interest and parliamentary expenses.

Mr. SIMPSON said he objected to the motion on the ground that the scheme which was represented to the ratepayers, and upon which their votes were taken, was to cost only £1,250,000, whereas it now appeared that the cost would be £3,500,000, which, he thought, did not reflect creditably on those who "got the scheme up," because they must have known at the time they asked the town to vote for the expenditure of £1,250,000, that the sum would ultimately be £3,500,000. His next objection was as to the manner in which the votes were taken. Many persons did not have voting papers at all, and in other cases the voting papers were never collected. Further, he was not at all satisfied that there was such an immediate requirement of water as the Committee would have the town to believe. He proposed the rejection of the motion.

Mr. RATHBONE said that although the town was originally only asked to decide a question involving £1,250,000, every one who understood the subject knew perfectly well what the ultimate intentions of the Water Committee were; and even if they did not, it was now too late to come forward at a meeting of this sort, and try to upset what the town had most deliberately and entirely approved.

Alderman BENNETT opposed the motion, because the Bill had never been before the Council in its present shape. He strongly objected to the way in which the matter had been brought before the Council. The Bill had been compiled behind the scenes, and though he was a member of the Water Committee at the time, he was kept in ignorance of the clauses until it was too late to object to them. He, therefore, moved that the resolution be postponed until the clauses in the Bill had been gone through by the Council.

The TOWN CLERK said this amendment was not exactly in order, but it would be if worded as follows:—"That this special meeting be adjourned to next Monday, to enable the Council to consider the provisions of the Bill before voting on the motion now before the Council."

After some little discussion,

Alderman BENNETT said he would not take up the time of the Council, but would withdraw the amendment.

Mr. BALFOUR thought Mr. Simpson's objection to the passing of the motion was a very reasonable one, because the Water Committee led them to believe that the scheme was to cost the town £1,500,000; and now they came for the sum of £3,250,000. He (Mr. Balfour) had asked the Chairman of the Water Committee for explanations, and the explanations he gave were entirely satisfactory to his (Mr. Balfour's) mind, and he believed they would also be satisfactory to Mr. Simpson's mind. He (Mr. Balfour) ventured to say that if the Haweswater scheme had been before the Council, and if the Council had adopted that at a cost of £1,500,000, the Council would now have been asked to vote not £1,500,000, but such a sum as would have embraced the whole of the outlay upon the Haweswater scheme for 50 or 100 years, just as the Bill now did with regard to the Vyrnwy. There was no alteration in the original estimates placed before the town, although the sum applied for was to be £3,250,000.

Mr. FORWOOD said that under ordinary circumstances it would be respectful in members of the Council, after the ratepayers had pronounced an opinion in favour of a scheme, to follow the wishes so indicated by the ratepayers; but they had this in mind, that the ratepayers had not the fact so clearly before them, at the time they gave their votes, as they could have wished, and the majority was of the narrowest possible kind. If it had been impressed upon the minds of the ratepayers that it was intended to put in the Bill a proposal to spend £3,250,000, he did not think they would have given the vote they did. Those in the Council knew that £3,250,000 would be required, but this fact was kept in the background; and there was little hope that when the Bill came to be gone through clause by clause they would be able to reduce the sum proposed in the clause referred to. When it was advocated that they should proceed for a water scheme, it was very strongly urged by the Chairman and the other members of the Water Committee that the new water supply was rendered absolutely necessary by the great growth of the out-townships; and they were promised, as one means of meeting the obligations cast upon the Council through the cost of the new scheme, that there should be an equalization of rates inside and outside the borough. And yet there was not one word in the Bill committing the out-townships to an equal charge for water with the borough. The ratepayers of the borough were to go to this great expense of promoting a Bill by which they would be compelled to continue what the Council had admitted was an anomaly—giving water to the out-townships at a cheaper rate than they did to those in the borough. It was quite obvious this was done to avoid opposition. The Chairman had stated that one reason why the estimate of £3,250,000 would be required was for interest on the outlay; he (Mr. Forwood) presumed Mr. Wilson meant interest during the cost of construction. He was surprised the Chairman should state this, because in the Bill there was this clause: "All moneys raised under the powers of this Act shall be applied only for purposes authorized by this Act to which capital is properly applicable." He failed to see one word in the Bill by which they could charge to capital interest on money they borrowed. The result would be that during the seven years the works would be in construction the present ratepayers would have to bear the cost of interest—about £600,000 or £700,000, or something like 3d. or 4d. in the pound. Then he thought they were unwise in going into a parliamentary contest on the scheme at the present time. At the end of six or eight weeks there was every reasonable probability that there would be a dissolution of Parliament, and the whole of the £30,000 they had so far spent in promoting the scheme would be thrown away, and all the expense of applying to Parliament would have to be incurred over again. They would see by the very small number of Private Bills promoted this session that private people saw this risk in advance; and he was surprised that the Corporation of Liverpool should throw away a large sum of money in promoting a Bill with this fact staring them in the face.

Mr. BOWER denied that £3,250,000, as the charge for the Vyrnwy scheme, was hanging over the heads of the ratepayers, and maintained that the Water Committee were simply pledging the Council to the cost of the first instalment. What the Committee were endeavouring to carry out was this: Whilst they retained in the hands of the present Council the power to deal with the cost of the first instalment, they wished that any future Council of 15 or 20 years hence should have the sole power of dealing with the second instalment—that was to say, whether the then Council would go on with the second instalment or not. They also desired to retain in the hands of the Council of a still more remote period the power of saying whether they would go into the expenditure for the third instalment. They had endeavoured to clear the ground so far as to prevent any future Parliament stopping the wishes of the town when the time arrived for them to take steps, if they thought proper to carry out the other sections of the scheme. They were going to do nothing at all but ask the town to spend money on the first instalment. Those who seemed surprised at the increase in the estimate evidently had not taken the trouble to refer to the Water Committee's reports, in which the estimates were given for the first and second instalments at, respectively, £1,253,000 and £730,000 in round numbers. The estimate for the third instalment was given, in the report of Nov. 27, 1877, at £871,000; and the amount for filtration (if it became necessary) for the entire three instalments was put down at £174,000. So that they were not asking the town to do anything more than to find the amount of the first instalment when the time came, and it was not true that the Committee had kept the public blind to the real facts. If they showed weakness at all, they would only be encouraging opposition; but if they showed earnestness and straightforwardness of purpose, with a determination to carry the scheme, the opposition would decrease, which, he was happy to say, it had done at the present time. As to a National Water Supply, if that was ever carried out, it would only be after the large towns had provided for themselves such supplies as were necessary. Then, possibly, some amalgamation scheme might be carried out; but the Government would never carry out schemes in the first instance, until the towns came forward and looked after their own interests.

After some further discussion, and the reply of Mr. WILSON, who asked for an unanimous vote to strengthen the position of the Committee, the motion was put and carried by 39 votes to 8.

The preamble and the first 28 clauses of the Bill were sanctioned without discussion.

On clause 29 being moved, which provided that all moneys raised under the powers of the Act should be applied only for purposes authorized by the Act to which capital is properly applicable,

Mr. FORWOOD asked if interest during construction could be paid from that source.

The TOWN CLERK replied that, if the Council wished it, the Bill might be amended, charging to capital interest during construction.

Mr. FORWOOD moved that this be done.

Alderman JENNINGS seconded the motion, which was agreed to.

Clause 30 was agreed to without discussion, and the next and concluding clause of the Bill was read, which was to the effect that the costs, charges, and preliminary expenses incidental to the preparing and applying for the Bill, and other costs in connection therewith, be paid out

of the public funds or rates in the hands of the Corporation, or hereafter to accrue to them, on the "Liverpool Water Account."

Mr. Forwood asked if these costs could be charged out of the capital account or out of the rates.

The TOWN CLERK: I am afraid it must come out of the water account. You had better leave it as it is, I think.

The Mayor took the opinion of the Council, and it was resolved to leave the clause as it stood.

Mr. Wilson formally moved the adoption of the Bill, which was passed without discussion.

THE CHELTENHAM CORPORATION AND THE LIVERPOOL (VYRNWY) WATER SCHEME.—A special meeting of the Cheltenham Town Council was held on Monday, the 19th inst.—the Mayor (Alderman Nash Skillicorne) in the chair—for the purpose of considering the propriety of opposing the Bill being promoted by the Liverpool Corporation for the supply of Liverpool with water from any of the Severn tributaries, and, "if so determined, of approving and sanctioning the costs and expenses of, and in relation to such opposition." The Corporation have *locus standi* in relation to the Severn, having acquired the right, by the purchase of the late Water Company's undertaking, to abstract some 3 million gallons a day from the river, and being the owners of the works by which Tewkesbury is already supplied from the Severn. Mr. Parsonage, the Chairman of the Water Committee, brought up their report and moved the adoption of it. It set forth the objections to the Liverpool scheme as generally acquiesced in by the other towns opposing, and pointed out that the right the town had of abstracting water from the Severn was one of increasing value, as the river was freed from pollution, and ought to be carefully guarded from any depreciation. The report concluded thus: "Your Committee are of opinion that the Liverpool scheme, in its present form, may be prejudicial to the interests of the town and district, and recommend that a deputation from the Council join in the deputation to the President of the Local Government Board, and that the Bill be petitioned against, but that the question of further proceedings be adjourned until after the deputation has been received." Alderman Wilson seconded the adoption of the report with its closing recommendation. Alderman the Baron de Ferrières proposed as an amendment—"That no action be taken," ridiculing the idea that the proposed abstraction of water by Liverpool could make any appreciable difference in the volume of the Severn, and arguing that a town of the size of Liverpool ought not to be lightly obstructed in its effort to obtain water, and that the old-world notion of confining a town to its own watershed was yielding to the exigencies of increasing population. Mr. Barnfield seconded the amendment. After a somewhat warm discussion, the report of the Committee was adopted by 11 votes to 8.

SUGGESTIONS FOR DEALING WITH LONDON SEWAGE.

By Major-Gen. H. Y. D. SCOTT, C.B., F.R.S.

[A Paper read before the Society of Arts.]

(Concluded from p. 99.)

It is usual with agricultural chemists to consider the nitrogen associated with organic matter, which freely decomposes, to be as valuable as nitrogen in the form of salts of ammonia; for instance, in guano, of which about one-half the nitrogen exists in the form of ammoniacal salts, and the other half as nitrogenized organic matter, which has still to pass into the form of ammonia before it becomes operative on vegetation, this latter half is considered as valuable as the first, owing to the quickness with which it changes into the ammoniacal condition. In nightsoil, the rapidity of its decomposition also raises its nitrogen to the rank of nitrogen in the form of salts of ammonia; but when fecal matters have been washed with water, so that they become less liable to putrefaction, and are mixed with other nitrogenous compounds, such as hair, vegetable debris, &c., which do not so readily decompose, some deduction from the value of the nitrogen should be made. Accordingly, Dr. Voelcker, when analyzing different samples of sewage manures for the report on sewage disposal by Messrs. Rawlinson and Read, whilst assigning to the nitrogen the same value as if it existed as ready-formed ammonia, stated expressly that he did so in order to avoid the charge of having put too low a value upon these manures; and in speaking upon the same subject at the Institution of Civil Engineers, on the 28th of March, 1876, the price of ready-formed ammonia being at that time 16s. per unit, he said that 15s. per unit would be too high for the value of nitrogen reckoned as ammonia, before its conversion into such. Consequently, Dr. Voelcker estimated that the calculated value of nitrogen, not already converted into ammonia, should be less than the value of ready-formed ammonia by at least 6½ per cent. on the value of the latter. Probably, therefore, we may safely calculate nitrogen, before conversion, as being worth 10 per cent. less than the market value of nitrogen in ammoniacal salts, such as sulphate of ammonia. The market price of this substance is at present 20s. per unit. I will, therefore, take the nitrogen at 18s. per unit. Concerning the value of phosphoric acid, which varies considerably as it exists in a condition either of insolubility or of solubility, I must speak at some length; this material being one I propose to add to the sludge, as I shall hereafter explain, in such a manner as to convert the ingredient into precipitated phosphate of lime. Any error in its assumed value is, therefore, of especial importance.

Dr. Voelcker made a very exhaustive series of experiments for the Royal Agricultural Society, on the solubility of phosphatic materials, and he drew the following conclusions, amongst others, from his investigations:—"Pure and dried phosphate of lime is sparingly soluble in water." "In a moist state, and in the voluminous condition in which it is obtained by precipitation from its solution, it is about four times as soluble in water as it is after it has been dried and heated." "The earthy phosphates in Peruvian and phosphatic guanos, still containing a good deal of organic matter, or salts of ammonia, are sufficiently soluble in water to be readily appropriated by plants." And in a letter to me, Dr. Voelcker writes: "The absence of acidity in the manure is an advantage when it is applied to land deficient in lime. There are many such soils, and on these phosphoric acid, in the shape of precipitated phosphates, produces a better effect upon vegetation than phosphoric acid in the shape of an acid soluble superphosphate, for unless the acid is rapidly neutralized by the alkaline elements (notably the lime in the soil) and precipitated in the soil, it cannot benefit the crop to which the superphosphate is applied. On the other hand, if there is a sufficient amount of lime or of other basic constituents in the land to precipitate the phosphate in superphosphate, I consider it better, as regards the distribution of phosphoric acid in the land, to apply the manure in the shape of superphosphate than in the form of precipitated phosphate. It is, moreover, impossible to distinguish by chemical means, with any great degree of accuracy, precipitated from ordinary phosphate of lime, and, in consequence, purchasers of manure will regard a guaranteed percentage of phosphates, actually soluble in water, with more favour than a guaranteed percentage of insoluble phosphates which may be present in a manure, partly as precipitated, and partly as ordinary insoluble phosphates;" and he suggests that a firm should sell manure, in which precipitated phosphates occur in plenty, "without any analytical guarantee, but on an established reputation for

introducing into the manure precipitated phosphates only," and thus "give the public a reasonable guarantee they are really present in a precipitated form."

It would appear, then, that Dr. Voelcker looks upon precipitated phosphates as being intrinsically little inferior, and for some soils superior to acid superphosphate, and, as far as agriculture is concerned, the precipitated might be substituted for the perfectly soluble phosphate, without appreciable loss of manurial efficacy. The difficulty lies in the analysis, and is essentially a technical one, which it is to be hoped chemists will find the way of overcoming, as precipitated phosphates are brought more into use. Indeed, there are some who are already commencing to listen to the complaints raised against such unjust valuations of manure as are given by chemists in respect of precipitated phosphates, and Mr. Sibson, in his useful little work on artificial manures, says: "The identification of this form of phosphate (reduced or precipitated phosphate) being thus often a matter of importance, I now give its approximate amount when so required; at the same time I should plainly state that I consider it distinct from soluble phosphate," and he gives the following scale of prices per unit, for fertilizers for 1878, such prices "being intended to apply to the purchase of manures under the circumstances usually prevailing in agricultural districts, when they are supplied in bags, carriage paid, and credit given. When bought in quantities in bulk for ready money, or fetched from the works, of course a lower scale would apply.

Price per unit for—

Soluble phosphate	£0 4 6
Ditto in mineral superphosphates	0 4 0
Precipitated phosphates	0 3 6
Insoluble phosphate (bone or guano)	0 2 6
Insoluble mineral phosphate, up to 7 per cent.	0 1 0
Potash sulphate	0 3 6
Ammonia	1 0 0

There can be no doubt that precipitated phosphates mingled with the decomposing matters of sludge—a very putrescible substance—are under conditions highly favourable to solubility. As may be seen from the investigations of Dr. Voelcker, ammoniacal salts materially increase the solubility of phosphates. And since, as is well known to chemists, phosphate of lime is easily soluble in carbonic acid, and both ammonia and carbonic acid result from the decomposition of the organic substances, there seems no reason for giving to precipitated phosphates in sludge-manures a lower value than that assigned to them in Mr. Sibson's table, under the terms of sale to which that table is intended to apply. To the phosphates naturally accompanying the organic matters which the sludge contains, we should assign the same value as for bone or guano.

Let us now investigate the cost of producing precipitated phosphate of lime, intermingled with sludge. I should premise that, as our object is not the preparation of a dry superphosphate, such as is manufactured for the market, a much freer supply of water is admissible than in the ordinary process of manufacture, where a dry powdery condition is essential in the finished product—a condition, moreover, somewhat difficult to obtain. The use of plenty of water much facilitates the process of solution, by enabling the acid to act more freely and perfectly on the mineral. It also does away, in great measure, with the noxious fumes evolved in ordinary superphosphate making, so that the process can be carried on without any extraordinary precautions. The mixing may be effected in strong wooden troughs, about 9 ft. by 4 ft. by 3 ft., pitched inside, and the dilute acid and mineral, finely powdered, should be stirred together for some minutes, until all action ceases. For one charge of a vessel such as the above, there will be required about 20 cwt. of Cambridge coprolites and 17 cwt. of brown sulphuric acid; or if mineral phosphates, with less carbonate of lime than Cambridge coprolites, be used, a little less acid is needed. Enough water should be used in order to leave the mixture in a more than semi-fluid condition—in a state, in fact, which admits of being readily mingled with the sludge. This sludge must have previously had mixed with it a sufficiency of milk of lime to leave the mixture alkaline after the application of the phosphoric acid.

The cost of bringing the phosphoric acid into solution, and of adding the lime, will be as follows. I obtain the proportions, excepting for the lime and the water, from Mr. Sibson's work on artificial manures, from which I have also taken the above account of a suitable mixing trough:—

20 cwt. of Cambridge coprolites, ground	£3 5 0
17 " brown acid, at £4	3 8 0
5½ " quicklime, at 16s.	0 2 8
9 " water	nil.
Labour of mixing 2½ tons of dry solid matters and wear and tear of troughs	0 2 4
2½ tons of dry solid matter, containing 1600 lbs. of tri-basic phosphate of lime, cost	£6 18 0

Being a little less than 2s. per unit for a material which Mr. Sibson values at 3s. 6d. per unit, delivered to the consumer in bags, carriage paid.

There would then appear to be a fair profit on the treatment of phosphatic materials, if introduced in this way into a manure which would find a market. I shall now proceed to show that there is every probability of being able to dispose of this manure at a price approaching that at which its constituents would be valued by chemists.

Let us first, however, consider the value of the fertilizers already existing in the sludge, to which it is proposed to add lime, and subsequently a solution of superphosphate, and thus to precipitate the soluble phosphate. From the scale of prices by Mr. Sibson, given above, we shall have to deduct from the value assigned to the ammonia 10 per cent., owing to the fact that in sludge this compound has no existence, nitrogen only, capable of forming it, being present. This will reduce the value to 18s. per unit, and our figures will stand thus:—

66·50 organic matter (without nitrogen)	nil.
3·50 nitrogen (= 4·25 ammonia), at 18s. per unit	£3 16 6
6·07 phosphate, at 2s. 6d. per unit	0 15 2
1·25 potash (= 2·30 sulphate of potash), at 3s. 6d. per unit	0 8 0
22·68 sand and other minerals	nil.
100·00	£4 19 8

In order to ascertain the quantity of precipitated phosphate which should be added to the manure, let us see what proportion is necessary to give the utmost effect to the above amount of ammonia. I should here point out that phosphates have been proved to be the ingredients without which plants cannot thrive, or even live. If any of the other mineral elements found in plants are absent from a soil, the plants may become stunted, and bear a very low crop of fruit, but they pass through the cycle of life. If phosphates are absent, however, they soon die. "Phosphates, therefore, not only themselves aid in the nutriment of plants, but they determine the beneficial action of the other mineral ingredients;" and, as Liebig says, "the phosphoric acid ensures and increases the action of the ammonia." Dr. Voelcker is of opinion that, for a manure for general purposes, the proportion of the phosphate of lime should be to the ammonia of the manure as 4 is to 1. M. Ville specifies that the phosphate of lime should

be to the ammonia in ratios varying from about 4 to $1\frac{1}{2}$ to 4 to $\frac{1}{2}$, according to the nature of the crop. If we assume, therefore, Dr. Voelcker's decision to be approximately correct for a general manure, we shall have to add to the sludge about $8\frac{1}{2}$ per cent. of precipitate phosphate, after which its composition and value would stand thus. But in order to avoid any appearance of making out too good a case for my project, I will value the finished manure on a scale which can scarcely be cavilled at by the most ardent unbeliever in the efficacy of sewage manure. The valuation of the ammonia is that adopted by Dr. Voelcker in Messrs. Rawlinson and Read's report—namely, 8d. per lb. This price was based on the then market price, which was unusually low.

50.15 organic matter (without nitrogen)	nil.
2.64 nitrogen (= 3.21 ammonia), at 15s. per unit . . .	£2 8 2
4.58 phosphate associated with the sludge, at 2s. per unit	0 9 2
8.23 precipitated phosphate (added to sludge), at 2s. 6d. per unit	1 0 7
1.73 potash sulphate (= 0.9 potash), at 8s. 9d. per unit . .	0 3 4
16.08 sulphate of lime, &c., from superphosphate	nil.
16.55 sand, &c.	nil.

99.96 value estimated on the perfectly dry manure. . . . £4 1 3

Dr. Voelcker, in reporting to Messrs. Rawlinson and Read on samples of sludge manure submitted to him by them, says: "It is manifestly practically wrong to estimate the money value of such bulky and poor manures by the same standard of prices at which the commercial value of guano, bone dust, sulphate of ammonia, and similar concentrated artificial manures are estimated. A more rational and correct estimate of the true value of sewage and nightsoil manures is attained by comparing them with ordinary farmyard manure, and the price which is paid for the latter;" and he expresses the opinion that the utmost a farmer can afford to pay for good dung of the theoretic value of 15s. per ton, if he has to cart it half a mile, would not exceed 7s. 6d., or half its estimated value.

On the other hand, he thinks that manures sell better at the value of £8 8s. per ton, than if they have a higher value. Manifestly, therefore, if he is right in his view, at this price the theoretic and market values of manures should coincide. I think, indeed, I might venture to say that he considers they do so, even at the price of £6 per ton. Some deduction, in any case, must therefore be made from the value at which the above estimate of the mixture of prepared sludge and precipitated phosphate works out, and what this deduction should be may, perhaps, be best arrived at by following the course pursued by Messrs. Hofmann and Witt, to show the disadvantages of feeble manures. I may then, for simplicity's sake, suppose the one manure to have a value of £8, the other of £4, without entailing an error of any consequence. Thus:—

Price of one ton of good manure at factory	£8 0 0
Spreading.	0 0 9
Total.	£8 0 9

Price of two tons of sewage manure at factory	£8 0 0
Spreading.	0 1 6
Total.	£8 1 6

Price of one ton of good manure at factory.	£8 0 0
Carriage for two miles	0 2 0
Spreading.	0 0 9
Total.	£8 2 9

Price of two tons of sewage manure at factory	£8 0 0
Carriage for two miles	0 4 0
Spreading.	0 1 6
Total.	£8 5 6

Price of one ton of good manure at factory	£8 0 0
Carriage for five miles	0 5 0
Spreading.	0 0 9
Total.	£8 5 9

Price of two tons of sewage manure at factory	£8 0 0
Carriage for five miles	0 10 0
Spreading.	0 1 6
Total.	£8 11 6

Therefore, at a distance of five miles, there is a relative disadvantage in using the sewage manure of 5s. 9d.; and, at a distance of two miles only, of 2s. 9d. If we say, then, that the manure—allowing for 10 per cent. of water, which it should contain—has a value of £3 10s. per ton, we probably shall not be far from the price which would be given for it by farmers, when once they understood its merits, within a radius of four or five miles from the manufactory. In such situations as those which would be occupied by the works on either side of the river, the market would by no means be limited to a radius of five miles from them; for, with water carriage, the farmers along the whole course of the river would probably draw their supplies of manure from these factories. If the sales would even cover the expenses of manufacturing the manure, as the process would be the means of keeping the most deleterious part of the sludge out of the river, it manifestly would be inexcusable to continue to throw the solids into the Thames. Let us see, then, what these expenses would be.

The first operation, when the supernatant water is drawn off from the deposit (which will consist of about nine parts of liquid to one of solid), is to add to the sludge about two-thirds per cent. of quicklime, slaked, and made into milk of lime. This is effected by running the milk over it, and then stirring the compound, which will effectually deprive the sludge of noxious smell. The next step must be to mix with the limed sludge such a quantity of the prepared superphosphate as will nearly, but not quite, neutralize the lime previously added. The mixture now becomes surprisingly inodorous, considering the origin of the greater part of it; the organic matter also loses its slimy, glutinous nature; and assisted by the precipitated phosphates and the crystalline sulphate of lime intimately incorporated with it, the compound drains and dries with comparative rapidity.

These additions will cost for materials about 16s. 6d. per ton of prepared manure, as may readily be seen by valuing the precipitated phosphate contained in it at 2s. per unit, which we found to be the cost of making it. To remove the sludge from the tanks and to dry it, including all the expenses of treatment, except the cost of building tanks, will amount to about 20s. per ton. This gives as the profit on the manure (£3 10s., less £1 16s. 6d.), £1 13s. 6d. per ton; or, say, £1 10s. per ton.

Sir Joseph Bazalgette estimated a few years since that, roughly speak-

ing, each gallon of sewage water carries down with it 100 grains of suspended matters, and the daily discharge, Captain Calver says, is 120 million gallons in dry weather. This would yield 279,225 tons of solid matter per annum, which quantity Captain Calver thinks too low an estimate. This estimate is, however, considerably higher than would follow from the analyses given by Hofmann and Witt, and by the Rivers Pollution Commissioners. I do not think that it can be assumed that the organic matter is more than from 50,000 to 55,000 tons per annum, and, if we add to this, for detritus and mineral matter, double its weight, as found in the outfall sewage by Professor Williamson, we arrive at only 150,000 or 165,000 tons of solid suspended matters per annum; whereas, with Dr. Letheby's estimate, we should get no more than 116,000 tons, and from the analyses of the Rivers Pollution Commissioners, and Drs. Hofmann and Witt, only 130,000 tons per annum. Concerning the quantity of solid organic matter in Thames sewage, we may speak with much more confidence, then, of the quantity of the solid mineral matter. Different estimates of the former vary less than 5 per cent.

Taking the lower of the above estimates, so as not to overstate my case—say 150,000 tons—it may readily be seen from the analyses that we may reasonably hope to effect a rough separation of the deposit. Thus, in a first set of depositing-tanks, we should keep back four-fifths of the heavier particles, entangling with them only a small proportion of the organic matter; and, in a further set of tanks, in which the sewage would be brought to complete quiescence, we might recover four-fifths of the organic matter (or 40,000 tons), mixed with half its weight of mineral matter, making a total of 60,000 tons available for the manufacture of a manure.

To this 60,000 tons we have to add about one-third for the phosphates, &c., mixed with them in the manufacture, giving us, as the total amount of manure, reckoned dry, 80,000 tons, or with the moisture, which we will take at 10 per cent., say 88,000 tons.

The question of what is to be done with the sand or silt deposit, amounting to 90,000 tons per annum, must also naturally suggest itself. What ought not to be done with it is quite certain; we ought not to cast it into the river. It may be quickly dealt with, and rendered perfectly clean, by passing it through one of Fryer's destructors, heated with waste cinders, which are now a drug in the market, and most difficult to dispose of; or it might be used for reclaiming a portion of the marshes at the expense of pumping it to some little distance, as was suggested by one of the Royal Commissions in reference to the whole of the deposit. Surely even this last plan would be preferable to putting it into the river and dredging it out again, and then having it still to dispose of.

If the Metropolitan Board take measures to keep out of the river the whole of the suspended matters which will deposit in tanks of a size moderate as compared with the total volume of sewage water, they will have done much towards rendering the London sewage practically harmless, as will be readily apparent from the following statements in the reports of various Royal Commissions:—

The chief part of the nuisance arising from the discharge of sewage into the rivers and streams may be obviated by simply arresting the solid matters in the liquid.

By far the greatest part of the solid matter which is held in suspension in water is readily deposited in rivers, covering the banks with mud, permanently raising the beds, gradually destroying the scouring power, and partially silting such rivers up.

That, however the appearance of the water may be improved after these deposits have been taken, yet the deposited matters lying in the bed of the current are under conditions favourable to putrefaction, and when the foul mud is disturbed by the prevalence of rain and during floods, it sends forth its effluvia among the populations which are near, and even, in the course of the rivers, far distant.

In short, successive Royal Commissions have repeated the truths told to the Metropolitan Board by their own advisers, Messrs. Bidder, Hawksley, and Bazalgette, in their report on the main drainage. They have further informed them that "covered reservoirs, of moderate size, ought to be constructed near each outlet, for the reception of the sewage water until it shall be discharged during the first hours of the descending tide, or to enable it to be defecated by lime or other chemical agent" (Report, p. 99) "before admission into the river," with a view "to the realization of its fertilizing contents, if such should hereafter become commercially valuable." (Report, pp. 98-99.)

In the foregoing recommendation, then, I have not exceeded that which Sir Joseph Bazalgette himself thought imperative upwards of 20 years ago, when his main drainage scheme was devised; but in order that the sludge to be used for manure may not be degraded by the mixture with it of a bulky precipitate of carbonate of lime, I have suggested that the coarser mineral suspended matters may first be allowed to deposit in a subsiding tank, and next that the sewage may be given a period of greater rest in order that the suspended organic matters may separate from the liquid, and be made available for manurial purposes. Finally, I would urge upon the Metropolitan Board the importance of carrying out the recommendation of their present adviser, given when he was acting with the above gentlemen, and I would recommend them to take steps for making the defecation of the sewage perfect by precipitating it with milk of lime. Subsidence alone will not effect the perfection of clarification which the nation might fairly require, if the sewage of London is to be thrown into the noblest river they possess.

If this further treatment be undertaken, it gives us another large quantity of worthless matter to be disposed of. For by using 12 grains of lime per gallon, it would, with the carbonate of lime derived from the sewage water, and other matters thrown down, occasion a total deposit of quite 220,000 tons per annum. This I would deal with in one or the other, or all of the following methods:—

1. By adding the proper proportion of clay, to be obtained from the river banks, with the requisite amount of milk of lime, so as to enable the deposit to be burned into Portland cement, as is now done at Burnley, under much less favourable conditions than would exist under the circumstances I have pointed out.

2. By re-burning the precipitate, and using it for a fresh portion of sewage. This operation might be repeated six times, after which the calcined deposit might be used for the manure process, or it might be sold for phosphatic agricultural lime. The phosphoric acid thus recovered would be worth upwards of £20,000 per annum.

3. By selling the deposit as a top dressing for land, for which purpose farmers might be willing to give for it, say, 1s. per ton pumped into barges.

I have endeavoured to put my suggestions to you without any exaggeration, and I now commend my estimates and figures to the attention of those interested in this question, and capable of examining into the accuracy of my deductions. The only point on which I myself see any grounds for doubt is on the question of what proportion of the detritus it is practically possible to separate from the organic matters. To effect such a separation as I have assumed would not, I submit, be a difficult task for engineers, and the experiment could be made at a trifling expense. The cost of the tanks, if executed in concrete, would probably not exceed £100,000, and as the sale of the manure might be expected to realize £132,000 per annum, it would certainly be sufficient to cover the interest on this sum, together with the expense of disposing of the sand.

I trust that the Metropolitan Board of Works will give their careful

attention to these figures, and, at any rate, attempt to keep out of the river all that can be detained, without further taxing the ratepayers of the Metropolis. The only reasonable objection that can be urged against my suggestions is that there might be a difficulty in finding a market for so large an amount of manure of a comparatively low standard. If those in authority turn a deaf ear to my arguments, I venture to hope that Parliament itself will intervene, and no longer bestow upon the Thames the unenviable distinction of being the only filthy river in the country.

AMERICAN GASLIGHT ASSOCIATION.

[Abridged from the "Official Report" in the *American Gaslight Journal*.]
(Concluded from p. 96.)

Mr. W. W. GOODWIN (Philadelphia) read a paper entitled

THE ECONOMY OF GAS AS A FUEL FOR COOKING PURPOSES.

He said: I have a statement of facts—the results of some experiments—which I will present to the Association without comment. I have also prepared a tabulated record of tests made by boiling a given quantity of water over a flame composed of different portions of gas and air under varying conditions, in order to determine which was the best quantity of air to introduce into gas to secure the most favourable results.

My standard was 8 lbs. of water. The gas was consumed at the rate of 10 feet per hour; and the time required to raise 8 lbs. of water from 73° to the boiling point was 28½ minutes, consuming 4·466 feet of coal gas. I would say here that I designed an apparatus for furnishing air in a measured quantity, and mixing it with the gas before burning. The apparatus is so arranged that the gas and the air can be put into the burner in their normal condition, or the gas and the air can be heated both together or separately.

Tabular Record of Tests on Boiling Water over a Flame Composed of Different Proportions of Gas and Air, under Different Conditions.—Coal Gas, 16½-Candle Power. Weight of Water, 8 lbs.

—	No. of Trial.	Temperature of Water.	Increase of Temperature.	Time Required.	Gas Consumed.	Per Cent. Less Time.	Per Cent. Less Gas.
Test No. 1. Pure gas at the rate of 10 feet per hour.	1	Deg. 80	Deg. 132	Min. 28·5	Feet. 4·5	—	—
	2	76	136	28·5	4·4	—	—
	3	76	136	28·5	4·5	—	—
	Average	77·33	134·6	28·5	4·466	—	—
Test No. 2. 1 volume of gas to 1 of air.	1	80	132	22·5	3·6	—	—
	2	74	138	23	3·6	—	—
	3	74	138	23	3·6	—	—
	Average	76	136	22·83	3·6	20	19
Test No. 3. 1½ volumes of air to 1 of gas.	1	78	134	22	3·4	—	—
	2	76	136	22·25	3·5	—	—
	3	76	136	22	3·5	—	—
	Average	76·66	135·3	22·08	3·46	22·5	22
Test No. 4. 2 volumes of air to 1 of gas.	1	79	133	21	3·3	—	—
	2	76	136	21·5	3·4	—	—
	3	76	136	21·5	3·4	—	—
	Average	77	135	21·3	3·32	25	25·5
Test No. 5. 2½ volumes of air to 1 of gas.	1	71	141	21·25	3·3	—	—
	2	74	138	22	3·5	—	—
	3	76	136	21	3·2	—	—
	Average	73·66	138·3	21·4	3·3	26	21·6
Test No. 6. 2½ volumes of cold air to 1 of heated gas.	1	73	139	28	4·1	—	—
	2	74	138	26	3·8	—	—
	3	74	138	27	3·9	—	—
	Average	73·66	138·3	27	3·93	5·2	11
Test No. 7. 2½ volumes of heated air to 1 of heated gas.	1	74	138	27	4·0	—	—
	2	74	138	26·5	3·9	—	—
	3	74	138	26·75	3·9	—	—
	Average	74	138	26·75	3·93	6	11
Test No. 8. 2½ volumes of heated air to 1 of cold gas.	1	74	138	26·5	3·9	—	—
	2	75	137	26·25	3·8	—	—
	3	76	136	25	3·8	—	—
	Average	75	137	26·25	3·83	7·8	12

In the first test the gas was cold and the temperature of the water was 77½° Fahr.

After determining the quantity of coal gas required to boil 8 lbs. of water, I mixed various quantities of air with the gas, with the following results, each test named being an average obtained from three trials, viz:—

In the second test 8 lbs. of water were used and 1 volume of air and 1 volume of gas. The quantity of gas consumed was 3·6 feet. In that case the boiling point was reached in 22·83 minutes, being 20 per cent. less time required, and 19 per cent. less gas than in test No. 1.

The third test was 1½ volumes of air, 1 volume of gas, and the same quantity of water. Time, 22·08 minutes; gas consumed, 3·46 feet, or 22·5 per cent. less time, and 22 per cent. less gas than in the first test.

The fourth test was 2 volumes of air and 1 of gas. Time, 21·3 minutes; gas consumed, 3·32 feet; or 25 per cent. less time, and 25·5 per cent. less gas required than in the first test.

The fifth test was 2½ volumes of air and one of gas. I will state that I found the best results were obtained with this mixture. It has been found, in Europe, that 2½ volumes produce the most favourable results. The candle power of the gas has something to do with it, I presume. This is certainly a very close comparison. In this test the quantity of gas consumed was 3·3 feet; the time occupied was 21·4 minutes; or 26 per cent. less time, and 26·1 per cent. less gas required than in the first test.

In the sixth test the gas was heated, and the time went up to 27 minutes; quantity of gas consumed, 3·93 feet; reducing the time to 5·2, and the gas to 11 per cent.

The seventh test was heated gas and heated air. The time required was 26·75 minutes; quantity of gas consumed, 3·93 feet; or 6 per cent. less time, and 11 per cent. less gas.

The eighth test was heated air and cold gas. Time, 26·25 minutes; consumption of gas, 3·83 feet; or 7·8 per cent. less time, and 12 per cent. less gas.

In tests Nos. 6, 7, and 8 the air and gas were heated separately in coils of copper pipe over separate flames, arranged so that the air or the gas

could pass through the coils or not, as was desired. Each of these coils had a heating surface of 472 square inches, and in the tests the tubes were heated to redness. The conclusion is that the best condition for burning gas, according to these tests, is 2½ volumes of air and 1 volume of gas, and both of them in their normal condition, or cold.

The paper then entered into minute details of a number of experiments made to ascertain the relative efficiency of an ordinary range and a gas-stove in the cooking of various kinds of edibles, the percentage of loss in weight, and the time required, being carefully noted. The viands were equally divided; and, in the result, it was found that, with the cooking range, the total time from the lighting of the fire until everything was ready to serve was 2 hours and 40 minutes. Of this time 30 minutes was required to heat the oven, leaving 2 hours and 10 minutes actual cooking time. Weight of coal used, including lighting of fire, 44 lbs. At the end of the time the fire was ready for more coal. Cost of coal, 44 lbs., at 5·50 dols. per ton, 10·95 cents; kindling, 1 cent.—total, 11·95 cents. With the gas-cooking stove, the total time from lighting the gas until everything was ready to serve was 1 hour and 50 minutes. The consumption of gas, by the test meter, was 38 feet, which (at 2·15 dols. per 1000 feet) cost 8·17 cents. The following is a table of the percentages of loss after cooking by the two systems:—

	Gas-Stove.		Range.	
Fish	Cost	35 c.	Cost	35 c.
	Product	28½ c.	Product	24½ c.
	Loss	6½ c.	Loss	10½ c.
Saving of gas-stove over range, 3½ cents.				
Beef	Cost	166½ c.	Cost	169½ c.
	Product	138½ c.	Product	117 c.
	Loss	28½ c.	Loss	42½ c.
Saving of gas-stove over range, 14½ cents.				
Chicken	Cost	61½ c.	Cost	60 c.
	Product	52½ c.	Product	42½ c.
	Loss	8½ c.	Loss	17½ c.
Saving of gas-stove over range, 8½ cents.				
Steak	Cost	24½ c.	Cost	24½ c.
	Product	20½ c.	Product	18½ c.
	Loss	4½ c.	Loss	6½ c.
Saving of gas-stove over range, 2½ cents.				
Chops	Cost	20 c.	Cost	21½ c.
	Product	16½ c.	Product	13½ c.
	Loss	3½ c.	Loss	7½ c.
Saving of gas-stove over range, 4½ cents.				

Total saving, 33½ cents.

At the conclusion of the business, On the motion of Mr. McILHENNY, a vote of thanks was passed to the President for his services in the chair; and, on the motion of Mr. CARTWRIGHT, a similar vote was passed to Mr. Nettleton for the manner in which he discharged the duties of Secretary of the Association during the years he filled that position, and from which he only retired at this meeting.

The vote was acknowledged in appropriate terms, and the proceedings ended.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Notwithstanding the severe weather, there has been no particular pressure for house-fire classes of fuel, and the supplies in the market have been amply sufficient to meet requirements, colliery proprietors in some cases being unable to move off all their production, and there has been a slight accumulation of stocks in waggons on the pit sidings. For other classes of fuel the demand improves slowly; but there will have to be a further considerable enlargement of requirements before the demand approaches the limits of production—at present much curtailed—in this district; and in the meantime colliery proprietors will have to content themselves with comparatively low prices. This, however, does not prevent a growing feeling of confidence as to the future, and now that there is the prospect of a steadily-decreasing competition from other large coal-producing districts, whose supplies are being absorbed for iron-making purposes, colliery proprietors here are not at all anxious to sell far forward, although many of them could do so without difficulty at the prices ruling in the market. The average quotations at the pit mouth are about as under:—First qualities of house coal, such as best Wigan Arley, 8s. 6d. to 9s.; seconds, such as common Arley and Pemberton four-feet, 6s. 9d. to 7s. 6d.; common round coal, 5s. 6d. to 6s.; burgy, 3s. 9d. to 4s. 3d.; good slack, 3s. to 3s. 3d.; and common, 2s. 3d. to 2s. 6d. per ton.

The advance in the price of coal for shipping purposes has given rather a check to this branch of business, and there is a considerable quantity of coal offering in the market at prices slightly lower than those which were being quoted a week or so back, steam coal delivered at the High Level, Liverpool, being offered at from 7s. to 7s. 6d., and delivered alongside at from 8s. to 8s. 6d. per ton.

It seems not improbable that the wages question in the coal trade will be shelved for a time. The employers are willing to give an advance as soon as there is an improvement in trade to justify such a step; but at present they decline to move, and there is little chance of the men obtaining any practical benefit by a strike.

So far as makers are concerned, a steady tone is maintained in the iron trade of this district, and for Lancashire pig iron, delivered equal to Manchester, quotations remain at 70s. per ton, less 2½ per cent., for both foundry and forge qualities. In some outside brands there has been rather an easier tone, owing to a good many second-hand lots having been put into the market. Finished iron continues very firm at advancing prices; some makers decline to quote at all, and it is difficult to say what are the actual prices, but £9 to £9 10s. is being asked for bars, delivered into the Manchester district. Founders, however, are not yet able to get very much better prices, and I still hear of pipes being quoted at very low figures, in some cases very little over £5 per ton.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The coal trade was quiet last week. The contracts made for gas coals are about completed. They show a rise of 6d. per ton since Christmas. In some instances, contracts have been entered upon to supply gas coals to the Baltic at the first open water. They have been made at 1s. a ton advance upon the rates of January, 1879. The shipping business done by small coasters in the English ports of the Channel in gas coals was

pretty considerable last week. In fact, more than two-thirds of the sailing tonnage which was engaged was for this trade. Some steamers and sailing vessels also loaded gas coals for the Irish ports. Coasting freights are easy. The rate has scarcely changed during the winter, and it is not likely to do so in the spring. Some contracts were completed last week for the very best qualities of coke. Straker and Love's sold at 20s. a ton. Secondary sorts are, of course, much below that quotation; but the business is very steady all round. Nearly all the contracts entered upon will run over the first half of 1880. Coke will be shipped to the Baltic at the first open water. The exportations of coke to Spain and the Mediterranean are not large at present. Manufacturing coals are in demand for local consumption. All the business done this week for deliveries over the year verify the statements which have been made in these columns on several occasions recently, that the advance in the rates for manufacturing coals upon the prices of the year 1879 is not likely to exceed 1s. per ton. That is absolutely so as regards the first half of 1880 at any rate. The same observation applies to most sorts of gas coals over the first half of the year, and without the iron trade advances in prosperity in longer strides over the second half of the year than it is likely to do in the first half, the rate will remain pretty much as quoted.

The iron trade of Middlesbrough, and the North of England generally, may be reported as unaltered. The shipments of iron to America are considerable. A number of large north country steamers are employed carrying iron from the Tyne, Tees, and Leith, to New York, Philadelphia, and Baltimore. The sales of iron to the United States are well maintained. It is pretty certain that more will continue to be made over 1880. The local demand for manufactured iron and metal castings is upheld.

The fire-brick trade is brisk. Some more good sales have been made, and prices continue to have a slightly upward tendency. The lead trade is manifestly slacker. Merchants can scarcely maintain recent advances. The chemical market was a little dull last week. Soda yielded a trifle where sales were made for immediate delivery. Bleaching powder improved in value.

Although the timber business is steady and prices keep firm, and for some descriptions of wood bidders seek, and occasionally get more money, there is little change to note. Large timber from British America will realize an advance in prices this year. Indian teak is scarce and dear. There are likely to be pretty heavy importations of deals and battens from the Baltic after the opening of that sea. Stocks of timber are low in this country.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At the usual monthly meeting of the Police Board of Greenock, held last Tuesday, there were under consideration the minutes of the Gas Committee of the 13th of January, which showed that a report by the Manager had been submitted and read, in which he regretted that the unaccounted-for gas appeared to be on the increase, notwithstanding the measures that he had adopted throughout the course of last year, and which were still being carried out, with a view to ascertain and remedy the causes that, in either the piping or meter systems, might contribute to an excess in the direction indicated; and, further, desiring the sanction of the Committee to employ the necessary number of men to allow of a continuous and thorough investigation of the systems referred to during the ensuing season. The Committee expressed satisfaction with the Manager's endeavours, and granted him the permission asked to engage additional men for this work. In moving the adoption of the minutes, Bailie Shankland said that the loss was increasing every year, and the Gas Manager was unable to find out any material leakage. They had rather more leakage in Greenock than the average in other towns. The matter was important, as they lost from £2000 to £3000 every year. He subsequently admitted that the loss was more than that. Provost Campbell, who occupied the chair, said the amount was about £6000 or £7000—a large amount to be wasted. No doubt, he remarked, the laying of new pipes to Inchgreen (the site of the new gas-works), which was a large extension, might account for the increase of waste within the last year or two. He suggested that a small committee should be appointed to look after the matter, the said committee including as many practical men as possible, who would be able to help the Manager in his endeavours. The suggestion was approved of, as was also one to the effect that a statement should be laid before the Board, showing the production of gas, the cost, the revenue, and the waste—indeed, the Provost said he already had the information, and would put it at the service of the Gas Committee.

It was reported at the last monthly meeting of the Broughty Ferry Police Commissioners that the Sheriff had approved of the Provisional Order asking for powers for the extension of the gas-works, and, therefore, a Special Committee was appointed to superintend the preparation of plans and specifications, and with powers, if necessary, to visit other places.

Notwithstanding the fact that the town of Coatbridge is the chief centre of the iron trade of Scotland, with a population of nearly 20,000 inhabitants, it is still destitute of any system of public street lighting. That it should have remained so long in its present anomalous position, having no properly constituted body to administer its affairs, is a circumstance which seems somewhat extraordinary—at least to outsiders. About twelve years ago a strenuous effort was made to form the town into a borough under the Lindsay Act; but the movement was defeated through the influence of what has since been popularly known as the "Garthsherrie party." During the past twelve years that party has lost much of its former power, and there is every prospect now of the burgh movement being set on foot again, which it is hoped will be successful.

The quarterly report on the condition of the Aberdeen Water-Works shows that in the last three months of the past year four somewhat important cases of repairs were executed on the aqueduct, the water being shut off 27½ hours in all, while minor repairs to the number of 25 were carried out. On 70 days the sluice-keeper at the Invercarnie intake reports the water to have been "very clear," on 6 days "clear," and on 15 days "brown;" while on one day—Nov. 16—the sluices were shut, and no water was taken from the river on account of its muddy state. The consumption, as measured at the two reservoirs, was 4,672,330 gallons for the 24 hours—4,444,000 gallons from the low service, and 228,330 from the high service reservoir. During the quarter repairs were executed in the city to 116 water-cisterns, 178 water-closets, 640 water-taps, and 118 burst pipes—these repairs being effected on the order of the surveyors of the private water supply.

Mr. Watson, Manager of the Dundee Water-Works, has just directed the special attention of the Works Committee of the Water Commissioners to the very great and systematic waste of water in the town, more especially during frosty weather. His report was approved of, and he was at once authorized to give notice that all parties persisting in wasting the water would be prosecuted.

A few days ago Mr. J. F. Bateman, C.E., F.R.S., Engineer of the new water supply scheme for the town of Forfar, visited the works, and expressed his satisfaction with the progress made. He thought it very probable that the people of the town would be enjoying the benefits of the

water by the month of March next year. On the occasion of his visit to the north, Mr. Bateman also made an inspection of the new water supply works for the city of Perth, regarding which he reported in very favourable terms to the Water Commissioners. He says that the works are substantially completed.

For some time past the higher levels in and around Rothesay have been rather unsatisfactorily supplied with water, and the Town Council are at present engaged in carrying out a scheme by which these higher levels will have an abundant supply of pure water. The source is the Dhu Loch, which is situated at a height of 300 ft. above the sea level; and the scheme will cost £10,000. With this water supply, which will rise above the highest hill in Rothesay, and that from Loch Ascog, there is not probably another town that can be found better, if so well supplied with this necessary of life. The Dhu Loch scheme is now about completed, and in a few weeks the water will be introduced into Rothesay.

There were violent fluctuations in the Glasgow pig iron warrant market during the past week. As high as 72s. 3d. per ton cash was paid on Thursday, and down to 68s. 9d. on Friday afternoon, the close, however, being 69s. cash and 69s. 6d. one month for buyers, sellers asking 3d. more.

The demand for house descriptions of coal keeps fairly steady, but the shipping business is very meagre.

SALE OF SHARES IN THE EASTBOURNE GAS COMPANY.—On Thursday last, Mr. Townier sold by auction, at Eastbourne, six original A shares and several B shares in the Eastbourne Gas Company. The A shares realized £15 10s. and £15 12s. 6d. each; the B shares fetching from £12 7s. 6d. to £12 12s. 6d. each. The shares were sold inclusive of the dividend accruing from Christmas last.

THE PROPOSED PURCHASE OF THE PONTYPOOL GAS AND WATER WORKS BY THE LOCAL BOARD.—At the meeting of the Pontypool Local Board on Wednesday last, the Chairman (Mr. E. H. Davies) stated that a deputation had waited upon the Directors of the Gas Company, who expressed their willingness to sell the works at a reasonable price, and said they would recommend the Shareholders to agree to the proposal. The deputation had also waited upon the Panteg and Abersychan Local Boards, and had written to the Llanvrechva Board. The Abersychan Board, while inclined to entertain the proposal, thought if it were carried out it would be advisable to consult the Directors of the Abersychan Gas Company with reference to the purchase of their works as well, and a deputation had been formed for this purpose. Mr. Russell thought the Local Board had better leave the matter where it was; they had plenty to do without meddling with such things. The Chairman said the success of the scheme would depend upon whether the terms would be such as would make the purchase a paying speculation; but they all felt that the gas and water supply should be in the hands of the Board, if it would pay.

THE GAS SUPPLY OF LONG EATON.—Last Thursday, a public meeting was held at Long Eaton, for the purpose of considering the desirability of the Local Board taking over and managing the supply of gas in the parish. Mr. Newsum, who occupied the chair, said that the object of the meeting was to consider whether they as a public meeting should recommend the Local Board to purchase the gas-works. If it was decided to purchase the works, they must look to the market value of the shares, and pay accordingly. A resolution was proposed by Mr. Drennan to the following effect:—"That this meeting, being a parish meeting of the ratepayers of Long Eaton duly convened and constituted, is of opinion that the proposed Provisional Order relating to the Long Eaton Gas Company, Limited, will, if carried into effect, be injurious to the interest of the ratepayers and inhabitants of Long Eaton; and that the same should be opposed on their behalf by the members of the Long Eaton Local Board." Mr. W. Wallis seconded the motion, which, after some discussion, was carried by a large majority. Mr. Wallace then moved, and Mr. J. Austin seconded a resolution approving of the offer of £18,000 for the purchase of the gas-works. This was carried with two dissentients only.

DINNER TO THE EMPLOYEES AT THE WIGAN CORPORATION GAS-WORKS.—Last Tuesday evening the employees of the Wigan Corporation Gas-Works held their annual dinner. Mr. J. G. Hawkins, the Manager, was in the chair, the vice-chair being occupied by Mr. Holt, the Borough Treasurer. The usual loyal and conventional toasts were given and responded to with much cordiality, and the Chairman then briefly proposed the "Health of the Members of the Wigan Corporation Gas Committee." He alluded in warm terms to the kindness displayed by the members of the Gas Committee on all questions relating to the welfare of the men, and said they were wishful in every way to promote their interests, so far as was consistent with the interests of the ratepayers. Mr. Airey replied on behalf of the Committee, and proposed the health of the Chairman. He congratulated the town on having a gentleman possessing the ability of Mr. Hawkins at the head of the gas department, and referred to the kindly feeling existing between the men and those whose duty it was to see that they did their work properly. The Chairman said he should always regard it as his duty to act kindly and considerately to the men under his supervision, knowing that they were all labouring with the intention of carrying on the gas-works for the benefit of the town. The health of the Borough Treasurer was then given; and also that of the visitors, the latter being proposed by Mr. Ralph Bolton. Thanks were accorded to the donors of the feast, and a number of songs, &c., were given, the proceedings throughout being of a most enjoyable nature.

Register of Patents.

3306.—WILKINSON, C. H., Slaithwaite, near Huddersfield, "Improvements in unions or couplings for connecting pipes." Provisional protection only obtained. Dated Aug. 22, 1878.

These improvements consist in the employment of two flanges, having a nut on the back of each flange for the purpose of being screwed on to a pipe. On the face of one flange a projection or ring is formed, on which is placed a washer of india-rubber or other elastic material. This projection enters a corresponding recess formed in the other flange, so that when the two flanges are drawn together by bolts or other means a perfectly tight joint is made.

3322.—BODART, A., Huy, Belgium, "Improvements in joints for pipes or tubes." Patent dated Aug. 23, 1878.

This invention refers to joints for pipes or tubes without sockets or flanges, the joint being composed of a leaden ring, two cast-iron coupling-rings, cement to solidify the joint, and a hoop for covering the coupling-rings. The ring is formed of a band or strip of milled or rolled sheet lead with a groove in the centre, and upon it are placed two cast-iron coupling-rings, having an internal flange against which the lead will be bedded. The free space in the coupling-rings is for receiving mastic or cement which hardens quickly. A hoop surrounds the coupling-rings, and prevents one of the pipes sinking below the other if the pipes are placed in soft ground. It also serves for preventing foreign substances getting into the groove in the ring.

3934.—ATKINS, T., Clapham, Surrey, "Improvements in the construction and arrangement of machinery and apparatus for the manufacture of compound carbonaceous materials, and gases generated therefrom, for increasing the illuminating power and purifying coal gas, and in using and applying the products derived therefrom to various useful purposes." Patent dated Aug. 24, 1878.

The first part of this invention relates to the construction of small portable retorts, cylinders, or tubes provided with small outlets for the escape of the gases evolved from the materials employed. The second part relates to improvements in the construction of cylinders and pistons of various diameters for the manufacture of globular and angular compounds of carbonaceous material, whether of the mineral, animal, or vegetable kingdom. The third part relates to improvements in fire-grates or furnaces made of fire-brick, wrought or cast iron, or such material as may be found most suitable for the purpose. The fourth part relates to the construction of ovens for baking or carbonizing any kind of fuel or carbonaceous substances. And the fifth part relates to the construction of a box or cylinder of any convenient form, by which the compounded carbon may be placed in layers or in other ways for the purposes of respiration.

APPLICATIONS FOR LETTERS PATENT.

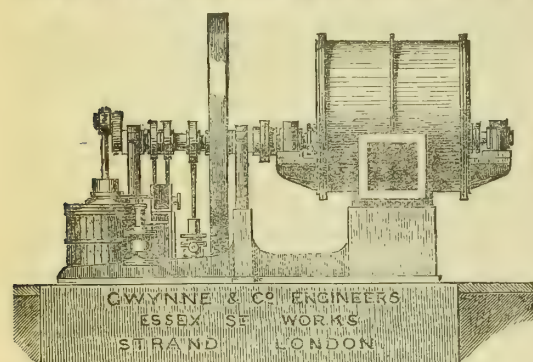
- 191.—ROBERTS, S. H., Coleman Street, London, "Improvements in pipe-joints." Jan. 16, 1880.
 205.—ATKINS, G., Birmingham, "Improvements in shade-holders for gas and other lamps." Jan. 16, 1880.
 241.—HADDAN, H. J., Westminster, "Improvements in apparatus for discharging coal waggons or similar vehicles." A communication. Jan. 20, 1880.
 275.—WATKINS, R., Walworth, London, "An improved water-waste preventer." Jan. 22, 1880.
 282.—SUGG, W. T., Westminster, "Improvements in the construction of gas-burners." Jan. 22, 1880.
 289.—LAKE, W. R., Southampton Buildings, London, "Improvements in apparatus for automatically lighting and extinguishing gas." A communication. Jan. 22, 1880.

PATENT WHICH HAS PASSED THE GREAT SEAL.

- 3140.—CLAYTON, S., Bradford, Yorks, "Improvements in motor-engines worked by gas or combustible vapour and air." Aug. 4, 1879.

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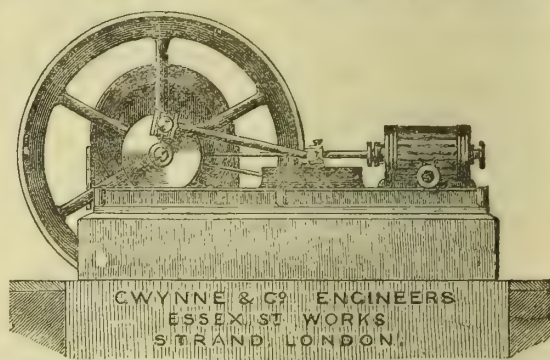
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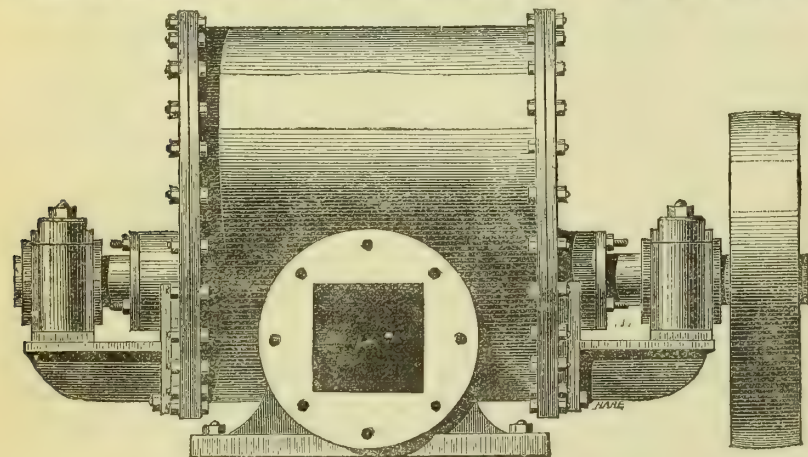


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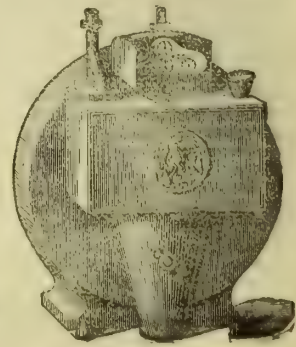
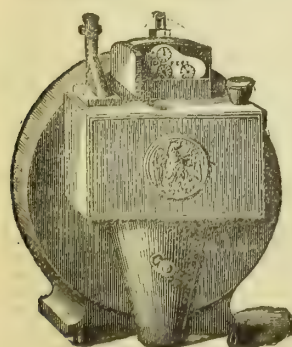
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TO CORRESPONDENTS.

- E. S.—Certainly not.
W. D.—We do not understand your question as stated. Send further, more definite particulars.
R. R.—You can sell either by weight or measure; always supposing that the implements used are in accordance with the Weights and Measures Act, 1878.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, FEBRUARY 3, 1880.

Circular to Gas Companies.

AMONG the commonly accepted recommendations of the electric light is its reputed immunity from danger, whether to property or life. It has been generally supposed that when the electric light is in use, perfect safety is ensured. Such, however, does not appear to be the fact, for the grandest of our national book collections—that at the British Museum—was recently imperilled in consequence of the falling of pieces of incandescent carbon from the lanterns hung from the dome of the reading-room, and this has threatened on two occasions recently to produce very serious damage. Of course, nothing can be more easy than to put glass saucers beneath the lanterns, to catch the pieces of red-hot carbon projected from the poles. But it is a very serious matter, when risks, such as those to which our national library was a short time since exposed, are considered. Within a short time of one another, two accidents have happened which might have been attended with serious consequences to the reading-room. The glass saucers now used may avert all danger in the future, but the fact nevertheless remains that twice the magnificent reading-

room at the British Museum has been in danger of destruction by fire, in consequence of the use therein of the electric light. The authorities of the Museum never have, we believe, given gas the opportunity of illuminating their splendid dome, which really, except on foggy days, never requires lighting up. Why it should be illuminated in the evening we, with every sympathy with poor clerks and working men, fail to see. We were once attentive readers in the afternoon, and generally found that one-half of our associates were, so far as we could see, indulging in useless amusement. There is not the slightest possible necessity for the opening of the British Museum library in the evening, so as to necessitate the use of artificial light. We have an intimate acquaintance with one public library which was resorted to on an evening by two sets of readers. The one were old "fogies," who frequented the news-room; the other were school-boys, who "crammed" from the translations of classical authors which they found on the shelves. The latter class would, in all probability, predominate in Great Russell Street, for nothing is easier than to procure a reader's ticket. The "working man" would never put in an appearance, much as his longing for information might prompt him, as the hours when reading is allowed must necessarily be short. It may be a great misfortune that that much-petted working man cannot be afforded more facilities for the acquisition of useful knowledge; but we fear that if the reading-room at the British Museum were thrown open to him altogether, he would not avail himself of his opportunities, except as a matter of vulgar curiosity. The real workers in the library—the Carlyles, the Macaulays, and the Buckles—have their opportunities in the daytime. The instances of working men who have employed their evening leisure for the benefit of their fellow-workers are, we fear, very few; but we shall be happy to see their numbers increase. If the use of the electric light at the British Museum tended to assist in the progress of the education of the working man, which we desire to witness, we should be satisfied to see the electric light in use, always supposing that no danger to our grand national institution is incurred.

But danger to national property is not the only thing involved in the employment of the electric light. It would seem, from newspaper reports, that danger to life may also ensue when the light is employed—that is, of course, supposing men to be foolish. We give for what it is worth the story of an accident which recently occurred at Aston, near Birmingham. A bandsman is reported to have seized the two conducting wires supplying electricity to several lamps—we are not told how many—at the public gardens at Aston, when he was immediately stricken down, and died shortly afterwards. The doctors say that he died of an electric shock. How he received the electric shock, under the system there employed for the production of the electric light, we fail altogether to see. Coroners, doctors, and juries, when they lay their heads together, no doubt arrive at most accurate conclusions; but in this case we fear they mistook a simple instance of apoplexy or heart disease for death by an "electric shock."

We shall not enumerate among the dangers of electricity the risk of life which ensues by coming in contact with the wires conveying electric force. To say the truth, we do not believe in these dangers, and the story we have related above we regard as altogether apocryphal. Many things besides an electric shock will bring men to a sudden death, and in the evidence in the case we have before us we cannot see any proof that the death of the man was occasioned by a shock. It must nevertheless be carefully borne in mind that danger unquestionably results from the reckless use of electricity. We ourselves have suffered from shocks, but it was in days when moist batteries and interrupted currents were used. Now, when a wire conveys electricity from Valentia to New York, nobody would be inconvenienced by handling the cable. Unfortunately, a good deal of ignorance prevails as to the effect of electricity on the animal system. Strictly speaking, all our knowledge of the effects of electricity on human life is derived from the consequences of thunderstorms and lightning-strokes.

The London and St. Katherine's Docks Company are advertising for tenders for lighting, by means of electricity, the quays and warehouses of the Victoria Docks. The advertisement specifies that some of the lights on the quays shall be moveable, and applicable to the illumination of ships. As regards the lighting of the interiors of the warehouses, it is stipulated that the lamps shall be moveable, in which, always supposing that everything we are told of the electric light is true, there will be no difficulty. If a man is willing to drag a copper wire after him, and carry a lamp, he may go

from the crypt to the ball of St. Paul's, and exhibit a brilliant light at every step of his journey.

Still referring to the electric light, we may note that there is a dispute going on just now as to which light—gas or the electric—answers best for illuminating our streets in the fogs which have recently unhappily visited us. Our own experience goes to show that the light obtained from the combustion of coal gas is more penetrating than that produced by the electric arc. If we could only have gas-burners of sufficient capacity, such as Sugg's or Wigham's, our thoroughfares would be well illuminated. In the absence of these, the multiplication of the gas-lamps and pillars now in use would be an immense boon; but the parsimony of our Vestries and other Local Authorities will stand in the way of any improvement in street lighting, unless that much more expensive and not half so agreeable electric light takes the place of coal gas.

Always supposing we can rely upon the reports which reach us in the American journals, the Edison light, if perfected, will be very far from cheap. In fact, it is acknowledged in America, where gas is much dearer than in this country, that it can very successfully compete with the electric force in the production of light. In another column will be found some facts concerning the calculated cost of a supply of the electric light, on Mr. Edison's last system, to the city of Baltimore. It is perfectly clear that the light, even with the latest claimed invention, would be enormously dearer than the equal illumination of the city by gas.

Illuminated buoys are voted to be a success. Our readers, however, know that we have no great admiration for Pintsch's lights in railway carriages, and consider that a buoy at sea, with a mere spark on the top of it, can be of very little use in guiding a mariner. The old story of the star-fish is revived by this invention. If we could get the star-fishes from the bottom of the ocean, and be certain they emitted light, Pintsch and his system would be at a discount. Mr. Sugg may presently provide a better light, but we can never suppose that a buoy with a spark on the top of it can be of the smallest use at sea. Will the inventors give us an account of the advantages of one of their gas-lighted buoys in the recent Channel fogs?

The proper material to be used for the conveyance of gas in private houses has always been a question. Iron pipes with T-pieces and elbow joints will find their way over any house, though it must be confessed that leaden pipes lend themselves with greater adaptability; but these, it appears, have their disadvantages. The mischievous rodent who infests our houses is, by his very nature, compelled to exercise his teeth upon some material, and he usually chooses the least resisting. More than this, he is a thirsty, and, bad as his character may be, is a particularly clean animal. Hence a love for water, which compels him to exercise his teeth on pipes he imagines convey that liquid. But unhappily he sometimes mistakes a pipe which carries gas, and, using his teeth, he pierces a hole, which, of course, admits the escape of the gas. In the north-western part of the Metropolis an accident of this kind recently happened, as a result of which, happily, no explosion occurred. What is the moral? To carry, at all events through the basements of buildings, iron services with elbow joints and T-pieces. Upstairs, composition pipes may be safely used; but down below, especially where rats are prevalent, iron services will be the best to employ.

We are happy to announce that the Reading Town Council and the Gas Company have come to an amicable arrangement, so that no opposition will be offered on the part of the Corporation to the Bill now being promoted by the Company. The latter have made some important concessions, which, to our mind, were not essential to the success of their Bill. Notwithstanding, we are glad the two bodies have come to terms.

The annual report recently issued by the West of Scotland Association of Gas Managers is a valuable document. It gives us, as we have said in past years, most interesting particulars as to the production of gas in Scottish works. We could wish, as we have before remarked, that the British Association would issue a similar return for England. It would, for example, be a matter of great interest to know the quality and quantity of gas which is obtained from coals in different localities. We can easily tell, from the illuminating power of the gas supplied, that cannel must be almost exclusively employed in Scottish undertakings. The illuminating power appears to range from 33 to 24 candles, according to the report, we notice; but, oddly enough, into this report of the West of Scotland Association enter notices of the gas affairs at Aberavon (Glamorgan), where the quality of the gas supplied is reported to be 14·5 candles, and at Bandon (co. Cork), where it is also 14·5 candles.

PROVISIONAL ORDERS FOR 1880.

PROVISIONAL ORDERS seem to be more in favour than Bills, with certain Companies, and it is not to be wondered at, considering the reasonable cost at which they can be obtained. For the forthcoming session of Parliament there are ten applications to the Board of Trade or to the Local Government Board for Orders relating to gas undertakings. We shall take them in their alphabetical order, as follows:—

The first is the *Chew Magna Gas Order*, promoted by the Chew Magna Gas Company, Limited, for the purpose of obtaining some further powers in relation to their undertaking. The Company seek authority to construct additional works on a piece of land described in a schedule. Gas of fourteen-candle illuminating power is proposed to be furnished, at a maximum price of 7s. 6d. per thousand feet. The usual day and night pressures are prescribed. No fresh capital is asked for.

The *Conway Gas Order*, for which application is made to the Local Government Board, is to authorize the Corporation of that borough to continue works for manufacturing, storing, and distributing gas, and for this purpose to borrow an indefinite sum of money, which is to be repaid by means of a sinking-fund in the course of sixty years. The maximum price which the framers of the Order propose to charge for gas is 8s. per thousand feet, and the Order will allow that the expenses of obtaining it may be defrayed out of profits when the price of gas is below 7s. 6d. per thousand feet. As soon as the price sinks to below 3s. 6d. per thousand feet, but not before, any excess of profit may be carried to the district fund. The gas proposed to be supplied is to have the illuminating power of fourteen candles, and it is to be furnished at a pressure of five-tenths between the hours of sunrise and sunset, and eight-tenths from sunset to sunrise.

The *Garstang Gas Order* fixes the capital of the Garstang Gas Company, Limited, at £2000, until authority is given by another Order, or by an Act of Parliament, to increase it. The Order proposes a supply of fourteen-candle gas at a maximum price of 7s. 6d. per thousand feet. The test burner is to be Sugg's "London" Argand, No. 1, and the testing-station is to be at the works.

The *Halstead Gas Order* is to authorize the Halstead Gas Company, Limited, to construct and maintain gas-works for supplying gas to the parish of Halstead, in Essex. The Company started with a share capital of £10,000, and the Order proposes the raising of another £10,000. The new capital is to be offered to the public by auction or tender, and, as usual, no lot is to be of more than £100 value. The original capital will, of course, be entitled, subject to the sliding scale, to ten per cent., and the additional to six or seven per cent., according as it is raised as preference or ordinary capital. As the Company do not appear to have borrowed any money on their original capital, they seek power to raise £5000 on their aggregate capital of £20,000. The standard price for gas, subject to the sliding scale, is to be 5s. 6d. per thousand feet. Gas of fourteen-candle illuminating power is proposed to be supplied, tested by Sugg's "London" Argand burner, No. 1, at the customary day and night pressures.

The *Harrogate Gas Order* is to authorize the Harrogate Gas Company to raise additional capital to the amount of £60,000, and to borrow on mortgage £20,000. The dividends on the new capital are to be limited to six or seven per cent., according as it is raised as preference or ordinary.

The *Holywell Gas Orders* are, on the one hand, to enable the British Gaslight Company, Limited, to apply a further sum of £10,000 towards their Holywell undertaking. The present capital chargeable to these works is £10,413, upon which ten per cent. is, of course, paid. The additional sum asked for in the Order will be entitled to a dividend of six or seven per cent., according as it is issued as preference or ordinary capital. Borrowing powers to the amount of £5000 are sought. The Company propose to supply fourteen-candle gas at a maximum price of 6s. per thousand feet, tested by Sugg's "London" Argand burner, No. 1. The usual day and night pressures are prescribed.

In competition with the preceding Order is one promoted by the Local Authority of Holywell. In it a proposal is made to purchase by agreement, but not otherwise, the undertaking of the British Gas Company. The Local Board, if they obtain the works, propose to supply fourteen-candle gas at a maximum price of 5s. 6d. per thousand feet, tested by Sugg's "London" Argand burner, No. 1; the ordinary day and night pressures being prescribed.

The *Long Eaton Gas Order* proposes to enable the Long Eaton Gas Company, Limited, to construct some additional works, for which purpose they seek power to raise the sum of £14,000. Their present capital is £16,000, entitled to ten

per cent. dividend; and the new capital will be entitled to six or seven per cent., according as it is raised as preference or ordinary. Borrowing powers to the extent of £6000 are prayed for. The new capital is proposed to be offered by auction or tender, the premiums to be applied as usual. Gas of fourteen-candle power is proposed to be supplied, tested by Sugg's "London" Argand burner, No. 1. The standard price, subject to the sliding scale, is proposed to be 5s. 6d. per thousand feet within Long Eaton, and 6s. 6d. beyond. The customary day and night pressures are prescribed.

The *Stone Gas Order* was mentioned in our last issue. It is promoted by the Local Board for the purpose of setting up works in competition with the Gas Company. Power is asked to borrow, for gas purposes, an indefinite sum of money, to be repaid, by means of a sinking-fund, in the course of sixty years. Gas of fourteen-candle power is proposed to be supplied, at a maximum price of 4s. per thousand feet. The usual day and night pressures are prescribed.

The *Trowbridge Gas Order* proposes to enable the British Gaslight Company, Limited, to expend a further sum of £20,000 on their Trowbridge undertaking. The present capital chargeable to these works is £20,253, entitled to ten per cent.; and the new capital will bear interest at the rate of six or seven per cent., according as it is raised as preference or ordinary. Borrowing powers to the extent of £10,000 are sought. Gas of fourteen-candle power is proposed to be supplied, tested by Sugg's "London" Argand burner, No. 1, at a maximum price of 4s. 6d. per thousand feet, and it is to be delivered at the ordinary day and night pressures.

There are eight Orders, as follows, in reference to water undertakings:—

The *Broadstairs Water Order* proposes to enable the Broadstairs Water-Works Company to raise a further sum of £16,000, and to borrow £4000, for the purposes of their undertaking. The new capital is to be entitled to six or seven per cent., according as it is raised as preference or ordinary.

The *East Blatchington and Seaford Water Order* is to give statutory authority to what is at present carried on as the private undertaking of Mr. R. Lambe, of East Blatchington, which is intended to furnish a supply of water to Seaford and East Blatchington. The source of water is to be a well in the last-named place. The undertaker proposes to charge ordinary rates for a domestic supply, but some of the extras are rather high. The Order will allow the undertaker to raise capital to the amount of £10,000, and to borrow to the extent of a quarter of that sum. As usual, the quality of the water is to be the best obtainable from the source.

The *Gisborough Water Order* is to authorize Mr. T. Chaloner, of Gisborough, to raise a further sum of £11,000 for the extension of his private undertaking at that place.

The *Harrogate Water Order* proposes to enable the Harrogate Water-Works Company to raise a further sum of £40,000, and to borrow £10,000, for the extension of their works. The dividends on the new capital are limited to six or seven per cent., according as it is raised by preference or ordinary shares. The works which will be authorized by the Order have been partially constructed, and the capital now asked for is required for their completion.

The *Luton Water Order* proposes to authorize the Luton Water Company to raise a further sum of £30,000 for the extension of their works, and to borrow £7500. The new capital will be entitled to six or seven per cent., according as it is raised as preference or ordinary.

The *Newhaven and Denton Water-Works Order* is to authorize the construction of works for furnishing a supply of water to Newhaven and Denton, in Sussex. The undertakers are the Earl of Sheffield and Mr. Henry Willett. The Order proposes a capital of £20,000, with corresponding borrowing powers. The source of the water is to be a well, of course in the chalk, in the parish of Newhaven. The rates proposed are ten per cent. on the annual value of houses below £20, and eight per cent. above. For water-closets more than one, 10s. each is to be charged, and for baths 12s. 6d. each. These rates, it must be admitted, are rather high.

The *Norwood (Middlesex) Water Order* is applied for to authorize the Norwood (Middlesex) Water-Works Company, Limited, to raise a further sum of £60,000, for the purpose of enabling them to furnish a better supply of water to Hayes, Hillingdon, and the remainder of their limits, and to borrow £15,000.

The *Pultheli Water Order* proposes to fix the capital of the private undertaking of Mr. A. E. Pownall at £8000, with a power to borrow £2000. The rates proposed are somewhat higher than usually obtain in rural districts.

URBAN WATER SUPPLY.

In former articles (see *ante*, pp. 12, 88) we have endeavoured to bring before our readers some facts on this important subject, communicated in the Return lately made to an Order of the House of Commons, "showing the means by which drinkable water is supplied to every Urban Sanitary District in "England and Wales." To bring the facts conveniently before our readers, we took into consideration at first the towns within the drainage area of the Thames, and in doing so had occasion to point out the extremely imperfect state of the information supplied in the Blue-book, both as regards the towns in that district—many of considerable importance being excluded altogether—and also as to statistics, a large number of the returns made being simply a declaration of utter ignorance on the subject on the part of the authorities consulted. We now proceed to consider the case of another very important drainage area—that of the Severn.

The Severn, as a river, differs very greatly in all respects from the Thames. Its sources, and those of all the tributaries on the right bank, are among the mountains of Wales, while those of the many tributaries entering from the left bank are in the comparatively low elevations of the new red sandstone in the middle of England, and the higher oolitic ridge of the Cotswolds. On the right bank there are few towns and not much cultivation; on the left bank, a multitude of towns and important manufacturing districts. The rainfall on the one side of the river is very heavy, and often torrential; on the other side it is smaller in amount, and more distributed. The tributaries upon the right bank are bright, pure streams, varying enormously in their volume at different seasons; those on the latter are more or less muddy, and not much subject to heavy floods. The rainfall on the Upper Severn and in the Vyrnwy Valley is nearly 64 inches; over the country traversed by the Wye it is 32 inches; and over the Usk and the Taff Valleys it reaches 46 inches. In the valleys of the streams coming from, and flowing over the new red sandstone, the rainfall hardly exceeds 26 inches, but in those draining the oolites and the limestones of the Mendip Hills it amounts to 37½ inches.

We have before us a list of 134 towns in this drainage area, but only 86 of them are referred to in the returns, and of a large number of these the information concerning water supply amounts to nothing. We will proceed briefly to discuss the returns made with reference to these 86 towns.

On the River Severn, as on the Thames, the number of large towns is very small. There are but three the population of which is above 10,000, and six between 5000 and 10,000. There are sixteen smaller towns of which the drainage belongs to the Severn proper, though several of them—such as Wenlock, Malvern, and Berkeley—are not situated upon, nor are they very near the stream.

Newtown, in Montgomeryshire, is the first town on the Severn of which we have any account. It has a constant supply from a watershed of 1200 acres in the Kerry Hills, the water being received into a reservoir and distributed unfiltered. The works are constructed to supply 200,000 gallons per day, or an average of about 34 gallons per head, at a cost of 30s. 10d. per head of population, but as yet only about one-third of the town is under supply. The charge for the water appears to be at the rate of 5·64d. per thousand gallons. Welshpool has a constant supply from a lake, the water being conveyed thence to a reservoir, and filtered. The daily supply is stated in one column at 20 gallons, and in another at 40 gallons per head; the cost of works has been not more than 15s. 4d. per head of population, and the charge is not more than 1½d. per thousand gallons if the supply is 20 gallons per day, and only ¾d. if 40 gallons. Shrewsbury is supplied chiefly from the Severn, but partly from springs in the new red sandstone, although only one-sixteenth part of the whole is from the latter source. The supply from the river is intermittent, and not filtered. The total quantity supplied daily is about 27 gallons per head. The cost of works, as purchased from a Company by the Corporation, was about 27s. per head of population, and the charge for water is 8·2d. per thousand gallons.

From Shrewsbury to Worcester are several important towns on and near the Severn, but in the returns no information is afforded as to water supply, except as regards Bridgnorth, where a copious supply from a spring is conveyed to the inhabitants free of charge. Worcester, like Shrewsbury, is supplied from the Severn, a quantity equivalent to about 30 gallons per head being pumped into a reservoir, and delivered, after filtration, in a constant supply. The cost of works was about 30s. per head of population, and the average charge is 2d. per thousand gallons. Malvern is supplied from springs in the hills adjacent. The quantity is only 9 gallons

per day; but the supply is constant, except when, owing to continued drought, the amount of water available is inadequate. The cost of works is stated at nearly 95s. per head of population, and the charge for water is 6.6d. per thousand gallons. Tewkesbury, like Worcester, is supplied with filtered Severn water, and till the passing of a recent Act authorizing the purchase of the Cheltenham Water-Works by the Corporation of that town, it was supplied by the Cheltenham Water Company. No particulars are given of the water supply of either Cheltenham or Tewkesbury pending the transfer of the works. Charlton Kings and Leckhampton both belong to Cheltenham, and were chiefly supplied by the Company. Gloucester has a constant supply from reservoirs receiving the collected waters of several small streams. The quantity in summer is about 17 gallons per head per day, but is somewhat uncertain, and is regarded as insufficient. The cost of works has been nearly £3 per head of population, and the charge, estimated upon the stated supply, is 5.6d. per thousand gallons. Clevedon, at the mouth of the Severn, has a constant supply of 32 gallons per head per day from springs in limestone rock. The cost of works has been more than £3 per head, and the charge for water is 6d. per thousand gallons.

Of the sub-basins of the rivers entering the Severn from the right bank, no information is given, except as regards a few of the towns on the Wye and the Usk. The first town on the Wye is Builth, situated in the mountains near the source of that river. It is supplied with spring water to the extent of nearly 20 gallons per head per day, the supply being constant and sufficient. The cost of the works was nearly 30s. per head of population, and the charge for water is 5.6d. per thousand gallons. The town of Hay is also supplied from springs, and the quantity is said to be sufficient, but is not stated. Hereford has a constant supply of filtered river water from the Wye to the extent of about 27 gallons per head per day. The cost per head of the works was 21s. 9d., and the charge is 3.3d. per thousand gallons. Leominster is supplied from a well and adits driven to increase the yield. The supply is constant and sufficient, being at the rate of 20 gallons per head per day. The cost of works per head of population was 26s. 2d., and the charge per thousand gallons is 3.2d. Coleford is described as having an ample supply from natural springs conveyed to the town, but not distributed, and Monmouth is supplied by a Company at the rate of 40 gallons per head per day, the water being taken unfiltered from the River Wye. The cost of works and the charge for water are not given. Lastly, we are told that Chepstow has a constant supply of filtered spring water to the extent of 30 gallons per head per day in the hands of a Company, the capital cost of works having been equivalent to 40s. per head of population, and the charge for water being only 1.4d. per thousand gallons. Two towns on the Wye—Kington and Ross—are also described as being supplied by Companies, but no other information is given. Seven towns in the Wye drainage area are not mentioned in the returns.

The Usk drainage area contains seventeen towns, some of them large and populous. All, except Brecknock, Crickhowel, and Caerphilly, are mentioned in the returns, but information is given concerning six only. Usk has no works and no regular supply. Panteg, Blaenavon, and Caerleon receive water from wells and springs, but no details are given. Abersychan is described as in the hands of a Company. Pontypool, which also supplies Upper Llanfrechna, is likewise supplied by a Company. In neither case is any return made. Abertillery is said to be in treaty for a supply. Abergavenny has a constant supply from mountain springs brought direct into the mains. Upwards of 40 gallons per head per day are taken. The works have cost nearly 21s. per head of population, and the charge per thousand gallons is 4.1d. Tredegar has a constant supply of about 5 gallons per head per day of surface water, partly springs, at a charge of 8.8d. per thousand gallons. Newport has from a Company a constant supply, obtained from springs and brooks, of 55 gallons per head per day. The capital expended is at the rate of £3 14s. per head of population, and the charge for water is at the rate of 3.4d. per thousand gallons. The waste is extreme. Rhymney is said to have a daily supply of only 4 gallons per house, the water being collected from the mountains into a pond, and thence conveyed two miles to a reservoir along the bed of a stream. It is then filtered before being distributed. The cost of works has been at the rate of 22s. per head of population. There is probably some mistake about the quantity delivered. Ebbw Vale has a constant supply of about 15 gallons per head per day, obtained from the River Ebbw, and collected into a reservoir. The cost of works is stated at £2 16s. 6d. per head of population, but no rates are yet

charged. Lastly, Brynmawr has a constant supply of 10 gallons per head per day from a catchment area at a high level, the water being stored and filtered. The cost of works has been very small (only 10s. 6d. per head of population), but the charge is 3.1d. per thousand gallons. The supply available is said to be half as much again as the quantity actually required.

It will be evident from the foregoing statement that several of the towns have river water supplied not always after filtration, the Severn water being used in most of the large towns on its banks. The cost of the works and the charge for the water varies a good deal, but is decidedly higher than in the Basin of the Thames. The proportion of towns provided with any regular supply is small, hardly exceeding one-third of the whole number. The quality of the water supplied is not alluded to in the returns, but with few exceptions it is probably good.

It will be seen that hitherto we have only considered the towns that are in the drainage areas on the western side of the Severn Basin, where there is heavy rainfall, and the sources of the streams are all pure and unpolluted. In another article we propose to take the tributaries entering on the left, or northern and eastern banks of the Severn.

THE OUTFALL SEWERS ON THE THAMES.

A LONG pause is now to take place in the arbitration on the Thames sewage outfalls. Twenty days have been occupied by the proceedings, and now the inquiry stands over until the 1st proximo. This protracted adjournment is understood to be mainly caused by the numerous engagements of the Umpire—Sir Charles Hartley. The delay is of no particular consequence, especially as the attention of the public has not been engaged in following the case very closely. A "horrid murder" would have occupied many columns of the daily press, and every examination of the accused would have been reported almost verbatim. But, despite all the accusations levied against the outfalls, and all that has been said concerning the "sewage zone," there has been no great excitement shown with regard to the conflict between the Thames Conservators and the Metropolitan Board. When the climax comes, no doubt there will be considerable discussion, unless some political crisis should intervene. It has been arranged that when the inquiry is resumed the evidence shall go on for four days consecutively, after which a further adjournment is to take place until March 9 and 10 for the speeches of counsel. The case for the Conservators came to an end on the fourteenth day of the inquiry. At least the Umpire said, "We will consider it closed;" and Mr. Bidder proceeded to address the tribunal on behalf of the Metropolitan Board. On the following day Sir Joseph Bazalgette was examined, and at subsequent dates there were other witnesses, including Mr. A. M. Rendel, Engineer to the Victoria Docks, Mr. Henry Law, Mr. Thomas Hawksley, and Mr. T. W. Keates, Chemist to the Metropolitan Board. The evidence of Mr. Keates has been only partially given, the adjournment taking place before the completion of this gentleman's statement. It is obvious that the case for the Metropolitan Board depends, to a large extent, on the evidence of this witness, who, as yet, has only dealt with one out of the three divisions into which he has separated his subject. Altogether, including the cross-examination, we may expect that Mr. Keates will occupy the attention of the Arbitrators for at least a couple of days longer.

Concerning the nature of the defence to be offered by the Metropolitan Board, we find it very distinctly stated in Mr. Bidder's address, that the evidence of Dr. Tidy as to the presence of sewage will not be disputed. It is admitted that sewage exists in the mud-banks near Crossness and Barking, and not only so, "but that it pollutes the whole of the river, and enters into the combination of every mud-bank from Teddington to Erith." But it is contended that while the quantity of matter which comes from the sewers is utterly insufficient to account for the banks, there is abundance of material from other sources much more than sufficient to account for all the mud-banks in the river. We may observe that if the witnesses for the Metropolitan Board are going to acknowledge that sewage from the great outfalls pollutes the river and mingles with the mud-banks all the way from Erith to Teddington, they are putting a very dangerous weapon into the hands of their opponents. Mr. Bidder, it is true, contends that the sewage manifests itself in a very small proportion. Acknowledging the presence, he denies the quantity. He says Dr. Tidy has himself admitted that the microscopic investigation which he recently carried out proved nothing as to quantity. "It shows the presence of sewage matter,"

argues Mr. Bidder, "but whether it be one-tenth of the bank or one-millionth of the bank he does not give you any indication of whatever."

Mr. Bidder's address was a short one, and he signified that he should have more to say at the close of his case. We apprehend it is intended to be shown that the Thames in the neighbourhood of London is necessarily a dirty river, independently of the outfalls, and that what is called "sewage" is in many cases polluting matter which never entered the sewers. The thousands of people on board the shipping in the Pool and elsewhere will account for a good deal. The storm overflows contribute something, as also the barge population, and a number of unobserved outlets from river-side premises, to say nothing of the dead dogs and cats which drift about everywhere. For the term "sewage" we may in some cases substitute Dr. Frankland's favourite phrase, "animal contamination," meaning that which may or may not have passed through the sewers. It is quite possible to account for Dr. Tidy's results without admitting anything that would substantiate the case of the Conservators, or that would justify the report made by Captain Calver. It is well to be bold; but it is possible to be too bold, and we think the Counsel for the Metropolitan Board has erred rather in the latter direction, though he is careful to point out that the mere presence of "sewage" in the specified mud-banks is not sufficient to give his opponents the victory. He even goes so far as to argue that if the banks in question were proved to be wholly sewage, the fact would not be sufficient to condemn the outfalls. Mr. Bidder argues that the banks may have been caused by something which was independent of the sewers, even though "every atom of those banks was sewage." The point is raised that mud-banks and shoals will exist somewhere, and that it is impossible to give the Thames more than a certain width and depth in a given part. Hence, as the Conservators dredged away one set of shoals they created another set. If a shoal be taken from the south side another appears on the north side, and *vice versa*. Thus Mr. Bidder arrives at the result "that the formation of these banks is the inevitable result of that which has been done by the Conservators and others at those points." The river can only keep open a certain sectional area, and if, by dredging, this be enlarged in one place, the natural action of the stream will establish a compensation by a deposition of mud in a new spot.

Mr. Bidder takes up a position which appears perfectly consistent with the cause he defends when he says: "It is impossible to come to any other conclusion but that the proportion of matter from the sewers in the banks is extremely insignificant." His position is also clear when he says that the banks complained of are like all other mud-banks in the Thames, and like all mud-banks that were in the river before the outfalls existed. On the question of quantity he also makes a strong stand. Great care is taken to exclude the road-drift from the sewers, and there is evidence that these efforts are, in the main, successful. Sir J. Bazalgette stated that there were more than sixty thousand catch-pits in the Metropolis, and above a hundred and thirty thousand tons of material had been removed from them during the year. One-third of this quantity would be water, and the rest detritus. From the sewers rather more than twenty-six thousand tons were removed in the course of the year. Practically, there was no detritus found at the gratings of the pumping-stations, and absolutely none in the sewage reservoirs. In short, "there never was any detritus in the sewers below the pumping-station. They had never been cleansed since the opening, and did not require it now." On the southern side some detritus had been taken out of the sewers, "but that was chiefly caused by the formation of new roads at Charlton."

The evidence of Mr. Keates has thus far related only to the amount of matter suspended in the sewage. He took the gross quantity of sewage coming down to the outfalls at one hundred and twenty millions of gallons in the twenty-four hours. Taking the average at twenty-three grains of suspended matter per gallon, this gave about one hundred and seventy-six tons per day, or rather more than sixty-four thousand tons in a year. This is dry matter, obtained with a temperature of 230° Fahr. The suspended matter previous to drying contained about sixty per cent of water. Nearly two-thirds of the solid matter would be organic, which would decompose into the gaseous and liquid state, and so pass away. Supposing the mud-banks were made exclusively from matter derived from the sewers, the annual accretion would be twenty-two thousand tons of mineral matter, to which might be added two thousand tons of organic, making a total of twenty-four thousand tons. Of course it is unreasonable to suppose that all this goes directly into the composition

of the three particular mud-banks complained of. The banks themselves contain nearly one million four hundred thousand tons of mud. Reckoning that the outfalls have been in operation fourteen years, they could not have contributed quite so much as a quarter of a million tons of solid matter to these banks in that length of time. It may be said that the mud-banks are partly water, and that we should make an allowance for this. If they are half water, this would double the effect of the solid sewage matter, making it equivalent to nearly half a million tons. Remembering how much must go elsewhere, and seeing that the banks contain a far greater quantity than can possibly come from the sewers, even if we reckon the whole of it, it may be fairly argued that the mud-banks are substantially caused by deposited matter, independent of the outfalls. However, we shall hear yet more on this point; and there is the probability that the final decision will attribute to the outfall sewers some share in the formation of the mud-banks, though in what degree we cannot anticipate. We are only struck with the fact that Mr. Bidder, in his address, endeavoured to extricate his clients from the mud-banks by distributing the outfall discharge over the whole tidal sweep of the river.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE HYDRAULIC MAIN.

SIR,—I feel that it would be scant courtesy to Mr. R. H. Patterson to remain silent when he appeals, as he does at the conclusion of his valuable contribution to your columns on the subject of the hydraulic main, for either my or Mr. West's experience of "White's apparatus." Hence I break a silence which I intended to maintain a while longer, until, by prolonged experience, I could state my views without the somewhat qualifying admission of short acquaintance with this, as I regard it, very important invention.

My opinion is that the hydraulic main is no longer a necessary part of a retort-stack. I have provided one in the new works at Tunbridge Wells, on the principle which, in general professional practice as well as in common life, I favour, of having "two strings to one's bow;" but, unless some unforeseen difficulty or derangement occurs, the hydraulic main will never be used, nor the dip-pipes ever be sealed. They are there, and although I conceive they may possibly be required to fall back upon, I do not think the contingency is in the remotest degree probable.

"White's apparatus" has given me great satisfaction; and, when used in combination with the steam-jet exhauster, there is not the slightest difficulty in keeping an absolutely steady gauge, the passage between the valve and the retort being perfectly unobstructed by dip-pipes—so steady, indeed, as to lead a casual observer to doubt the possibility of its being in action, notwithstanding the disturbing influences resulting from drawing and charging retorts. The only governors I use at Tunbridge Wells, between the retorts and the gasholders, are those in connection with the steam-jet exhausters.

As it is my intention very soon to publish my views on "Modern Gas Manufacture," as illustrated at these works, I shall abstain for the present from going further into the various questions raised and ably dealt with by Mr. Patterson, and illustrated in part by the experience and investigations of Mr. George Livesey and Mr. Young; all being matters of exceedingly great interest, and deserving careful attention.

R. P. SPICE.

21, Parliament Street, Westminster, S.W., Jan. 28, 1880.

FROZEN LAMP SERVICES.

SIR,—Mr. T. Gilchrist, of Sligo, holds, I think, a wrong idea about frozen lamp services, if he thinks they are caused by an insufficient fall to the main-pipe. The reason he is seldom or never troubled with this inconvenience is, that the winter climate of Ireland is uncommonly warm, in consequence of the heat given off by the Gulf Stream. For instance, the meteorological observations at Valentia, Cork, and Mullaghmore hardly ever note the temperature below freezing point. Scotland and the eastern parts of England now and then have greater cold, caused by easterly winds from the Continent, and the thermometer sinks to 20° or, though very seldom, to 15° Fahr., at which temperature there will perhaps be a good many frozen services every night. Now, on the Continent—say in Germany, where the cold varied between +5° and -13° Fahr. during the four weeks December frost period of 1879—gas-works were very much troubled with frozen lamps, so that 10 to 15 per cent. of the public lamps used to be stopped up.

The explanation is very simple. The gas as it enters the holders is at a temperature of, say, 50° Fahr., and cools down to perhaps 2° or 3° above the day temperature, which is generally about freezing point when the sun is shining. On being discharged into the public mains in the evening, it is not cooled down any farther, because the ground at a depth of 2½ to 3 inches only freezes after several weeks of intense cold. (The calamity of frozen services sets in at the same time as every strong frost.) From there it enters the lamp service, and as soon as it arrives above ground is subjected to a cold of, say, 5° Fahr. The moisture it contained in the ground, corresponding to a temperature of 37° Fahr., must be condensed at great velocity until the moisture in the gas is reduced to that quantity which it can hold in solution at about 5° Fahr. This condensed water settles down on the inner surface of the pipe in the form of hoar frost, choking a ¾ or 1 inch pipe in a very short time.

The best remedy is strong spirits of wine or absolute alcohol, which, in absorbing the moisture of the ice, gets heated to a certain extent

and dissolves the crystals. It is a well-known fact that if, after a long period of strong frost, thawing sets in, and the ice inside the lamp service (in the column) begins to melt, the water, on reaching the ground part of the service, freezes again, in consequence of the temperature of the ground still being, perhaps, 5° or more below freezing point, and a greater number of lamps will now and then be seen frozen up than at the time of the frost.

As to Mr. John McCrae's method of applying hydrochloric acid and hot water, it appears to me that great difficulty would be experienced in finding the hot water, unless every man sent out to open services were supplied with a stove, &c.; besides, the acid would prove rather destructive if frequently applied.

The best plan is, I consider, to send the gas into the mains in a perfectly dry state, and the difficulties of ice and naphthaline stoppages would be done away with. The proposal was made long ago, but I have not heard of its having been carried out in more than one or two places, nor do I know what the general effects have been.

Aix-la-Chapelle, Jan. 22, 1880.

C. R. J. PEPEYS.

SIR,—Several of my brother managers have given their experience in this matter, and some of them have taken a great deal of trouble in trying various remedies to drive out the bugbear. Mr. McCrae seems to have hit upon a plan for thawing the ice in lamp services; but I fear his remedy will leave a greater cause of trouble to the manager, and loss to his company, than the frost was to both. A correspondent in the JOURNAL of Jan. 3 gives his experience in using methylated spirits in the frozen pipes, and this remedy I should think would not be fraught with the danger of eating away the iron, as Mr. McCrae's may do; but as to one man clearing 50 lamps per day I will say nothing about.

I consider it is not so much expense that the manager or his company would care about as the clamour of the public, who make no allowance for the weather, and think we keep men hanging up behind the door, and can take one down at every beck and call, forgetting that when they are frozen out, others, and sometimes scores of them, are in the same fix. And worse than all is that sometimes even some of the directors who happen to be on the local boards, &c., are as unreasonable as the public, and not only think, but say, that the reason of the pipes stopping with the frost is that the services have not sufficient fall-back to the main. This is not correct, even though Mr. Gilchrist assures us such is the case. If it is so, how is that when the hydrochloric acid is introduced, together with a few pints of hot water, into each lamp service, the pipes are cleared? And, again, when the methylated spirits are poured into the pipes by "W. S. M.G.," why are not these service-pipes drowned out instead of being cleared? If it is condensation in the bend or any part of the horizontal service-pipe, why does it not cut the gas off at any time of the year, or as soon as the pipe is charged with condensed gas?

My experience is that, as a rule, it is not the horizontal part of the service-pipe that stops, but the bottom part of the upright pipe at the ground line that gets full of ice. This I have proved in several ways—first, by putting down the pipe a 3/4-inch iron rod till it stopped, and then measuring by the rod the outside pipe; secondly, by placing a small fire against the bottom of the pipe till the lamp could be lighted; thirdly, by taking the stand-pipe out of the bend. This I did, and found in the bottom of the pipe a plug of ice 2 inches long, which caused the stoppage, while the gas would blow at the bend.

Does the above prove that the horizontal pipe is wrongly laid, or that the cause is condensation trickling down the pipe till it reaches the ground line, where it is frozen, and the constant trickling down to that place and freezing eventually stops the pipe altogether?

I have remedied the defect by using two old pails, which I have made into fire-baskets, and filled them with coke fires, taking with us a bushel of small coke in an iron barrow, with a piece of gas-pipe tied across the barrow handles, with a pail hung on each side. We place one pail against a bracket lamp-pipe, and the other is carried on to another lamp; but if it is a pillar lamp that is stopped, we put both pails to it—about fifteen minutes for a pillar lamp, and sometimes five minutes for a bracket lamp is sufficient. I mostly have two men at the work, as they have the pails, barrow, and ladder to take with them. They do about six lamps per hour.

Yesterday I tried a scheme that was recommended to me, which was to pour into the pipe about a quarter of a pint of naphtha. This is the best remedy I know of. Before trying the plan, I put a piece of ice about an inch square into a small tin, and poured on to it two tablespoonfuls of naphtha, and in a few minutes the bottom part of the ice began to dissolve. By this experiment I proved that the naphtha would remedy the defect. I at once secured a tin bottle, taking with me a man and a ladder, and commenced pouring into the lamp-pipes a little naphtha, going on from one to the other till I had visited about twenty, being the number of complaints for that day, and, with one exception, the whole of them are right; the faulty one being, in my opinion, choked with rust.

Basingstoke, Jan. 23, 1880.

A. THOMAS.

GAS COMPANIES ACCOUNTS.

SIR,—I should like to ask, through your columns, if any gas companies subject to the Gas-Works Clauses Act, 1871, have discontinued the custom of filing with the Clerk of the Peace their annual accounts, which they were required to file under the Gas-Works Clauses Act, 1847, clause 38.

Looking at the Gas-Works Clauses Amendment Act, 1871, clause 35, I find that certain companies are required to file their accounts with the local authorities by March 31 in each year; also to keep copies of the said accounts, and sell them to any applicant at 1s. per copy. This appears to be ample provision for all requirements of publicity, and will meet the references wanted by any interested parties. Therefore, in reading the first clause of the Amendment Act, 1871, I should suppose that the filing of accounts with the Clerk of the Peace under the Gas-Works Clauses Act, 1847, is inconsistent with the Act of 1871. Clause 1 reads as follows:—

"The Gas-Works Clauses Act, 1847, and this Act shall be construed together as one Act, and the provisions of this Act shall be held to repeal

and supersede such provisions of that Act as are inconsistent with this Act."

Now, I should infer from this that the Legislature did not deem it necessary to enforce both of these clauses—i.e., clause 38 of the old Act, and clause 35 of the new Act—but that the filing of accounts with the Clerk of the Peace was repealed. However, I should be glad to know from any of your readers, what is the practice of depositing their accounts—I mean such as are subject to the Gas-Works Clauses Amendment Act, 1871.

As I have been concerned in a case where the question is in dispute, and as the Clerk of the Peace charges an exorbitant fee, and local authorities do not charge anything in this locality, it is perfectly right that gas companies should have the benefit of the new Act, if the repeal of the old clause be intended.

Jan. 28, 1880.

QUESTANT.

Parliamentary Intelligence.

GAS AND WATER BILLS, 1880.

The examination of petitions for private Bills was resumed on Monday, the 26th ult., by Mr. Robinson, the junior Examiner, who continued his sittings day by day during the week. In the course of that time the whole of the remaining Bills relating to the supply of gas or water came before him, and in the case of each of the following (unopposed) petitions, the Standing Orders were declared to have been complied with:—Ackworth, Featherstone, and Purston Gas Bill; Cardiff Water-Works Bill; Chester Gas Bill; Dartford Gas Bill; Dearne Valley Water Bill; Doncaster Corporation Water Bill; Edinburgh and District Water Bill; Hull Lighting Bill; Hyde Gas Bill; Lancashire County Justices (Water) Bill; Lincoln Gas Bill; Liverpool United Gas Bill; Malton Gas Bill; Maidstone Gas Bill; Reading Gas Bill; Stafford Borough Bill; Wakefield Corporation Water Bill; Wandsworth and Putney Gas Bill; Wigan Improvement Bill; Yarmouth Water Bill.

The consideration of the Rathmines and Rathgar Township (Vartry Water Supply) Bill (opposed) and the Sligo Borough Water Bill (unopposed) was postponed until the 6th inst.; and of the Birkenhead Borough Bill and the South Metropolitan Gas Bill (both unopposed) until the 9th inst.

Legal Intelligence.

HIGH COURT OF JUSTICE OF IRELAND.

EXCHEQUER DIVISION—DUBLIN, SATURDAY, JAN. 24.

(Before the LORD CHIEF BARON, and Barons FITZGERALD and DOWSE.)

CORPORATION OF KILKENNY v. KILKENNY GAS COMPANY.

This was an action of ejectment brought in respect of a portion of the premises upon which the gas-works in Kilkenny were recently erected. Defendants having made a lease of their works to Mr. George Anderson, of London, that gentleman obtained leave to appear and defend. In his defence he stated that his landlords had been in possession of the works for many years; that they had laid out large sums in extending and improving the works; and that the plaintiffs acquiesced in the expenditure. The defence also stated that the defendant during his tenancy of the works, now for a period of two years, had also expended large sums of money in like improvements, and, therefore, in point of equity, the action could not be sustained. The plaintiffs demurred to this defence, contending that it was no answer in point of law to the fact that the premises were held from the old Corporation by a lease of 1838, which, owing to the disabling Acts then affecting Corporations in Ireland, prevented them from executing a lease in the interval before the coming into operation of the Municipal Reform Act, and therefore that the lease was *ultra vires*.

MR. HEMPHILL, Q.C., MR. MORGAN B. KAVANAGH, and MR. PHILLIPS appeared for the plaintiffs; MR. W. H. JOHNSON, Q.C., and MR. J. ROCHE for Mr. Anderson; and MR. W. RYAN, Q.C., and MR. J. GIBSON attended to watch the proceedings on the part of the Gas Company, who had filed defences as to matters of fact, which will be submitted to a jury at the next Wicklow Assizes.

MR. KAVANAGH opened the demurrer, and in its support cited Acts of Parliament and authorities bearing on the question, for the purpose of showing that the Corporation had not the power at the time to execute the lease in question.

MR. ROCHE replied on behalf of the lessee, and characterized the action as an unrighteous attempt to deprive improving tenants of the fruits of their industry and improvements. He contended that, even if the original lease were invalid, the Corporation, by letting (in 1870) a piece of adjoining land for the purpose of extending the works, had given validity to, and set up the original lease.

The hearing of the arguments having concluded, the Court reserved judgment.

THURSDAY, JAN. 29.

The LORD CHIEF BARON delivered judgment in this case to-day. He said it was a demurrer to an equitable defence by Mr. George Anderson, the lessee of the works. The ejectment had been brought by the plaintiffs against the defendant to recover possession of certain premises in the city of Kilkenny, upon which the defendant had erected gas-works, upon a notice to quit, alleging that the defendants were tenants from year to year to the Corporation. The defendants pleaded the statutory defence that they were in possession, and also an equitable defence that they were in possession under a lease from the Corporation, dated July, 1838, and upon the faith of that lease had spent large sums of money in erecting the works with the entire knowledge and acquiescence of the Corporation; and they claimed specific performance of the lease, or compensation for the money expended on the works. Counsel for the plaintiff demurred to the equitable defence, on the ground that the lease was made after the passing of the 6 & 7 William IV., cap. 1, which became law in 1836, and prohibited all alienation of corporate property pending the passing of the Municipal Corporations Act, 3 Vict., cap. 103, which Act, in sec. 140, prohibited the making of leases longer than 31 years; consequently the lease was void *ab initio*, and no specific performance of it could be granted, and the Corporation could not be ordered to pay compensation, as they would not have any power to levy a rate to pay it. He held that the lease was void *ab initio*, because it was made *ultra vires*, and contrary to Act of Parliament; and that, as the plaintiffs were a corporation, defendant was not entitled to any compensation, as there was no possible fund out of which to pay it. The demurrer was therefore allowed, with costs.

The other learned Judges concurred.

Judgment accordingly.

STAFFORDSHIRE ASSIZES—NISI PRIUS COURT.

MONDAY, JAN. 26.

(Before Justice MANISTY and a Special Jury.)

HIPKINS v. CORPORATION OF BIRMINGHAM.

CONTAMINATION OF A WELL AT WEST BROMWICH.

This was an action brought by Charles Hipkins, the owner of two houses in Jervoise Street, in the parish of West Bromwich, against the Birmingham Corporation, to recover certain penalties, to which he alleged he was entitled under the 160th and 161st sections of the Birmingham and Staffordshire Gas Act, 1845, by reason of the defendants having permitted water to escape from a gasholder-tank belonging to them, and to pollute the plaintiff's well. The plaintiff sued for a penalty of £200, and for a penalty of £20 a day for each day that the pollution continued—in all 36 days—making together £920.

Mr. JELF and Mr. HATTON appeared for the plaintiff; and Mr. MATTHEWS, Q.C., and Mr. ANSTIE for the defendants.

Mr. JELF, in opening the case, said the plaintiff, who was the owner of two houses in Jervoise Street, West Bromwich, brought this action to recover certain penalties in consequence of the pollution of a well on his premises, resulting from the acts of the defendants in making gas and allowing certain water to escape from a tank on their premises. The plaintiff did not mean to say that he had actually sustained damage to the extent of the penalties named. What he did say was, that the defendants, who were a wealthy corporation, had purchased a certain undertaking, with the rights and the liabilities attaching to it, and that the Act of Parliament under which they had obtained the undertaking had provided regulations by which in certain events they were to pay penalties, the object being to prevent the occurrence of injury to persons property from the operation of the works. Inasmuch as the defendants had brought themselves within the meaning of the words of the statute, they were liable to the plaintiff to the extent of the penalties claimed. The damages actually sustained by the plaintiff were not inconsiderable, because in 1867 he bought the land on which the houses were built, and sank the well at considerable expense, and the water being once contaminated by water from the gas-works, the products therefrom were of such a subtle character that they insinuated themselves into the ground, and would continue to pollute the water for a long time to come. He then referred to the Act of Parliament by which the Birmingham and Staffordshire Company's gas-works were transferred to the Birmingham Corporation, which Act he said provided that they should take over the undertaking, with all its rights and liabilities, and it substantially placed the Corporation in the same position as that occupied by the Staffordshire Company. He explained that the 160th section of the Act 8 & 9 Vict., c. 66, which was an Act to enlarge the powers of the Birmingham and Staffordshire Gaslight Company, enacted that "if the Company shall at any time cause or suffer to be conveyed or to flow into any stream, reservoir, aqueduct, pond, or place for water within the limits of this Act, or into any drain, sewer, or ditch communicating therewith, any washing, substance, or thing which shall be produced in making or supplying gas, or shall do any act to the water contained in any such stream, reservoir, aqueduct, pond, or place for water, whereby the water therein shall be fouled or corrupted, then the Company shall forfeit for every such offence the sum of £200." There was also subsequent statute with reference to pollution by gas-works products. He next referred to a similar action brought by a brother of the present plaintiff against the Staffordshire Company before the works were transferred to the Birmingham Corporation. In that case he said it was contended that the defendants were not liable unless there was some negligence on their part, and that the injury did not result from their acts, but from mining operations. The majority of the judges in the case were of opinion, however, that negligence was not a necessary element, and that the defendants were liable totally irrespective of personal fault. After reading the decisions of the judges, he said it was perfectly clear that the Staffordshire Gas Company were liable; and he pointed out that for every day the pollution was continued, after notice had been given of the fact of the injury, the defendants were liable to a penalty of £20 a day. If the Staffordshire Company would thus have been liable, it would be for his friend (Mr. Matthews) to show how it was that the defendants were not also liable under the present circumstances. The facts of the case were that on the 9th of May last the water in the plaintiff's well was found to be impure and unfit for use, and the same day a sudden depression took place in the gasholder-tank, and there was no doubt that a collapse occurred in the bottom of the tank. The water, impregnated with gas, escaped, and in that way the well was polluted. The pollution went on, as was admitted by the Corporation, until the 10th of June, 27 days after notice was given, and there were also subsequent days on which the pollution continued.

Mr. Charles Hipkins, the plaintiff, was examined, and deposed to the facts stated by the learned Counsel. He said his houses were on the opposite side of the road to the defendants' gasholder. The Corporation pumped all the water out of the well by the 10th of June, and it was dry until the 1st of July, when water came again. His well was still polluted, but not so badly. On the 18th of August the water came again, and was even then polluted.

Mr. MATTHEWS contended that the plaintiff must show a continuous flow of water from the gas-works to the plaintiff's well, in order to make the defendants liable after the 10th of June, up to which date they admitted the well was polluted. Proceeding with the cross-examination of the witness, he asked if he had received, through his Solicitor, the following letter from the Town Clerk, dated Oct. 28, 1879:—

Dear Sirs,—*Hipkins v. Corporation*.—While the Corporation will resist to the uttermost any attempt on the part of the plaintiff to extort money from them in the shape of informer's penalties in respect of an accident caused by no negligence on their part, and by which they have been the greatest sufferers, they are most anxious to do him ample justice if he has really sustained any injury.

The matter has been carefully considered during the vacation, and now without admitting any liability whatever on the part of the Corporation, I am instructed to make the following offer:—(1) To pay the cost of laying on the water of the South Staffordshire Water-Works Company to the plaintiff's premises. (2) To pay the plaintiff in cash, or give him a security on the Corporation rates for a sum sufficient to produce, at 25 years purchase, the annual water-rate which he would have to pay to the Company. (3) To pay your client's costs.

After conferring with your client, I shall be glad to hear from you on the subject.

(Signed) E. J. HAYES, Town Clerk.

Witness said he had not heard of the letter before.

Justice MANISTY thought that the letter appeared to open the door for the plaintiff to make a liberal arrangement with the defendants, and he suggested the advisability of his conferring with his Solicitors on the matter. He thought that the Corporation seemed to be anxious to do something liberal.

A conference took place as suggested, and during this the following letter from plaintiff's Solicitors, which was received in reply to the above, was read:—

Sir,—We object to your insinuation that the plaintiff is attempting to "extort money in the shape of informer's penalties." It is plain he is no informer. He seeks to recover compensation for the injuries you have done him in the way provided by law, and, although we are sorry that you have been unfortunate, we have no doubt you will be amply compensated by the profitable results of the undertaking.

With regard to your proposal, our client has an objection to use South Staffordshire Company's water on any terms, and therefore we can have no hesitation in declining it.

You will have to give us a substantial sum of money, or else fight the question, and personally we are happy either way; but we esteem, as you must do, the value of peace and quietness, and whenever you are disposed to talk reasonably with us, we shall be happy to settle the matter. But you must sink altogether the power and wealth of your Corporation, and remember there is law and justice to be had by the poorest suitor.

We are quite prepared to meet you, and to do all that is right and reasonable.

(Signed) DUGGAN and CO.

After the consultation,

Mr. MATTHEWS intimated that no arrangement had been come to, and he proceeded with the cross-examination of the witness, who admitted that the property, the value of which he estimated at £900, was mortgaged. His houses had not been injured by mining operations.

Mr. JELF said the plaintiff had clearly forgotten the communication which was received by his Solicitors, for he had had two interviews with the Town Clerk of Birmingham on the matter.

Mr. MATTHEWS then submitted a number of objections. In the first place, he said, there should have been a notice of action, under the Municipal Corporations Act. The Birmingham Gas Act gave the Corporation no power to act as a body, but everything they did was by virtue of their being a Corporation under the Municipal Corporations Act. His second point was that the water polluted was not the plaintiff's water, by reason of the mortgage. And he objected, thirdly, that evidence had not been given that defendants had "caused or suffered" the water from the gasholder-tank to be conveyed into plaintiff's well. He further contended that it was necessary for his friend (Mr. Jelf) to show that the cause of the pollution was not the act of a third person, by mining operations. He did not want in the least to withdraw from the admission made by the Town Clerk that washings had flowed into the well, and for the £200 penalty his point would not arise; but as to the second group of penalties which supposed a continuing to flow, he submitted that there was no evidence of any water flowing into the well after the first break of the tank, and defendant must give evidence of it before he could recover the second bunch of penalties.

Mr. JELF having briefly replied,

Justice MANISTY decided that the matter must go to the jury.

Mr. MATTHEWS then addressed the jury for the defence. He commented on the fact that the Corporation had already made plaintiff a liberal offer, which was contained in the letter that had been read. Mr. Hipkins was not contented with this, and said he would have his "pound of flesh." He (Mr. Matthews) pointed out that the real cause of the injury was the mining operations which were carried on in the neighbourhood. The Corporation were unable to find solid land anywhere in the locality on which to put the tank, and they were bound by Act of Parliament to supply gas, and they could not do so without a holder. The jury would therefore see the difficult position in which they were placed. He reminded them that the plaintiff was not the only inhabitant of Jervoise Street. He had merely been put into the front of the battle, and there would be other houses to which the Corporation might be liable if they were to be held responsible for all the penalties claimed in this case. The accident to the tank was caused by mining operations, and he would try and satisfy them that there had been no negligence whatever on the part of the defendants, but rather that the utmost care was used by the Gas Committee, and that they went to great expense to prevent any accident of the sort. As to the penalties alluded to, he submitted that no water continued to flow after defendants commenced pumping, and that if the penalties were to be paid it would be because they had used their energies to try and remedy the mischief caused. He, in conclusion, asked whether it was possible for the defendants to stop the foul water from flowing any sooner than they did, and he urged that they had pumped as hard as they could until they made the place dry.

Mr. Hugh Young, a Gas Engineer, deposed that he superintended the construction of the gasholder. The tank cracked across the bottom in 1858, and he attributed it to the working of neighbouring mines. He described the means that were taken for the repair of the damage; and stated that the tank continued perfectly sound from then up to the time referred to in the action.

Mr. Henry Hack, Engineer at the Saltley gas-works of the Corporation, said that up to the time when the accident occurred no leakage had been discovered from the tank in question. As soon as the leakage commenced, pumping was begun, and it was continued until the tank was empty on the 10th of June. No more gas had been stored in the tank since that time, and if any mischief had since ensued it had been through gas products being in the soil. The gas was blown out on the 27th of May. The utmost diligence and skill had been used to remedy the results of the accident to the tank.

In reply to Mr. JELF, witness said the Corporation had since abandoned the defective tank.

By Mr. MATTHEWS: He was not conscious of anything having been done to the tank since, that had caused a flow of gas and water to the well.

TUESDAY, JAN. 27.

Mr. MATTHEWS said that he would not have to trouble the Court further, a compromise having been come to.

Mr. JELF said this was the case, the defendants having behaved very liberally—consenting to pay £200 and costs—judgment, however, to be entered for them.

YORKSHIRE WINTER ASSIZES—WEST RIDING DIVISION.

LEEDS, FRIDAY, JANUARY 30.

(Before Justice HAWKINS.)

THE RECENT EXPLOSION AT THE BRADFORD CORPORATION GAS-WORKS.

The charge of manslaughter arising out of the explosion which occurred at the Bradford Corporation Gas-Works on the 22nd of November last, was in the Crown List for trial at these Assizes.

Justice HAWKINS, in his address to the grand jury, alluded to the case. He said that, among others, there was a charge against a man named Samuel Ryder for the manslaughter of William Holt, at Bradford, but it had only come before him on the Coroner's depositions, and he did not know whether the prisoner had been before the Magistrates. It was very desirable, if a man was to be indicted for such an offence as this, that the case should be investigated before the Magistrates as well as before the Coroner, in order that he might be put on his defence. The facts of the case were that the prisoner was in the employment of the Bradford Corporation, at their gas-works in Thornton Road. On the 22nd of November, early in the morning, there was an explosion at the works, with the result that a man named Holt was killed. Previous to the explosion the prisoner had noticed that there was an escape of gas in the purifying-house, as undoubtedly there was, at the rate of about 5000 feet per hour. The prisoner had been forbidden by his employers to enter the purifying-house, particularly if he had a lantern; but he had either forgotten his instructions or disregarded them, for, in order to see what was the cause of the escape of gas, he entered the purifying-house with a lantern, the consequence being the explosion. The prisoner's lantern was found in the purifying-house, and also his hat. This was one of those cases in which it was quite certain that no harm had been intended to anybody. The prisoner was doing

the best he could, as he thought. He was acting unquestionably in disobedience to his employers instructions, but it did not follow that disobedience to the orders of a master was to constitute a case of culpable negligence against a man, so as to make him responsible for the death of another fellow-creature. The grand jury would ask themselves whether, under all the circumstances, the prisoner was guilty of such culpable criminal negligence in the matter that they ought to return a true bill for manslaughter.

Subsequently, the Grand Jury having returned a true bill, *Samuel Ryder* surrendered to his bail on a charge of the manslaughter of *William Holt* at Bradford, on Nov. 22, 1879. He pleaded "Not guilty."

Mr. SLINGSBY, who appeared for the prosecution, said he did not intend to offer any evidence, whereupon

Justice HAWKINS, addressing the jury, said that this was a most unfortunate case. It seemed there was on the day named in the indictment an escape of gas at the Bradford Corporation Gas-Works, and that the prisoner, no doubt with the intention of remedying it, went into the purifying-house with a light. Unfortunately, an explosion took place, and in it the man Holt was killed. The prisoner also sustained serious injuries. The Coroner's jury, on inquiring into the death of Holt, came to the conclusion that his act amounted to one of manslaughter, and he was committed upon the Coroner's warrant. The matter was subsequently before the Magistrates, who came to the determination that there were no grounds for committing him; and now the Counsel for the prosecution had informed the Court that he would not offer any evidence in the matter. This was very proper; because it would not be sufficient to convict the prisoner of manslaughter to prove that he simply imprudently went into a place where there might be an escape of gas, but they would have to show that he went in there most recklessly, criminally, and grossly negligent in the discharge of his duties. There was no evidence that the prisoner did this, so they would, of course, find him not guilty, and he would be discharged.

The jury then formally tendered a verdict of "Not guilty," and the accused was liberated.

LISKEARD COUNTY COURT.—MONDAY, JAN. 19.
(Before Mr. M. BERE, Q.C., Judge.)

THE SUPPLY OF WATER TO LISKEARD WORKHOUSE.

At the December sitting of the Court, an action was heard of *The Liskeard Water-Works Company v. The Board of Guardians of Liskeard Union*; and to-day judgment was delivered. The proceedings were nominally taken to recover three-quarters of a year's rent for water supplied by the plaintiffs, who are incorporated under a private Act, and who claim to be entitled to charge the Guardians at a special rate of £40 per annum, on the ground, among others, that the water supplied to the workhouse is not supplied for domestic purposes. The Guardians paid £11 into court, contending that the water used was for domestic purposes. The plaintiffs held, on the other hand, that it was for public purposes, and could only be obtained on special agreement between the parties. Negotiations having been unsuccessful, the action had been brought to settle the matter.

Mr. CHILDS appeared for the plaintiffs; and Mr. SHEELLY for the defendants.

Mr. BERE, in giving judgment, said: This is an action brought to recover three-quarters of a year's rent to Michaelmas last, for water supplied by the plaintiffs, who are incorporated by a special Act of Parliament, to the workhouse of the Liskeard Union. I will first dispose of the amount claimed, which is alleged to be due as being the sum which, at the rate of £40 a year, the Directors of the Company contend they have, under their Act, a right to charge the workhouse with, on the ground, among others, that the water supplied to the workhouse is not used for domestic purposes within the meaning of the Company's private Act, or of the Water-Works Clauses Act, 10 Vict., c. 17, which is incorporated therewith. I am of opinion that the claim of the plaintiffs, so far as the amount is concerned, cannot be supported, inasmuch as the powers given by their Act are confined to agreements between plaintiffs and public corporations desirous of having such supply of water. The demand that was made in Mr. Childs's letters of Aug. 20, and Dec. 21, 1878, and not agreed to by the defendants—but, on the contrary, declined by them—can hardly be an agreement between plaintiffs and defendants, which only will satisfy the clause in the Company's Act, under which they sue. The plaintiffs are, however, entitled to some payment, as the defendants have not paid anything for water since Christmas, 1878. What amount they are to be paid is, therefore, the question; but before determining that point, I will shortly deal with the arguments which were used to show that the defendants had brought themselves within the 35th section of the Company's Act—because their use of the water was for other than domestic purposes. The 34th section of the Company's private Act defines what are not domestic purposes, and using the words "for further purposes," raised the contention that any water used in the workhouse was used for public purposes, because the workhouse was a public place. This contention appears to me a very far-strained one, and I am of opinion that the words "for public purposes," do not apply to the place where the water is used, but the purposes for which it is used, such purposes being hinted at, at any rate, in the 34th section of the Water-Works Clauses Act, and are for the cleansing of sewers and drains, cleansing and watering the streets, and supplying any public pumps, baths, or washhouses. A fountain open to the public, but restricted in use, is not a supply for public purposes. Further, I am of opinion that a workhouse is not a public place. In the case of *Regina v. Wallingham Union*, a workhouse was held to be rateable, inasmuch as it was not devoted to public purposes, and was beneficially occupied. In the case *Marks v. Benjamin*, the word public received judicial interpretation. A place was public to which all persons had a right to go, whether gratuitously or for payment. The workhouse certainly will not receive any one who knocks at the door, even if he offers to pay for his bed. Another objection was taken under the 33rd section of the Company's Act, which shows who the persons are who are alone to be supplied with water, under the Act, for domestic purposes—namely, "the owner or occupier of any house." It was contended that such house must be a dwelling-house; and that, though the Guardians might be occupiers, yet they could not be called dwellers. The word "dwell" has, however, also received judicial interpretation; a railway company dwells at its principal station, a gas company where it carries on its business, a pier company where its registered offices are. I therefore come to the conclusion that the defendants are occupiers of the house in which they dwell, and are a corporation who may demand water from the plaintiffs. Now, as to the amount they are to pay, it appears that ever since 1862, under some agreement or other, the sum of £25 has been paid by the defendants to the plaintiffs, and although no record of this agreement exists, I must assume that as between the contracting parties all things were duly done to make such agreement binding, and that it is binding. The defendants have paid money into court calculated on the scale of prices put forth by plaintiffs, in which a house of £100 is charged at the rate of 3½ per cent. The scale is a descending one from 5½ per cent. to 3½, but I do not think that the plaintiffs are pledged to this scale, and therefore but for the agreement they might charge at the

rate of 6 per cent. on the rateable value of the workhouse, in accordance with which I give judgment for £18 for the three quarters due at Michaelmas, 1879.

It was pointed out that the rent had always been paid in advance, and that such was the Company's rule.

Mr. BERE therefore altered his judgment to £25.

Judgment for plaintiffs accordingly.

WORSHIP STREET POLICE COURT.—TUESDAY, JAN. 27.
(Before Mr. HANNAY.)

THE EAST LONDON WATER-WORKS COMPANY AGAIN CONVICTED.

The East London Water-Works Company were summoned by Alfred King for having neglected to furnish him with water, he being an owner of a house, and entitled to receive a supply during the time the rates for such supply had been paid.

Mr. LEWIS appeared for the complainant; and Mr. WRAGG for the defendants.

Mr. LEWIS, in opening the case, said that the Company had kept his client, on some buildings he had erected in Bethnal Green, without water for nearly six weeks, although notice had been given and the necessary deposit paid. The Company had, he understood, some idea, which he thought foolish, of their rights, and so refused. He then called attention to the regulations for supplying water by the Company, and the section of the Act of Parliament imposing a penalty of £10 for refusal.

Mr. WRAGG said that the objection taken on the part of the Company had regard to the fittings. By their regulations, the Company had a right to refuse to supply water until the water-closets and water-supply apparatus were fitted with an efficient waste preventer, so that no more than 2 gallons of water should be supplied at one flushing. On the premises in question an apparatus which the Company's Engineer could not approve of had been fixed, and hence the refusal.

Evidence was then given by the plumber employed on the building, as to the fixing of a patent anti-waste water apparatus, and as to the efficiency of the same in complying with the regulation for preventing a flow of more than 2 gallons at one flushing.

Mr. Alfred Tylor was called, and explained the action of the apparatus. In reply to Mr. LEWIS, he stated that at one time the Water Companies sought to have specified in their Acts the apparatus that should be used. A Parliamentary Committee was, however, appointed on the matter, and it was shown that it would cost over £4,000,000 to supply London houses under such a regulation. He was examined on the Committee, and in the end the regulation stood that an efficient waste preventer should be fitted. The waste preventer he had patented was in use by most of the large Water Companies, and was not liable easily to get out of order.

John Topp, a foreman in the employ of the New River Company; Mr. Walker, Sub-manager of the Reading Corporation Water-Works; George Davis, a foreman plumber to a builder, and several other witnesses gave evidence as to fixing the apparatus in question, and as to its complying with the regulations.

Mr. WRAGG, in cross-examining some of the witnesses, showed that the apparatus was fixed under the seat of a water-closet, and was worked at the same moment with the ordinary valve. In addressing the Magistrate, he said that the Company's Engineer objected to this mode of employing a waste preventer, and claimed that the Company had a right to say what apparatus should be employed.

Mr. LEWIS pointed out that there was nothing in the regulations of the Company which gave them any such power, or in any way prescribed how the apparatus should be fixed.

Mr. Clayton, of Westminster Chambers, and Mr. Seaton, Engineer to the Company, gave evidence that they did not think the apparatus efficient.

Mr. LEWIS put in a letter signed by Mr. Seaton, in which water service was refused because the apparatus was fixed under the seat, "which," the letter said, "the Company did not allow under any conditions whatever."

Mr. HANNAY, in giving judgment, said that he could only come to the conclusion that it was an afterthought by the Company to say that the apparatus was not efficient, and the letter of the Engineer bore that out. The regulations, however, gave the Company no power to say that the apparatus should not be fixed under a closet seat. If they thought they had that right, they could themselves have raised the question by summons before the Court. They had first taken up an untenable ground, and the new position, that the apparatus was not efficient, was not supported by evidence. He imposed a penalty of £5, and ordered the Company to pay £10 10s. costs.

A second summons in which the Company were complained of, on other grounds it was understood, was adjourned by consent for a fortnight.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health on the Composition and Quality of the Metropolitan Waters in January, 1880:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitro- gen. — As Ni- trates, &c.	Ammonia.		Hardness (Clark's Scale).		
				Sal- line.	Or- ganic.	Before Boil- ing.	After Boil- ing.	
<i>Thames Water Companies.</i>								
Grand Junction	21.45	0.048	0.158	0.001	0.008	15.8	3.6	
West Middlesex	22.20	0.081	0.158	0.0015	0.008	16.2	3.8	
Southwark and Vauxhall	22.45	0.066	0.165	0.000	0.009	16.0	3.6	
Chelsea	21.40	0.022	0.150	0.0005	0.008	15.8	3.6	
Lambeth	21.20	0.043	0.167	0.001	0.010	15.6	3.3	
<i>Other Companies.</i>								
Kent	33.10	0.007	0.435	0.000	0.002	21.2	6.0	
New River	22.85	0.024	0.185	0.000	0.008	16.0	3.2	
East London	24.10	0.026	0.183	0.0015	0.009	16.5	3.8	

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours.

The water was found to be clear and nearly colourless in all cases but the following, when it was very slightly turbid—namely, Lambeth and West Middlesex.

C. MEYMOTT TIDY, M.B.

REDUCTION IN THE PRICE OF GAS AT MATLOCK BRIDGE.—A reduction in the price of gas at Matlock Bridge is announced of 5d. per 1000 feet, with 10 per cent. discount if accounts be paid within 14 days of becoming due.

HOLMFIRTH GAS COMPANY.—The annual meeting of this Company was held on Wednesday last—Mr. B. Butterworth presiding—when a dividend at the rate of 5 per cent. per annum was declared.

PARA GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held at the London Offices, 7, Union Court, Old Broad Street, on Thursday, the 29th ult. —JAMES BRICKWELL, Esq., in the chair.

The SECRETARY (Mr. T. S. Borradaile) read the notice convening the meeting, and the following report and statements of account were presented:—

The Directors have again the pleasure to submit to the Shareholders the usual half-yearly statement of accounts and balance-sheet, which now show the position of the Company's affairs up to the close of the financial year ending Sept. 30, 1879.

The net profits for the six months amounted to £5204 3s. 8d.—a larger amount than has been reached for many years. This result has been obtained partly by reduction of working expenses, and partly by increased business. In comparing the figures with those of the former year, it will be observed that the revenue from private lighting and residual products has been augmented.

In the previous half year it was deemed prudent to provide for a probable loss in exchange in remittance to this country. This was done to the extent of £250. Your Directors are glad to say that, owing to a rise in exchange, this amount proved to be in excess of the requirements, and consequently the result shows a balance in favour of this account amounting to £145 16s. 8d. for the half year.

The general trade of the province of Pará appears to be improving, and the recent advance in the price of rubber and other products cannot fail to have an influence, direct or indirect, to the advantage of this Company.

At the time the present Board accepted office there existed a debenture loan of £10,000, raised at 10 per cent. The loan and interest thereon has been reduced from time to time, there now remaining only £2100 to liquidate. It is the intention of your Directors to retire the balance of this loan when it matures in February next. Although these debentures have lately only carried 5 per cent. interest, it is considered a matter of congratulation to the Proprietors that the improved condition of the Company's affairs allows of the account being closed.

The sum of £200 has been appropriated from the available revenue of the Company to the reduction of the amount standing to the debit of lighter capital account.

With the balance brought forward from the previous half year (after payment of the August dividend), £652 6s., the available amount for division (reduction of lighter capital, bad and doubtful debts, and loss for unserviceable meters being provided for) is £5592 6s. 8d., and from this the Directors now recommend a dividend at the rate of 6 per cent. per annum for the half year just closed, payable on and after Feb. 19, 1880. This, together with the interim dividend paid in August last (in accordance with the powers vested in the Directors) at the rate of 4 per cent. per annum, will make a total dividend of 5 per cent. for the twelve months ending Sept. 30, 1879, leaving £586 4s. 8d. to carry forward.

Advices received from the Manager (Mr. G. H. Sumner) continue to be very satisfactory, and he reports that the works of the Company are maintained in a very efficient condition.

Two of your Directors, Mr. Louis Penny and Mr. Thomas Clarke Tatham, retire by rotation, but are eligible for re-election, and offer themselves accordingly.

Mr. Philip Crellin, the Auditor of the Company, likewise retires from office; but, being eligible, also offers himself for re-election.

Dr.	General Balance-Sheet, Sept. 30, 1879.	Cr.
Authorized capital . . .	£175,000 0 0	
Less not taken up . . .	8,130 0 0	
	£166,870 0 0	
Debenture loan . . .	2,100 0 0	
Fire insurance-fund . . .	1,087 6 8	
Bills payable . . .	372 7 1	
Sundry creditors in London	375 18 3	
Ditto in Pará . . .	552 2 6	
Gas-fitting rental reserve-fund to March 31, 1879 £900 7 7		
Add reserve for the current half year, less expended in repairs . . .	110 19 9	
Profit and loss . . .	5,592 6 8	
	£177,961 8 6	

Revenue Account, for the Half Year ending Sept. 30, 1879.

Coal and wood for carbonizing £3,135 16 11	Public lamps . . .	£5,828 3 4
Wages, includ. lamplighting, purification, & carbonizing 1,916 0 2	Private lights . . .	3,595 17 6
Salaries . . .	Public establishments . . .	388 17 8
Sundry charges . . .	Illuminations . . .	162 11 7
Retorts . . .	Fittings-rental . . .	121 14 11
Repairs . . .	Meter-rental . . .	212 4 8
Office expenses, stationery, printing, &c. . .	Lighter revenue . . .	224 8 9
Law charges . . .	Coke . . .	1,139 10 4
Gas-fitting revenue and expenditure . . .	Tar . . .	149 15 6
Interest and discount . . .	Exchange . . .	145 16 8
Debenture interest . . .	Transfer fees . . .	2 17 6
Directors fees . . .	Rent and taxes . . .	53 5 8
Travelling expenses . . .		
Profit and loss . . .		
		£12,025 4 1

Profit and Loss Account.

Dividend paid July, 1879. . .	£3,337 8 0	Balance brought forward from March 31 . . .	£3,989 14 0
Bad debts to this date . . .	£82 1 9	Revenue account (profit) . . .	5,204 3 8
Less recovered in the half year . . .	45 16 8		
	36 5 1		
Less amount written off for unserviceable meters . . .	27 17 11		
Ditto, in reduction of lighter capital . . .	200 0 0		
Balance carried forward . . .	5,592 6 8		
	£9,193 17 8		£9,193 17 8

The CHAIRMAN: Previous to placing before you the resolution for the adoption of the report and accounts, I will make a few remarks with respect to our year's operations. In the first place, I think we may strongly congratulate ourselves—I am sure that is the feeling of the Board—as to the satisfactory condition in which all our affairs are at present; also on the fact that for some time past they have been progressing towards this condition. In reading the report, you cannot have failed to notice that considerable improvement has taken place since the Board last had the pleasure of meeting you. I will just briefly refer to the items in the report, one of the first being with respect to the advantage we are now deriving from the favourable alteration in the rate of exchange. Only a day or two ago, when our last remittance arrived, we obtained a rate of 23½d. That was against 19d., the lowest rate; and it was at this low rate we debited our accounts with a considerable sum. I am glad to say this was in excess of our actual requirements. So much the better for the year's accounts. As to the paragraph referring to our debenture loan, I think that is a matter for considerable congratulation, because I hope in a few days, or, at all events, in the course of the ensuing month, we shall be able to liquidate the whole of the debt—I call it a debt—of which now only £2100 is outstanding. This amount will fall due about the middle of February, and we propose not to renew it, but to pay it off at the period of which the holders will have due notice. I may say that our general working during the past year has been highly successful; but we have also been much assisted by the continuation

of favourable prices for coal, and the freights have been equally in our favour. Our carbonizing operations have been very satisfactory, and we have derived considerable advantage from the improvements in working, and other changes, in having been able to reduce our unaccounted-for gas to a very small amount, particularly for a district situated like the one in which our operations are carried on. Our unaccounted-for gas, which you may term leakage, is now reduced to about 8·6 per cent., which really is very low—only, in fact, a trifle higher than that of the best-managed Metropolitan Companies. It is gratifying to see that our gas supply has been very good, inasmuch as we have manufactured over 500,000 more feet of gas this year than we did in the year 1878. In money it amounts to an excess of £447. Our coke also, which has been such a drug to us, has shown some improvement, though not so much as we could have wished. The price does not vary to any very great extent, but the receipts have increased by £112. On another product—tar—which had been almost useless, we have received an excess of £79 18s.—roughly £80—as compared with the amount received in the former year, and this, considering the great disadvantage we labour under in regard to residual products, is not, I think, an unfavourable return. It may be a sort of condensation of the items I have just given you, and it may be satisfactory to you to hear that for each ton of coal we have had something like a receipt of £6 5s. 11d. That is averaging the product of each ton of coal for the twelve months. I may make a remark in reference to the reserve-fund. I think you will see that, although we have no reserve-fund, we have from time to time been making up some little arrears, which is something similar; that is to say, we have this last year written off £200 on account of the lighter capital, of which nothing has hitherto been written off. Although the lighters even now are all in very good condition—indeed, almost equal to new—we think it quite right that periodical reductions should be made in the account. I think you were informed at the last meeting that we had written off a considerable sum on account of meters. That is another item for which, if not neglected, it has not been convenient to set apart any amount—this meter depreciation; and that will now be continued similar to the practice of gas companies in England. As most of you are perhaps well aware, there is considerable depreciation in meters—so much so, that most of the Metropolitan Companies set apart 10 per cent. for meter depreciation. I am not aware that there is anything else very special for me to refer to, for our report deals pretty fully with most of the matters connected with the working of the Company. I will, therefore, now move—"That the report and accounts of the Directors to the Shareholders, as presented, be and they are hereby approved and adopted."

Mr. T. C. TATHAM seconded the motion.

Mr. ALFRED PENNY said the Directors were to be congratulated on the excellent working of the past twelve months. So far as he was personally concerned, it was very much beyond his expectations and hopes. He felt it was decidedly a matter for congratulation to have arrived at the position indicated by the accounts which had been placed before them on this occasion. He never expected that the Company were going to pay 5 per cent., but it was very satisfactory to find they were not only offering that rate of dividend, but were doing so out of fairly-made profits. As to the debentures they were going to pay off, he should like to know from what fund this was to be done? With regard to the rate of exchange, it was a variable thing, and although they showed a small profit this year, they might find themselves "in the mud" next; so he did not attach very much importance to the rate being in their favour this year. He hoped, however, they would get their money over without sustaining much loss. In one gas company he was connected with—the Bombay—they suffered very greatly by loss on exchange. They had lost there between £6000 and £7000 in the half year, which caused a large diminution in the profit, and he hoped the Pará Gas Company would not be exposed to such a disadvantage. As regarded the working of the undertaking, that was extremely satisfactory. As an expert, he was bound to say that it was most satisfactory to find that their unaccounted-for gas was only 8 per cent., which showed that great care was exercised by those who had the management of the concern on the other side; and, in fact, the whole business of the Company appeared to be conducted in an admirable manner. The Directors must have exercised much care and skill in bringing the Company into the position it now occupied, and the Shareholders fully appreciated what they had done.

The CHAIRMAN: In answer to your question as to the loan, our requirements are now very much less than they were some time ago. This arose from the large arrears then due to us from the Government. I do not know how many quarters it was, but I believe we were sometimes for half the twelve months without receiving anything from the Government; but I am happy to say that during the greater part of the last six months they have paid ready money. Almost immediately the amount was due we have had the remittance, and this enables us to work with smaller capital. Therefore, when this £2100 falls due, we shall not require to renew it, and it will be paid off about the middle of next month. We do not require this money, so it is tantamount to having so much less capital. There is no question that it is a very creditable thing indeed for the Brazilian Government to keep such good faith with us, and pay so promptly; and it is also satisfactory to find, from the improvement of our general business, that we are able to do without the money. We have tried from time to time to make the burden as light as possible, by first reducing the amount of £10,000 to £5000, and then by gradually paying off this smaller sum. I should be very sorry to cast any reflection on the former management of the Company, because you must bear in mind that although the rate at which the money was borrowed was as high as 10 per cent., the former Board had many difficulties to contend with, which we have not. Money, too, at that time, may have been very dear, and perhaps they could not borrow money quite so readily as can be done at the present time. I do not wish, therefore, to take upon ourselves all the credit, with the view of making the former management look not so bright. With respect to the remark about the rate of exchange, I will merely say that the loss was much less than in the previous twelve months.

Mr. ALFRED PENNY said he had only observed that the rate of exchange was exceedingly fluctuating, and that although they now obtained the benefit of a good rate, yet they might find themselves back again to the rate of 19d. Therefore he did not think much importance should be attached to the fact that the rate was now in their favour.

The CHAIRMAN: We have given instructions to our Manager that the funds kept in the Brazils shall be as small as possible—that is, that he shall remit the money as soon as convenient after the receipt of it. At present we have some money—perhaps between £2000 and £3000—which I believe he will send over almost immediately, and we hope that we shall not have a lower rate of exchange than at the present time.

Mr. LOUIS PENNY observed that by the Company's contract with the Provincial Government they had the right to receive from them the difference between the par of exchange—27d.—and the current rate. The only occasions on which they could lose by exchange were when accounts were received two or three months after presentation, when exchange had fallen; but, on the other hand, this was compensated for when exchange happened to rise. In effect, the receipts for gas were, in the long run, unaffected by exchange.

Mr. ALFRED PENNY said the Chairman's explanation with regard to paying off the loan was most satisfactory, for if he understood him correctly, money had been borrowed on debentures for working capital, and now that they had brought their funds into proper condition, by receiving payment of over-due accounts, they no longer needed the money, and were enabled to pay it off without putting any burden on the Company.

The CHAIRMAN: Exactly.
Mr. LOUIS PENNY: And out of funds in hand.
The motion was carried unanimously.

The CHAIRMAN then moved—"That the interim dividend paid to the Shareholders at the rate of 4 per cent. per annum for the half year ending March 31 last be and is hereby confirmed, and that a half year's dividend up to the 30th of September last, at the rate of 6 per cent. per annum for the half year just closed, and free of income-tax, be payable to the Shareholders on and after the 18th of February next."

Captain J. W. CLARKE seconded the motion, and it was carried.
The CHAIRMAN then moved, and Mr. F. D. GODWIN seconded, the re-election of Mr. Louis Penny as a Director, and the motion was carried; as was a similar resolution, on the motion of the CHAIRMAN, seconded by Captain CLARKE, for the re-election of Mr. T. C. Tatham.

Captain CLARKE moved, and Mr. E. F. LAMBERT seconded, the re-election of Mr. Philip Crellin as Auditor for the ensuing year, and the motion was agreed to.

Mr. TATHAM then brought forward the question of the proposed alteration in the Articles of Association, and observed that the resolution really required no explanation. The Shareholders had all found the inconvenience of one of the articles as it stood, and the alteration proposed was only a slight one. At present they had to wait an hour for a quorum at their meetings, and then, if one were not present, adjourn for a week, when, if again there was no quorum, they adjourned *sine die*. The Directors therefore proposed to make the following alteration in clause 47 of the Articles:—

If, within half an hour from the time appointed for the meeting, a quorum is not present, the meeting, if convened upon the requisition of members, shall be dissolved; in any other case, the members then present shall be a meeting, and shall, if the majority of those present (such majority to be ascertained by a show of hands) so desire, proceed to the transaction of the business for which such meeting has been called.

It was unnecessary for him to say anything further to commend the alteration to the favourable consideration of the Shareholders.

Mr. ALFRED PENNY desired to second the motion, as a "punctual and suffering Shareholder." At their last meeting he had to wait an hour, and he thought they could not do better than adopt the resolution, and so remove the inconvenience, for those who took an interest in the Company's business and attended the meetings punctually ought not to suffer for those who did not.

The CHAIRMAN said it was with as much satisfaction to the Board as to the Proprietors generally that they had arranged for this alteration to be made. Mr. Tatham, who was so conversant with legal matters, had looked into the question, and the Board had the greatest confidence that it was in every respect right and legal for them to make the alteration.

The motion was put and carried unanimously.
Mr. TATHAM said it would be necessary to have another meeting to confirm the resolution, and he was afraid the attendance of 20 Shareholders would be necessary.

Mr. ENGLISH then moved—"That the best thanks of the meeting be given to the Chairman and Directors of the Company, for their efficient services in the conduct of the Company's affairs during the past year." The Shareholders must see, from the state of the Company's affairs, that their thanks were due to the Chairman and Directors.

Mr. ALFRED PENNY seconded the motion, stating that in his former remarks he had acknowledged how much they were indebted to the Chairman and Directors for the skill they had displayed in conducting the Company's affairs, and for the very handsome return they had given the Shareholders on this occasion.

The motion having been carried unanimously,
The CHAIRMAN said: I can only, on behalf of myself and colleagues, say we appreciate the kind feelings you have expressed. At all former meetings we have received the greatest kindness and forbearance from you, and I thank you very much for your vote to-day.

General MASON next proposed—"That the best thanks of the meeting be given to the Secretary, Manager, and Officers of the Company, for the satisfactory and able manner in which they have discharged their respective duties."

Mr. ALFRED PENNY said he had intended to move the resolution, but he was equally pleased at having the opportunity of seconding it. He was quite competent to form a judgment on the work done by the officers of gas companies; and certainly all he had seen of the very excellent services rendered by the Secretary of this Company, and the good work done by those on the other side, quite justified him in seconding the vote of thanks proposed, and he hoped that the meeting would most cordially support the resolution.

The CHAIRMAN said he was quite sure the Board could endorse all that had been said of the value of the services of the Secretary and the staff.

The motion was carried unanimously.
The SECRETARY, in acknowledging the vote on behalf of the Manager, the staff, and himself, said it had always been a pleasure for him, in the last ten or twelve years, since he had held the position of Secretary of the Company, to do all he could to satisfy the requirements of the Directors, and to push forward as much as possible the interests of the Shareholders. The proceedings then terminated.

DEARNE VALLEY WATER BILL.—A meeting of the ratepayers of Darfield was held last Thursday, to consider the propriety of agreeing to, or protesting against the township of Darfield being included in the Dearne Valley water scheme. Mr. Stephen Leal, F.G.S., occupied the chair. The matter was discussed at great length, and eventually a resolution was moved—"That the Sanitary Authority of Darfield be requested to petition the House of Commons to have the township of Darfield expunged from the Dearne Valley Water-Works Bill." An amendment that the Sanitary Authority do not take any steps to oppose the Bill was also moved; but eventually the original motion was carried.

LIMERICK WATER SUPPLY.—At the meeting of the Limerick Corporation last Tuesday—the Mayor (Mr. Michael O'Gorman) presiding—the award of the Umpire in reference to the city water supply was read. It determined that the water which the Water Company were able and willing to lay on was not proper, nor was it sufficient; that the purposes for which the water was required by the Corporation were reasonable; that no question arose, or could arise as to the "terms of supply;" and that the Sanitary Authority and the Company should each bear their own costs of the reference, and the costs consequent upon the reference, with the exception of the costs of the award, which should be paid by the Company. The award was, on the motion of Dr. O'Sullivan, seconded by Mr. Bernal, referred to the Water Committee for consideration.

READING GAS SUPPLY.

A Special Meeting of the Reading Town Council was held last Friday—the MAYOR (Mr. H. B. Blandy) presiding—for the purpose of considering a report from the Committee of the whole Council, as to their meetings in reference to the Bill about to be introduced into Parliament by the Reading Gas Company for extending their capital and premises, &c.

The report stated that the Council met in committee on the 14th ult., in accordance with the resolution of the Council at the previous meeting, and considered the report of the Public Lights and Gas Committee (then presented) as to the proposed new Act of the Reading Gas Company. The Committee, having discussed at length the matters referred to in the report, appointed a Sub-Committee, consisting of Aldermen Hewett and Andrewes, and Messrs. King, Hill, Blackall, Simonds, and Monck, to confer with the Directors of the Gas Company upon the Bill, and especially as to the proposed increase of capital, the prescribed maximum prices, and the illuminating power of the gas; and the Sub-Committee were empowered to engage such professional assistance as they might deem expedient.

The report then stated that the Council again met as a Committee on the 22nd ult. The Sub-Committee reported that they had considered the report of the Public Lights and Gas Committee which was referred to them for consideration, and particularly the following points relative to the proposed new Act of the Reading Gas Company, viz.—1. The powers proposed to be obtained by the Company for raising additional capital to the amount of £150,000, exclusive of any premiums which might be obtained on the sale of new shares. 2. The maximum rates of charge for gas supplied by the Company. 3. The illuminating power of 14 candles proposed by the Bill. The Sub-Committee had also conferred with the Directors of the Company, and discussed very fully the several questions above referred to. The final result of the conference was embodied in a letter addressed by the Secretary of the Company (Mr. Robert Bradley) to the Town Clerk, which said that without prejudice, and on the understanding that the arrangements previously entered into on other matters, as mentioned in the report made by the Public Lights Committee to the Council on the 8th inst., would be carried out, and that no fresh questions were to be raised or new demands made, the Directors were willing to make the concessions on the 1st and 2nd of the questions raised as follows, viz.—1. Limit of capital. That the amount of new capital to be raised be £100,000 in cash, including additional borrowed money and premiums on shares, the details of same to be hereafter arranged. 2. Prices of gas within the borough:—

	Price per 1000 Cubic Feet, Act of 1870.	Price to be inserted in Company's Bill.
To consumers of less than 20,000 cubic feet half yearly	s. d. 4 6	s. d. 4 3
Do. 20,000 and less than 40,000 half yearly	. . . . . 4 3	. . . . . 4 0
Do. 40,000 or upwards, half yearly	. . . . . 4 0	. . . . . 3 9
Gas supplied to public lamps	. . . . . 3 6	. . . . . 3 5

3. Illuminating power of gas to be 14 candles, tested by Sugg's burner as prescribed in the Bill.

Having regard to all the circumstances, the Sub-Committee thought that the terms which the Company were willing to accede to might be accepted by the Council, especially as the Bill would contain a provision limiting the amount of new capital to be raised in any one year, agreeably with a proposal made by the Sub-Committee. If the Council accepted the terms, it would be unnecessary for them, the report proceeded, to take any action with a view to formally opposing the Company's Bill; but care must be taken to ensure that full effect was given to the arrangements made with the Company. Those arrangements were briefly as follows:—(a) The arrangements referred to in the report of the Public Lights and Gas Committee relating to the extinguishment of the rights of way possessed by the Sanitary Authority over the lands of Messrs. Huntley and Palmer and Mr. W. I. Palmer; as well as the acquisition by the Sanitary Authority of the right to use the proposed new road and the proposed bridge over the River Kennet, and the acquisition by the Sanitary Authority of a piece of land adjoining the sewage pumping-station, which has been scheduled by the Company for the purposes of the Bill. (b) The substitution of the proposed new standard burner for that now in use for testing the illuminating power of the gas. (c) The appointment of the Municipal Buildings as the place for testing the gas. (d) The above-mentioned arrangements with regard to the additional capital of the Company, the maximum charges for gas within the borough, and the illuminating power of the gas. (e) The preservation intact (with the variations provided for in the present arrangements) of the provisions contained in the Reading Gas Acts, 1862 and 1870, for the protection of the public and the gas consumers. (f) The due protection of the public interests in regard to the sewers, the water power at Blake's Lock, and other similar matters. (g) The incorporation of the Gas-Works Clauses Act, 1871, in the new Act, and the immediate applicability of that Act to the undertaking of the Company, but so as not to interfere prejudicially with these arrangements between the Company and the Corporation.

The report concluded by stating that the Committee having considered the report, it was moved by Alderman Hewett, and seconded by Alderman Andrewes—"That the Committee do recommend to the Council that the proposed arrangements with reference to the Bill of the Gas Company, referred to in the report of the Sub-Committee, be agreed to, and that the Town Clerk be empowered to arrange that Messrs. Sherwood and Co., the Parliamentary Agents for the Bill, shall prepare the alterations and amendments in the Bill necessary for carrying out the arrangements, and also to arrange that the Bill, as altered and amended, and also the agreement for carrying out the proposals with respect to the rights of way, the proposed new road and bridge, and the purchase of land adjoining the sewage pumping-station, be settled by Counsel in behalf of both parties." Whereupon it was moved as an amendment by Mr. Blackall Simonds, and seconded by Mr. Colebrook—"That the report of the Sub-Committee be referred back to them for further consideration." The amendment having been put, was declared to be lost, only the mover and seconder having voted for it. The original motion was then put to the meeting, and carried with two dissentients.

The report having been entered on the minutes of the Council, Alderman HEWETT proposed that it should be approved, and that the resolutions adopted by the Committee on the 22nd ult. should be adopted and confirmed by the Council.

The motion was seconded by Alderman ANDREWES.
A long discussion took place, but finally, after Mr. Colebrook had talked of moving an amendment, but had withdrawn from that position, it was put to the Council, and carried with two dissentients.

TISBURY GAS COMPANY, LIMITED.—A Company with this title was registered on the 21st ult., with a capital of £2000, in 400 shares of £5 each. The object is to erect works for the supply of the town of Tisbury, Wiltshire, and neighbourhood with gas; also the trading with such substances as may arise from the manufacture of gas.

MIDLAND ASSOCIATION OF GAS MANAGERS.

(Continued from p. 135.)

The only paper read at the recent meeting of this Association was one by Mr. W. North, of Stourbridge, and was descriptive of a gas washer patented by Mr. A. P. Ker, of Birmingham. An illustrated description of this invention appeared in the JOURNAL, Vol. XXXIV., p. 636. The paper was as follows:—

A NEW FORM OF WASHER.

The subject which I have the honour to bring before your notice is a new form of gas washer or scrubber. The important part which washing and scrubbing play in the process of gas manufacture is too well known amongst you, and has been so often commented upon by able members of this and kindred Associations, that it will be unnecessary for me to dwell upon it. An apparatus by, and in which the process is carried on forms the subject of this short paper; and it is agreed upon on all hands that washing and scrubbing is not only essential but positively necessary for the economical and thorough purification of gas.

Washers and scrubbers are perhaps more numerous and diverse in form and manner of working than any other part of the various plant of gas-works, and the one under notice being a new one which may not have come under your observation, is my excuse for bringing it before you.

For the purpose of augmenting the scrubbing power at the Stourbridge Gas-Works I was induced to recommend the erection of a washer patented by Mr. A. P. Ker, the Superintendent at the Adderley Street gas-works of the Corporation of Birmingham. It is placed so that the gas from the original scrubber passes through it on its way to the oxide purifying-boxes. The form of the washer is rectangular, and its internal dimensions are 8 feet long, 4 feet wide, and 2 feet deep. It is placed upon two slight walls to keep it above the ground, for convenience of approach. The details of the interior I will now endeavour to describe, as well as its manner of working.

I have before stated that it is a rectangle in section. In the bottom plate are two transverse openings or slots running nearly the whole distance across it. These are covered on the outer side by a semi-circular pipe having a branch in the middle for connecting the inlet thereto, and the slots are carried through the bottom plate, and stand clear of it a sufficient distance (in this case 3 inches) to allow for the water necessary for its proper action. Covering each of the slots on the inner side, is a hood partly composed of wrought, and part of cast iron. In shape the hoods somewhat resemble shallow square boxes inverted, with one end taken away and the bottom inclined from the horizontal. The outlet edges of the hoods terminate at the water-line, and the incline, which is not arbitrary, is in my case 1 inch in 4 feet, giving a pressure of 1½ inches from inlet to outlet. Fixed to the under side of the hoods, and extending transversely through them, is a width of corrugated wire weaving of about ½-inch mesh, and carried to the outlet edge of them. An overflow-pipe is fixed at the level of the outlet edge of each of the hoods, and carried down into a sealed cistern underneath, to allow the liquor to run off. The upper tray and hoods are made in a precisely similar manner, and are only a repetition of the first ones. The apparatus is fed in the usual manner with an ordinary syphon, fixed upon the top of it.

The manner of working the apparatus is as follows:—The inlet gas passing up through the slots into the back part of the hoods depresses the water until it is below the corner or inner edge of the inclined part, when the gas commences to pass along, driving the water before it, which leaves the wire weaving saturated and dripping, and the gas in its passage is broken up into small quantities about 30 different times in its passage along one plate, and is brought into direct contact with the water on its way. The gas having a pulsatory motion allows the water to return again, after its passage, to saturate the weaving again, and so on *ad infinitum*. It is only necessary to give the requisite feed water to ensure its continuous action. It gives a pressure of from 2 to 3 inches, and has no intricate working parts, consequently little wear and tear or liability to derangement. The weaving being enclosed cannot oxidize, and is likely to last as long as any other part; neither can it become clogged or choked with tar, owing to the continuous oscillations of the liquor.

During the time the washer has been working I have considerably increased my sale of ammoniacal liquor, which in itself has paid for the outlay, besides the relief given to the purifiers.

The overflow water is weak, owing to the small quantity of ammonia passing the scrubber, and another reason is owing to the large size of the cistern, and consequently large quantity of water to be retained in the top tray of a weak nature to accomplish the purpose intended. If the washer had been made 4 feet long instead of 8 feet, with trays 2 feet long each, and the same inclination—that is to say, ½ inch in the 2 feet—and instead of having two trays four had been used, it would have given the same amount of washing surface, and would, in my opinion, have been a much better arrangement, for then there would only have been half the quantity of water necessary to keep the upper tray sufficiently clear to do its work effectively; the pressure would not have been increased; it would have required less space for fixing; and I am convinced it would have been more efficient. This view is concurred in by the Patentee, who intends constructing the washers for the future in the modified form.

As to the working results, I shall have less to say than I expected, and for this reason: I find that with our maximum make—301,000 feet per diem—from some cause or other the washer does not take out all the free ammonia; while with half that make, and with, say, 15 to 17 gallons of water per ton of coal, the gas at the outlet of the washer was practically free from ammonia. This has been mentioned to the Patentee, and hence his intention to alter the form of the apparatus.

The oscillation of water in the washer is considerable, and my impression is that this motion does at some point leave the wire weaving quite unsealed, and so a portion of the gas may pass without being thoroughly washed. This would be obviated in the modified form.

As regards the quantity of liquor made, we can produce from 35 to 37 gallons of liquor per ton of coal carbonized, the strength of liquor being 5½° to 6° Twaddell; and, believing that the principle is right, I have no doubt but that the apparatus can be made to do for 300,000 cubic feet what it does for 150,000 cubic feet. It has the advantage of being simple and comparatively inexpensive, needing little foundation, being easily fixed, and it wants no machinery to work it.

I would add that ours is the only one that has been made on a working scale, and we are all aware that inventors do not always succeed in producing a perfect article at their first attempt; but I have no doubt that Mr. Ker will succeed in producing an effective apparatus on his principle.

The PRESIDENT asked for information with reference to the cost of the apparatus.

Mr. NORTH said the one he had at work was presumed to be equal to a make of 500,000 feet per diem, and it was fixed for £50.

Mr. JONES said he understood that this washer did not eliminate the whole of the ammonia. That its performance was very good, he thought could not be doubted; but he should like to ask the author of the paper if he could give the percentage of sulphuretted hydrogen and carbonic acid, as well as the strong ammonia in the liquor when it was removed from

the washer. He (Mr. Jones) held that washing was one of the cheapest methods of purifying gas, and its cheapness depended upon the degree to which the water used in the washing could be impregnated with the gases required to be eliminated; and he should, therefore, be obliged to Mr. North if he could tell what percentage of these gases the apparatus he had described removed from the foul gas. This would give an idea of the degree of foulness of the gases which the purifiers had to deal with when it went forward.

Mr. HUNT did not remember that Mr. North described what apparatus he put the gas through before arriving at this washer. He also asked how much liquor was obtained.

Mr. COOPER (Banbury) inquired what it cost Mr. North for purifying previous to the erection of the washer.

Mr. NORTH said he was sorry he was not in a position to give the particulars asked for by Mr. Jones; but he would endeavour to obtain them. With regard to another question asked, he said they had a scrubber 25 feet high and 6 feet diameter; also one set of condensers before the scrubber, and then came the washer. He thought they obtained 16 gallons of liquor per ton of coal carbonized more than before the washer was put in.

Mr. HUNT: What is the average strength?

Mr. NORTH: 5½° to 6° Twaddell.

The PRESIDENT: What was the strength of the liquor before? I should suppose it reduces it.

Mr. NORTH: It does reduce it.

Mr. JONES: The net gain is 16 gallons of liquor per ton.

Mr. NORTH said that was so; but they must be aware from what the washer did that the liquor was weak when it came from the apparatus. He thought there would be an advantage in this respect when the washer was modified. As regarded the cost of purification, he could hardly say what the gain was. They, however, looked more for a gain in the liquor, and that was their object in having the washer to increase the quantity and keep it the same strength on the average, though they did not overlook the advantage of taking the last trace of ammonia out of the gas.

The PRESIDENT thought it was very plain, from what Mr. North had said, that there were advantages to be gained from washing. This, of course, they all knew; but what was a proper washer they perhaps were not so satisfied about. The apparatus Mr. North had introduced to their notice seemed on paper to be effective, and with his experience and the alteration to be made, he (the President) had no doubt it would be of much more use. He could only say that it was by such discussions and inquiries as they had had that they obtained information; and he moved that the thanks of the meeting be given to Mr. North for his paper.

Mr. ANNAN seconded the motion, which was carried.

Mr. NORTH, in acknowledging the vote, said he should always be glad to contribute to the Association what facts came within his knowledge. On this occasion he would have been more satisfied if he had had a perfect apparatus to describe.

VOTE OF THANKS TO THE PRESIDENT.

Mr. DAVIES (Kidsgrove) said: It is customary on these occasions to propose a vote of thanks to the President, and I am sure we cannot pass him by without carrying out that good old custom. The manner in which he has presided over this meeting has afforded pleasure to every one here. I propose that our best thanks be given to the President for his services in the chair.

Mr. W. WINSTANLEY (Newcastle-under-Lyme): I have great pleasure in seconding that proposition.

The motion was put and carried.

The PRESIDENT acknowledged the compliment, and said: I hope we, as an Association, shall go on prosperously to the end of the chapter; that the Association will prosper under our care; and that we shall all be benefited by our connection with it.

NEWPORT (MON.) GAS-WORKS BENEFIT SOCIETY.

On Monday, the 26th ult., the Fifth Annual Dinner of this Society was held. Mr. T. CANNING, the Engineer of the Company and Treasurer of the Society, presided; and the vice-chair was occupied by Mr. J. WHITEFIELD, Secretary of the Society. At the close of the dinner, the usual loyal and patriotic toasts were given. After which,

Mr. T. JONES proposed "Success to the Newport (Mon.) Gas Company."

The CHAIRMAN responded. He said the Company had been successful, and he hoped would continue to be, though their prosperity was like that of other companies in the town—they only prospered as the town did. The staple of their manufacture was coal; and this was raised locally. The expenditure which they went to for the coal was distributed locally; so that, in every way, the town was connected with the Gas Company, for the latter formed an integral part of the former.

Mr. J. BOWEN next submitted the toast of "The Chairman and Board of Directors of the Newport (Mon.) Gas Company."

The CHAIRMAN returned thanks on behalf of the Board of the Company. He said he would convey to them the hearty reception awarded to their names.

In responding to a toast of "The Mayor and Corporation of Newport," Mr. VAUGHAN said there was a good relationship existing between the Gas Company and the Corporation, and this was due in a great measure to the Engineer of the Company—Mr. T. Canning. He (Mr. Vaughan) was pleased to hear of the very flourishing condition of the Society; and advertised in gratifying terms to the opening of a subscription at the gas-works for aiding the destitute people in the West of Ireland. In conclusion, he thanked all for the warm feeling evinced towards the Mayor and Corporation of the town.

The CHAIRMAN then proposed "Success to the Newport (Mon.) Gas-Works Benefit Society." He said he believed the Society had done a great deal of good. The Society was now in its fifth year. Its members had collected the sum of £230 12s. 6d., of which they had disbursed to the needy £116, and the remaining £114 had been distributed as dividends. A certain balance was also in the bank. Since the first meeting they had interred two members, and also two members wives, and eight children, at the expense of the Society. They incorporated with them the employees of the Water-Works Company, the Secretary of which (Mr. Charles Cullum) was unable to be present. Donations to the Society had grown larger, and its funds increased, so that they had been able to subscribe towards the Indian famine and the Abercarne explosion funds, and were now doing something towards relieving the West of Ireland destitution.

Mr. J. WHITEFIELD, Secretary of the Society, who responded, read the balance-sheet for the past year. There was a balance left in the bank of £6. Twelve months contributions, entrance fees, &c., £53 8s. 10½d.; balance from last year's dividend, 10s. 1d.; donations, £9 4s.; interest from the bank, 7s. 1d.—total, £69 10s. 0½d. Expenditure: Members for sick pay, funerals, &c., £27 13s. 5d.; stationery, £1 12s. 11d.; balance in hand, £6 7s. 1d.; paid out to members as dividend, £33 16s. 7½d. This, he said, was a good balance-sheet for the past year.

Among the toasts which followed were "Success to the Newport and Pillgwenly Water-Works Company," proposed by Mr. Stockwell, and

responded to by Mr. Sheppard in the absence of Mr. Cullum; "The Manager and Engineer, Mr. Canning," proposed by the Vice-Chairman, and responded to by Mr. Canning; "The Officers of the Newport (Mon.) Gas Company (coupled with the names of Mr. Hazell and Mr. Fiddes)," proposed by Mr. Dudley, and replied to by Mr. Hazell, Mr. Fiddes contributing a song; "The Donors of the Society (coupled with the name of Mr. T. Spittle)," proposed by Mr. Hopkins, and replied to by Mr. T. Spittle, jun.; "The Officers, Committee, and Stewards of the Society," proposed by Mr. Donovan, and responded to by Mr. Whitefield.

SALE OF SHARES IN THE NEW RIVER COMPANY.

At the Auction Mart, Tokenhouse Yard, on Wednesday last, Messrs. Edwin Fox and Bousfield offered for sale two fifteenths of a King's share, and fifteen £100 new shares in the New River Company. As some interesting particulars relating to this great undertaking and its three classes of shares (King's, Adventurers, and New) were given in the JOURNAL as recently as Dec. 2 last, it is unnecessary to repeat them, further than to say that each original share in its entirety is worth about £95,000, and any portion of it is freehold estate, and confers upon its possessor voting powers for the counties of Hertford and Middlesex. The dividend on these shares last year was at the rate of £2200 per annum, and in 1874 a bonus of £1008 per share was declared. The new shares rank *pari passu* with the original, but do not confer parliamentary voting powers. The dividend on the shares at Midsummer last was at the rate of £10 3s. 8d. per cent., and in 1874 a bonus of £4 15s. 6d. apiece was declared upon them.

In opening the sale, Mr. Bousfield briefly alluded to the increasing income of the Company, to the abundance and excellent quality of their water, and to their vast landed estates, the whole undertaking constituting, he said, an excellent and perfectly safe investment. Referring to the action now being taken by the Government in reference to the Metropolitan Water Companies, he said that in the event of the New River Company's property being, at an early date, acquired by the Crown, the proprietors would obtain the maximum value for their shares, and the equivalent in a first-class Government security, and no doubt would still be left in possession of their large landed estates; on the other hand, should the purchase be delayed, a certain increase in the income of the Company would ensure even greater advantages in the future.

He then proceeded to take offers for the King's shares, which were put up in 20 lots, each representing the 150th part of an entire share, and realized the following prices:—Lot 1 and lots 17 to 20, £630 each; lots 2 to 16, £625 each—total, £12,525. The new shares were sold—4 at £380 and 11 at £385 each—total, £5755.

The prices obtained for the portions of the King's share were rather lower, and for the new shares rather higher than those realized at the sale of similar stock in November last.

In all cases the shares were sold inclusive of the dividend accruing to June 30 next.

EDISON'S LATEST DEVICE REVIEWED BY AN EXPERT.

Colonel Makins, one of the Directors of the Chartered Gas Company, has kindly forwarded to us a copy of the *American*—published in Baltimore—of the 4th inst., in which is an account, under the above heading, of an interview between one of their reporters and Mr. Hambleton, Manager of the Baltimore Gas-Works. The account is worth reproducing in its entirety. It is as follows:—

A representative of the *American* yesterday met a gentleman prominently connected with the gas interest, who, during the past week, spent a day and night at Menlo Park with the object of examining Edison's latest form of electric illumination, and comparing it—principally in respect to cost and practicability for domestic usage—with gas. This gentleman was willing to state, in the briefest possible compass, the reasons that influence his positive opinion that the electric light, as now displayed at Menlo Park, cannot become a successful rival of gas. He had conversed with Professor Edison, and the figures with regard to the latter's plans are given just as he stated them.

The following expresses Edison's projects for lighting in large cities, and the comments passed upon them by the gentleman from whom this information is derived: "In the first place," said he, in answer to questions of the *American* representative, "Edison proposes to use in cities engines of 1000-horse power each, which would give him 8000 lamps, his calculation being on the basis of 1-horse power for 8 lamps. Now, suppose we estimate that, on the average, there are 25 houses in each block in a city—say Baltimore—seven blocks would make half a mile, comprising one side of a district, so that in a district embracing a quarter of a square mile we should have 1225 houses. Edison admits that with his 1000-horse power, or 8000 lamps, he can only provide illumination for a district of this size, and, consequently, the proportion for each house would be less than 7 lamps. Say that Baltimore comprises six square miles, it would require 24 1000-horse power engines to cover that ground; and this engine power, at Edison's own calculation, would give only 192,000 lights, each of which is of less intensity than a good gas-jet."

"Is that a fact as to the luminosity of his carbonized paper horseshoe lamps?"

"Edison has not made a photometric test; but to my eye his light is not equal to 16-candle power. There are 25,000 consumers of gas in Baltimore, besides 4000 or 5000 street-lamps. In the 24 hours of Christmas day and night there was burned in this city 3 million cubic feet of gas, which, of course, was all made or stored during the preceding 24 hours. Edison's machinery would have to be adequate to furnish these 3 million feet between the hours of five and twelve o'clock p.m., as he cannot store electricity, but must produce it as it is called for. Divide 3,000,000 by 7, the number of hours during which there was the heaviest demand for gas, and we have 428,570 feet as the hourly consumption, or equal to 100,000, in round numbers, of Edison's horseshoe lamps. But, for a proportion of these 7 hours the rate of gas consumption was double that, or equal to 200,000 of Edison's lamps. We see that his two dozen 1000-horse power engines would just fall a little short of doing this, even granting that he can accomplish what he expects in the ratio of horse power to light. But the most he has done is to light 40 lamps with an engine capable of working up to 80-horse power, and he has not lit more than 40 lamps from one of his electric generators."

"How about the stations and districts?"

"Edison names 1000-horse power as generating as much electricity as he can dispense from one station, and the district is to be only a quarter of a square mile, otherwise the distance would be too great for the operation of his system. If he has one station to start with, he must obtain as customers all the consumers in that district of a quarter of a square mile, for he cannot travel outside of it to get customers without establishing a new station, with all its apparatus of boilers, engines, generators, &c. By his own figures there must be 200 generators to each engine to convert its steam power into electric force. A 1000-horse power engine and its appurtenances, such as coal-yard, &c., in the centre of a choice district in the city, would occupy a large amount of valuable ground. His smoke-stack would be another formidable affair; for, when he was burning 300 lbs. of

coal hourly, which his engine would require, a stack enabling him to deliver the products of combustion high enough in the air not to create a nuisance must be very costly. Buildings to accommodate all this machinery would necessitate a huge outlay; and think of 24 such stations in the city! This is only a theoretic deduction from his experiments, and it is doubtful whether he can do on a large scale what he does in his laboratory. Then there comes in the question of the labour about such an establishment, which, again, would be very costly. I will show you something bearing upon the expense. At the West Side pumping-works in Chicago, an engine worked at about 400-horse power, but capable of 600, was run for 55 days in November and December, 1876. The cost of running was—for salaries and wages, 1430 dols.; oil for cylinder, 101 dols.; lard oil, 142 dols.; tallow, 18 dols.; packing, gaskets, &c., 127 dols.; sundry expenses, 7 dols.; lighting the building, 624 dols.; repairs, 45 dols.; making a total of 2394 dols., or about 44 dols. per day. This is exclusive of coal, of which there was burned 1,080,000 lbs."

"How would Edison's total of expenses stand?"

"His 1000-horse power engine would take at its maximum working 25,000 lbs. of water per hour for conversion into steam. If he used a condenser, it would take even more. That is over 3000 gallons of water hourly, and 3000 lbs. of coal for each engine. He must have all this, for the reason that he has to be prepared at any moment to give his customers the outside quantity of electricity needed. A gas company can take a day or two to make the illuminating element that Edison must furnish immediately, and therefore his plant is very expensive. His conductors are to be laid in underground tubes, and be insulated on the inside. These tubes will cost as much per foot as the smaller gas-pipes, and the cost of the copper wires for conduction is another considerable item. The skilled labour required to lay these tubes and wires would be at least twice as expensive as that of the men who do the corresponding work for the gas corporations. You will see that there is altogether involved the cost of the engines, boilers, and generators, together with that of the city property needed for the stations, the outlay for the buildings, coal, water, labour, and the expense of conductors for the current, and the aggregate must certainly go so far beyond the cost of gas that there can be no comparison between the two methods of illumination. The gas companies have their mains and pipes already in place, and Edison must supplant the whole system. They are already occupying the ground, and if their plant had to be written down, still the people could not afford to throw it away. The probability of Edison being able to compete successfully with gas can be judged from the fact that he has now a light inferior in illuminating strength and superior in cost, and he cannot modify it as we do gas, by regulating the flow, but it has to be burning in full or not at all, making it necessarily expensive to the consumer. At Menlo Park they do not hesitate to say they are trying to make something as good as gas, and they admit that they have not as yet succeeded. Now, the limits of the usefulness of gas have not been reached. The era of cooking by gas is so near that it will soon be here, and the price will then doubtless be decreased. Gas saves fuel in the house, on account of the heat given out by the burners, and we have gas-engines that are economical in their operations. The products of the combustion of gas can be easily carried off, and in such a way that they will carry with them the other impurities of rooms, thus conducing to perfect ventilation. Gas can be sent all over a city from one producing point; but Edison's system proposes a station in every district embracing not more than a quarter of a square mile in extent. Altogether, I do not think that the holders of gas stock need fear that Mr. Edison is going to impoverish them."

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is still an absence of the animation which had been expected throughout the coal trade of this district, and the improvement which has been reported in the iron trade has not yet been felt in the coal mining industry, so far, at least, as Lancashire is concerned. The cold weather has not even produced any considerably increased demand for house-fire classes of fuel; and of the better descriptions of round coal there has been a good deal of stock accumulating at many of the collieries. Coal for gas-making purposes is, of course, in less demand, and the requirements of consumers will naturally decrease until the usual contracts are made in the summer. For the common classes of round coal there is a moderately fair demand, and good hard forge coals meet with a ready sale; but supplies, as a general rule, are plentiful, as the increased demand has been more than met by the larger output from the pits. Burgy is just now only being made to order, and the requirements are very small. With regard to slack, although the cotton mills are in better operation, and in other branches of industry there is a greater consumption, there is no actual scarcity of supplies. A few of the colliery proprietors are pretty well sold, and have very little to offer, but there are many others where slack, if anything, is rather a drug, and although there is the expectation that higher prices will be obtained, the larger stocks which are still held have a natural tendency to keep down prices at present. So far as prices generally are concerned, there is, if anything, rather a weaker tone, and holders of stocks will in many cases give way a little to effect sales for prompt delivery, but there are very few colliery proprietors who will quote forward at present rates. The average quotations at the pit mouth are about as under:—Best Wigan Alley, 8s. 6d. to 9s.; seconds, 7s. to 7s. 6d.; Pemberton four-feet, 6s. 9d. to 7s. 6d.; common round coal, 5s. 6d. to 6s.; burgy, 4s. to 4s. 6d.; good slack, 2s. 9d. to 3s. 3d.; and common, 2s. 3d. to 2s. 6d. per ton.

An active demand is maintained for coke, and prices are firm.

In the iron trade there has not been much change since last week. For pig iron, prices appear to be about stationary at present, No. 3 foundry and No. 4 forge Lancashire, delivered into the Manchester district, remaining at about 70s. per ton, less 2½ per cent. For forge numbers there is a good demand, but foundry is rather difficult to sell. In the finished iron trade, business continues very brisk, with a good inquiry from America for both hoops and bars. For hoops, delivered equal to Manchester or Liverpool, about £10 10s. per ton is asked, and for bars from £9 to £9 15s. per ton.

There is no material improvement to report with regard to the position of founders, engineers, and machinists.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

Contracting for delivery of coals over the year was continued in earnest last week. A quantity of the best steam coals were thus sold at 10s. per ton for forward delivery. Several of the large Northumberland colliers are indisposed to sell any more at that rate at present. Some large contracts have been made for the delivery of the highest qualities of gas coals, too, to be shipped in the Tyne Dock. The contract rate is 7s. per ton, less 2½ per cent. Second-class gas coals of a fair sort are offering at 6s. 6d. per ton, less 2½ per cent. discount. Sailing vessels are loading gas coals for the ports in the Lower Baltic. The freight is higher this year.

The upward tendency in the price of coke is checked, but recent advances are strongly maintained. There is a great amount of contracting complete for the first half year. Durham small coals hold an excellent position in the market. The quotation for good average sorts is 4s. to 5s. per ton. There is no inquiry on the Tyne for house coals. During the entire history of the trade, scarcely has it ever been in such a depressed condition as this winter. There was no advance in the prices of best Durham house coals in January upon what they were in September. The Yorkshire collieries are competing with Durham collieries in the sale of gas and house coals. There has of recent years been a great development of the Yorkshire coal trade shipping at Hull, Grimsby, Goole, and other places. The shipments of coke from the Tyne to Spain are improving. Germany has recommenced to import Tyne coke. It has done very little of this over the past three years.

Some very large contracts were made for the best Northumberland steam coals at Newcastle on Friday, at 10s. 6d. per ton.

There were some large sales of fire-bricks on the Tyne last week. Business is very brisk in this trade at Derwent-Haugh, Blaydon, and other parts of the river.

Coasting freights were about 3d. per ton lower last week. The rates that were paid small vessels to load gas coals were—Folkestone, 6s. 4½d.; Teignmouth, 6s. 4½d.; Cowes, 6s. 7½d.; London (Ratcliff wharf), 5s. 6d. and 5s. 9d.; Rochester, 6s. 6d.; Dublin, 8s. 6d.; Plymouth, 6s.; Devonport, 6s. 6d.; Poole, 7s. 6d., for small ships; Waterford, 8s.

The price of lead has kept up. The iron market in the Cleveland district was a little flat last week. The manufacturing and foundry trade of the Tyne, however, is very brisk.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The first annual general meeting of the Falkirk Lighting Company, Limited, was held on Thursday last, Mr. James M'Gilchrist, Chairman of the Company, presiding. The report of the Directors, previously circulated, was taken as read, and in referring to it the Chairman spoke of the great improvements which the Company had carried out during the past year, and stated that the result of the first year's working was very satisfactory. A good dividend was declared, and a handsome balance was carried forward to next year's account. It is the intention of the Directors before long to reduce the price of gas 5d. per 1000 cubic feet—that is to say, from 5s. 10d. to 5s. 5d. per 1000 feet. When this reduction in price takes place, the gas consumers of Falkirk will have their gas at 1s. 3d. per 1000 feet less than they were paying for it previous to the purchase of the gas-works by the present Company. For many years they were charged at a much higher rate than the gas consumers of other towns similarly situated. However, when the further reduction referred to comes into force, they will be supplied with gas on as favourable terms as are in operation in almost any town of like size in Scotland.

A very commendable act has lately been done by the Dumbarton Corporation Gas Commissioners. They have issued a brief notice to gas-fitters, and all persons connected with the building trades of the town, or those who are about to build. The circular states that a large percentage of the consumers complaints of "bad gas" are due to the small pipes that have been fitted into all classes of property in Dumbarton, without any regard being paid to the quantity of gas which the pipes require to pass, so as to give the jets a proper supply at a pressure low enough to ensure the most satisfactory and economical consumption of the gas. In order to prevent such complaints, and to save proprietors the expense and annoyance of every now and then cleaning and enlarging their gas-fittings, they indicate the sizes of pipes that should be used, the lengths that may be required, and the greatest number of burners that may be used with the given sizes and length of piping. So far as new properties are concerned, the Gas Commissioners reserve to themselves the right to refuse a supply of gas until the conditions laid down in their instructions are conformed to. The smallest size of pipe that is allowed is one having an internal diameter of ¾-inch.

Owing to the rapid extension of the residential village of Kilmacolm, and the opening of a very large hydropathic establishment there, it has been found absolutely necessary to increase the productive and storage capacities of the local gas-works. With that object in view, a conference was held during the past week between the Directors of the Gas Company and those of the hydropathic establishment.

Mr. Alexander Smith, Manager of the Aberdeen Corporation Gas-Works, delivered an interesting lecture on "Artificial Light," on the evening of Monday, the 26th ult., before one of the leading literary societies of that town. He traced the history of artificial light from the primitive appliances of our ancestors to the most recent improvements in gas and electricity. A number of the lights alluded to were shown in illustration of the lecture.

Business was done on Friday in Glasgow Gas Annuities at £222 5s., and in shares of the Edinburgh and Leith Gas Company at £28 10s.

Messrs. Robert Napier and Sons, the eminent shipbuilding firm of Glasgow, made an experiment with the electric light a week or two ago, during the morning and evening hours, in lighting up the new storehouse which they are building for the Admiralty. The result proved to be so satisfactory that they have now erected a second dynamo-electric machine and lamp in the ship-yard, specially for the lighting of a large steel steamer, a vessel of 5500 tons, for the Montreal mail service, conducted by the Allan line. Both lights were in use in the open yard about four hours per day during the past week.

The Works Committee of the Dundee Water Commission lately had under consideration an application from the inhabitants of Carnoustie for a supply of water; and after discussion they agreed to recommend the Commission to allow water to be taken from the Monikie reservoir at 3d. per 1000 gallons, the applicants to bear all the expense of leading the water from the reservoirs and distributing it through the village.

A meeting of the Irvine Water Commissioners was held on Thursday evening—Provost Brown presiding. The Clerk read a letter from the Kilwinning Local Authority, containing the resolution passed at the last meeting of that body, namely—"That the meeting agree to purchase the water required to supply the district from the authorities of Irvine and Dundonald at the rate of 3½d. per 1000 gallons." Bailie Orr moved that the authorities agree to supply Kilwinning on the basis proposed. Mr. Wm. Henderson, chemical manufacturer, submitted that if Kilwinning obtained a supply of water at 3½d. per 1000 gallons, the public works of Irvine ought to have water at the same rate. Bailie Orr pointed out that it cost the Irvine authorities 3½d. per 1000 gallons to bring the water from the Munnock Hills to Muirside Toll, the place where Kilwinning proposed to make a connection, but to bring the water to Irvine the prime cost was, as near as possible, 4½d. per 1000 gallons. The works, therefore, could not have the water at the same price as Kilwinning. The motion was agreed to. The meeting then proceeded to consider as to the rate to be charged per 1000 gallons for water supplied for trading or manufacturing purposes. Mr. Barr moved that 4½d. per 1000 gallons be charged, which was seconded by Mr. M'Comick. Mr. Breckenridge moved, and Mr. Bannatyne seconded, that the charge be 4d. per 1000 gallons. On a division, the motion was

carried by 16 votes to 6. Bailie Orr said if the works did not accept the terms offered they were bound to go to the Sheriff as arbiter.

The delivery of water into Edinburgh on the 27th ult. was equal to 3628 gallons per head per day over a population estimated at 298,350.

Last week's Glasgow pig iron market was generally dull and irregular, with a tendency towards flatness, the price on Friday, at the close, being 68s. cash, and 68s. 6d. one month.

The coal market is moderately steady, but the amount of business doing is limited, especially in the shipping department, in which there are no signs of immediate improvement. The steamship *Cid* left the Clyde on Thursday morning, bound for Havana, with 1850 tons of gas coal on board.

The Paris Gas Company have recently introduced some improvements in the lanterns used by them with their large gas-burners. The new arrangement consists in placing in the lower part of the lantern a ring of metallic gauze, by means of which a current of air is caused to play over the inner surface of the glass, and pass away in the direction of an opening formed in the upper portion of the lamp. The cooling of the glass effected by this air current is assisted by a cone, which is intended to carry off the products of combustion. The cone is attached to the other metallic parts of the lantern at a very few points only, and around these cold air circulates; so that no matter to what degree the temperature of the cone is raised, the least possible effect is produced upon the glass, while the upper portion of the lantern is not unduly heated. The advantage of the new arrangement is that it allows of the employment of burners of much higher power than was possible with the form of lantern originally adopted.

WORCESTER NEW GASLIGHT COMPANY.—At the half-yearly meeting of this Company last Thursday, a dividend at the rate of 10 per cent. per annum was declared.

THE GAS ENGINEER'S AND SUPERINTENDENT'S POCKET ALMANAC.—We have received the copy of this useful publication for 1880, which is issued by the American Meter Company, of Philadelphia. Several changes have been made in the book since we noticed it on a previous occasion, the year before last. The character of the work is well maintained; and it will doubtless be found of much service to those to whom it is sent. We may state that it is a private publication of the above-named Company, and is not on sale.

GRIMSBY WATER COMPANY.—The Directors of this Company, in their annual report just issued, state that the balance available for dividend is £1549 1s. 2d., out of which they recommend that £200 should be carried to the reserve-fund; £1260 be paid as dividend at the rate of 6 per cent. per annum for the half year; and the balance, £89 1s. 2d., be carried over to the credit of the next account. The new well is stated to be completed, and in every way a thorough success. The revenue account shows the receipts to have been £3959 4s. 2d., and the expenses £2573 1s. 11d. The receipts from interest on the reserve-fund, and estimated debts for water yet uncollected, come to £1609 1s. 2d., which, after a deduction of £60 owing by the Company on revenue account, leaves the amount above-stated available for dividend.

MAP OF THE METROPOLITAN WATER COMPANIES DISTRICTS.—Mr. Preston Davies, of Nos. 5 and 6, Victoria Street, Westminster, who some time since prepared a coloured map of London showing the boundaries of the districts of the Metropolitan Gas Companies, which met with a very favourable reception, has now prepared a similar map, showing the boundaries of the districts of the Metropolitan Water Companies. Mr. Davies has had much experience in works of this description; and, possessing unusual opportunities for securing accuracy of detail in reference to the limits of the boundaries of the several Companies, has produced a map that may be implicitly relied upon, and one which is drawn upon a scale that renders it very suitable for office purposes.

THE SUPPLY OF WATER BY METER.—On Wednesday, the 21st ult., at the Walsall County Court, before Mr. W. D. Griffith (judge), the case of *The South Staffordshire Water-Works Company v. Peter Bull* was heard. The point involved was as to the consumption of water by meter. The Company sued the defendant for £18 9s. 8d., the balance of an account for water supplied under an agreement at a certain rate per 1000 gallons, according to the registration of a meter fixed by the Company. The defendant objected to the claim, on the ground that he believed the meter registered more water than he used; but the Judge decided that, in the absence of proof of this, the agreement to pay according to the registration of the meter was binding, and his decision was accordingly given in favour of the Company for the full amount claimed, and costs.

THE GAS SUPPLY OF WATERFORD.—Last Tuesday, a special meeting of the Corporation of Waterford was held, for the purpose of receiving a report from the Gas Committee as to the arrangement to be made with the Gas Company for the public lighting of the city. The Town Clerk read the correspondence between the Company and the Committee, from which it appeared that they were willing to accept the offer of the Company to light the city at £3 16s. net per lamp per annum, on condition that the charge for gas to private consumers should be reduced to 4s. 6d. per 1000 feet. The Company, in their reply, declined to mix up the question of public and private consumers, and sent in a bill for over £800, which was due to them by the Corporation. It was resolved to pay the Company £3 16s. per lamp, the amount to be paid within a month after it becomes due, or else interest at the rate of 5 per cent. to be charged.

THE WORCESTER TOWN COUNCIL AND THE LIVERPOOL CORPORATION WATER SCHEME.—Last Tuesday, in accordance with the provisions of the Municipal Corporations (Borough Funds) Act, a public meeting of owners and ratepayers in Worcester was held, for the purpose of considering the advisability of opposing the Liverpool Corporation Water-Works Bill, 1880, and, if the meeting so determined, of giving consent to the opposition initiated by the Town Council. Little interest was manifested in the proceedings, there being only about 40 persons present at the commencement of the meeting, and at no time were there more than 200 people in attendance. The Mayor, who presided, explained the objects of the Bill, and how it was thought it would injuriously affect the town of Worcester. He moved, and Alderman Dingle seconded, a resolution authorizing the Corporation to take the necessary steps to oppose the measure in Parliament. When put to the vote, the motion was carried by a large majority—only 8 hands being held up against it.

WHITWORTH VALE GAS COMPANY.—The Directors of this Company, in their report to the Shareholders for the half year ending Dec. 31, say that the depression which they have previously had to report in the district has continued to exist during the last half year, with the exception of a few weeks. The gas-rental for the half year amounted to £1596 11s. 10d., against £2074 12s. 1d. for the corresponding period of the preceding year, showing a decrease of £478 0s. 3d. Notwithstanding the lessened consumption of gas, it is, they say, very satisfactory to find such a large increase, in proportion, in the receipts for tar and ammoniacal liquor, thus amply justifying the outlay incurred in putting down the new condensing and scrubbing apparatus. The result of the half year's working is a profit

of £656 6s. 6d., out of which the Directors recommend a dividend at the rate of 6 per cent. per annum, free of income-tax. This will absorb £499 18s. 7d., and allow of £156 12s. 11d. being carried to the next half year's account. The last dividend paid was at the rate of 5 per cent. per annum, and the one previous to that at the rate of $\frac{7}{8}$ per cent.

MANCHESTER CORPORATION GAS-WORKS LOAN.—On Tuesday last an inquiry was held at the Manchester Town Hall, by Mr. S. J. Smith, one of the Local Government Board Inspectors, as to an application made by the Corporation for power to borrow £250,000 for purposes connected with their Bradford Road gas-works. Alderman Lamb (Chairman of the Corporation Gas Committee), Mr. Talbot (Deputy Town Clerk), and other gentlemen were present. Mr. Talbot explained that the application had reference to the new gas-works of the Corporation at Bradford-cum-Beswick, and said that the sum already expended on these works had been £316,961, and that in order to complete the existing contracts a further sum of £61,774 was required. The estimated cost of the necessary apparatus for gas-making and of four gasholders was £120,000, making a total of £498,735. Under the Corporation's Act of 1875 they were only authorized to borrow £250,000, leaving a balance required of £248,735. It was therefore proposed, and application was now made to borrow £250,000. Alderman Lamb and Mr. J. J. Harwood supported the application, and stated that when the works were completed the cost of them would be £750,000. The inquiry being concluded, the Inspector paid a visit to the works.

CARLISLE CORPORATION GAS AND WATER SUPPLY.—We have been favoured with a copy of the accounts of the Carlisle Corporation Gas and Water Department for the year ending June 30, 1879. In our issue of Oct. 21 we gave an abstract of the gas accounts, and have nothing to add except that from the capital account it appears that, during the year, £12,001 15s. 3d. was spent on the new gas-works. We may state that, during the twelve months, the illuminating power of the gas supplied was 19 candles; and the price 2s. 9d. per 1000 feet. As regards the water-works, the capital account shows as follows:—

Total expenditure on works to June 30, 1878			
(less annual depreciations)	£42,632	11	1
Less one year's depreciation, at 3 per cent.	1,278	19	6
	£41,353	11	7

Extensions during the year—			
Mains	£257	9	8
Service-pipes	435	15	1
	693	4	9

£42,046 16 4

There was a balance on profit and loss account (being profit for the year) of £2362 5s. 10d.; the receipts from water sold being £6388 5s. 6d.

SEWERAGE DIFFICULTIES IN WILTS AND DORSET.—At Salisbury, as also at Weymouth and Dorchester, the inhabitants have for some time been perplexed as to the public drainage and the disposal of the sewage. These difficulties have been increased by the threatened opposition of landowners to any scheme not in compliance with the requirements of the Rivers Pollution Prevention Act. At Salisbury the Corporation have been contemplating the establishment of a sewage farm, which at both Weymouth and Dorchester has been scouted as a most costly experiment, strongly to be avoided. Mr. T. Hawksley, C.E., has presented an elaborate report in regard to the Weymouth drainage. He suggests an outfall sewer to receive in its course the whole of the drainage, and estimates at £25,000 the cost of the works which he proposes. He expresses the opinion that the causes of the effluvia so long complained of can only be completely removed by reclaiming the now submerged land, and thus destroying the lake. This operation may, he says, be effected in either of two ways—first, by raising the ground now forming the bottom of the lake to a level above that of the highest tides, at a cost of £80,000 or £100,000; secondly, by embanking the channel of the River Wey, and draining the reclaimed lands by steam-driven pumps, in the manner practised in the Fens, at a cost of probably £20,000. At Dorchester the Corporation have decided to adopt the precipitation system, the idea of a sewage farm being abandoned on account of its costliness. The Borough Surveyor is preparing a scheme, and this is to be submitted to the Local Government Board for their approval. It is expected that in order to meet the requirements of the Rivers Pollution Prevention Act a very considerable expense will have to be incurred.

SERIOUS GAS EXPLOSION AT CARDIFF.—The *South Wales Daily News* reports that owing to the severe weather the roads in Cardiff are frozen hard, and in many places the water in the pipes leaning to the houses is frozen in the ground under the roadway, hundreds of persons depending on those who are more favourably situated for a supply of water for domestic purposes. All the drinking fountains in the town are stopped from the same cause. Among them is a gas-pillar and drinking fountain at the corner of Westgate Street and the Cowbridge Road. The gas-pillar has a large square basement, on the sides of which are the drinking fountains, approached by massive stone steps. Above the jets of water is a handsome cast-iron pillar, surmounted with three lamps. The basement portion of the post is hollow, and this would be filled with gas in the usual way. On Wednesday morning a man in the employ of the Corporation endeavoured to thaw the water-pipes, so as to obtain a supply of water for the fountain. For this purpose he dug a hole in the ground near the stone steps, and when he had reached the pipe, as he supposed, he made a fire for the purpose of thawing the water. Both water and gas pipes are contiguous, and in a short time the gas-pipe melted, and the fire communicating with the gas, a terrific explosion took place, which blew up the stone steps, smashed the iron pillar in pieces, some of the fragments being thrown a considerable distance. Fortunately no one was injured, but a number of persons had narrow escapes from the falling fragments of the pillar. The serious nature of the explosion was due to the large volume of gas in the basement of the pillar, and the melted ice generating steam.

MR. W. H. PREECE ON GAS V. THE ELECTRIC LIGHT.—At a meeting of the Society of Telegraph Engineers, held in the rooms of the Institution of Civil Engineers, Great George Street, Westminster, on Wednesday last, the newly-elected President, Mr. W. H. Preece, delivered his Inaugural Address, on the progress of telegraphy, in the course of which he made the following reference to the electric light and gas. The light had, he said, been making considerable progress, and was gradually forcing itself into practical use, in spite of many of the drawbacks to its employment that had still to be removed. The lamp of the future had not yet been produced, though steadiness and duration had very much advanced during the past twelve months. One of the most notable and useful applications of the light had been on board ship, to further the operations during the night in laying and repairing cables. He was present on board the s.s. *Dacia*, in the Mediterranean, when this was done, and the success was unequivocal. The Brush generating machine had recently been introduced into this country, and its performances were certainly the most advanced form the electric light had yet taken. There were over 800 of these lights in the United States; and it was worthy of notice that it had quietly crept into existence without the aid of the ubiquitous and omniscient newspaper correspondent, or the transmission of any sensational telegrams, to the detriment and discomfort of gas shareholders. Gas was

not going to be affected by the electric light. The proper function of gas was to generate heat. Ninety-four per cent. of the ingredients of gas were consumed in generating heat, and only 6 per cent. in producing light. It was remarkable that so amenable and tractable an agent for heating purposes as gas had not been more utilized; but the fact was that the public were ignorant of its properties, careless of its employment, and callous of its defects. It was not too much to say that 50 per cent. of the gas manufactured was absolutely wasted for illuminating purposes by the wild extravagance with which it was burnt, and by the want of those systems of regulation which had been introduced to compensate for irregularities and excesses of pressure.

THE ASHTON, STALYBRIDGE, AND DUKINFIELD WATER-WORKS ARBITRATION.—The *Oldham Chronicle* says: "We very much doubt whether any of the parties to the costly arbitration to determine the value of the Ashton, Stalybridge, and Dukinfield Water-Works will be thoroughly satisfied with the award they have obtained at the expenditure of £22,397 2s. 4d. The Joint Water-Works Committee of the Ashton and Stalybridge Corporations and the Dukinfield, Mossley, and Hurst Local Boards was not only authorized to carry out the Greenfield scheme, but had also to take over the works already possessed by the three first-named Authorities, and the dispute has been as to the price at which these old works should be transferred to the Joint Committee, each body, of course, seeking to enhance the value of its own separate property as much as possible. The existing works of the Ashton Corporation, the Stalybridge Corporation, and the Dukinfield Local Board were, in fact, to be sold to the Joint Committee for as much as they would fetch, and the total cost was to be contributed by the various bodies represented on the Joint Committee, in the following proportions:—Ashton 259 parts, Stalybridge 185 parts, Dukinfield 111 parts, Mossley 75 parts, and Hurst 45 parts; it being, of course, understood that if the value of the plant belonging to any of these Authorities should exceed the amount of its contribution to the total cost, it would have something to receive, instead of having something to pay. It may be interesting to notice the different valuations that were put forth by the different bodies. On behalf of Ashton the figures given were—Ashton, £186,920; Stalybridge, £127,125; Dukinfield, £24,167. The Stalybridge valuation was—Ashton, £163,669; Stalybridge, £131,569; Dukinfield, £22,846. On the other hand, the Dukinfield valuation was—Ashton, £170,148; Stalybridge, £83,288; and Dukinfield, £34,988. It will be seen, therefore, that while Ashton and Stalybridge were agreed in putting down the Dukinfield works at £22,000 or £24,000, they differed greatly as to the respective values of their own undertakings, and that the Dukinfield estimate was in marked opposition to those both of Ashton and Stalybridge, but, being the least in the aggregate, was most favourable to the interests of Mossley and Hurst. After the prolonged arbitration the values have been decided as follows:—Ashton, £173,679; Stalybridge, £124,196; and Dukinfield, £34,287; the result being that if each Authority had consented to make a comparatively slight deduction from its own estimate of its own works, they would have come without difficulty to a conclusion it has cost them £22,000 to arrive at by legal means. Working out the results of the different valuations, we find that the amount to be received by Ashton for its plant, after deducting its proportionate contribution to the general fund, was variously estimated as follows:—Ashton valuation, £57,167; Stalybridge valuation, £44,701; Dukinfield valuation, £59,479; Arbitrators award, £46,226. The amount to be received by Stalybridge, after a similar deduction, was represented as £34,430 according to the Ashton valuation; £43,020 according to the Stalybridge valuation, £4239 according to the Dukinfield valuation, and £93,160 according to the Arbitrators award. Dukinfield was called upon to pay, over and above the value of its plant, as follows:—Ashton valuation, £31,450; Stalybridge valuation, £30,288; Dukinfield valuation, £12,441; Arbitrators award, £20,335. The amount to be contributed by Mossley varied as follows:—Ashton valuation, £37,579; Stalybridge valuation, £35,898; Dukinfield valuation, £32,047; Arbitrators award, £36,906. Whilst the Hurst contribution showed the following variations:—Ashton valuation, £22,547; Stalybridge valuation, £21,539; Dukinfield valuation, £19,228; Arbitrators award, £22,143. Comparing the amounts the various parties will receive or pay under the Arbitrators award with the sums as worked out from their own respective claims, we find that Ashton is £10,941 worse, Stalybridge £9660 worse, and Dukinfield £7894 better off than they would have been if their own valuations had been accepted; while, with regard to Mossley and Hurst, it will be seen from the above figures that their contribution does not vary greatly whichever valuation is taken. In the meantime there is the sum of £22,397 to be paid by the parties as the legal costs of the arbitration."

Register of Patents.

3422.—TASKER, W. J., Halifax, "Improvements in illuminating apparatus applicable to street-lamps and other gas-burners." A communication. Patent dated Aug. 29, 1878.

This invention consists, firstly, in the employment of a clockwork movement attached to each lamp bracket, or standard, by means of which the flow of gas can be increased or diminished at the desired period automatically. The supply-pipe leading to the burner is provided with a cock or tap, the aperture of which is of the proper size to allow sufficient gas to pass through to produce a full-sized flame. There is also a small passage leaving the supply-pipe below the cock, and entering the same above the cock, so as to allow of the constant passage of a small stream of gas to the burner, when the cock is shut off. A small lantern or shield, with perforations, is placed round the upper part of the lamp or burner, and is capable of being raised so as to surround the flame when desired. To the spindle of the stop-cock is attached a two-armed lever, one of the arms of which is attached by a crank pin and rod to a double notched wheel connected with the clockwork mechanism. The other arm is connected with a rod for raising and lowering the small lantern or shield.

The operation of the apparatus is as follows:—When the retaining catch is removed by the clockwork, the notched wheel makes one-half of a revolution before it is again arrested by the catch, and in so doing it either closes the stop-cock, or raises the shield so as to surround the burner, or vice versa. If the stop-cock is closed, the gas still continues to flow through the side passage, leaving a minute flame, which is protected by the shield. When in due course the retaining catch is again removed, the notched wheel completes its revolution, and the gas is fully turned on, and the shield lowered.

Secondly. The invention refers to apparatus for extinguishing gas only. The clockwork mechanism is employed with the addition of a cam, which, at the desired hour, makes a half revolution, and operates a catch lever, which releases the stop-cock lever, and allows the same to be closed by a spring. When the gas is next lighted, the catch lever is connected with the stop-cock lever ready for the next operation of extinguishing.

Thirdly. The invention relates to a method of performing the operations of increasing or diminishing the flame described in the first part by means of electricity. Instead of removing the retaining catch by means of clock-

work, it is removed by means of a lever attached to the armature of an electro-magnet. When it is desired to put the apparatus into operation, it is only necessary to establish the electric current for an instant, so as to remove the retaining catch, which is replaced by a spring as soon as the wheel has made half a revolution, and the current is broken. The current may be established or broken either by hand or clockwork mechanism.

Fourthly. The invention relates to a method of extinguishing only by electricity. The catch lever governing the stop-cock is attached to the armature of the magnet, and is removed from the stop-cock when the current is established, and the cock is closed by a spring, as described in the second part.

3445.—SIEBERT, O., Lisle Street, London, "Improvements in gaslight apparatus and arrangements connected therewith." Patent dated Aug. 30, 1878.

This invention consists mainly of the following arrangements:—For regulating the gas to the burner a screwed socket is arranged, provided with a seat, in the centre of which is a small opening; and above is the screw, into which screws the burner. The burner at the lower part is provided with a peculiarly shaped plug, so formed as to come to a point immediately over the opening in the seat, the sides being provided with openings so that the gas issuing from the opening in the seat passes up, around, and thence to the burner, the regulation being effected by turning the screwed piece, and with it the plug. This screwed piece is provided with a triangle or globe holder, each arm of which is grooved or recessed, and into the groove or recess a small spring is placed. The spring is covered by a piece of metal terminating in the clip for holding the globe, such clip being passed through an opening made in each arm, the upper portion being turned inwards to clip the rim of the globe, and the lower part forming a projection to draw or force the plate in or out to suit the size of the globe.

3462.—HERITAGE, J., Clapham, Surrey, "Improvements in ball-valves." Provisional protection only obtained. Dated Aug. 31, 1878.

According to these improvements the ball-lever, where it is hinged to the valve-box, is formed with a cam-shaped projection in contact with the end of the valve-spindle. This operates in such a manner that upon the falling of the lever the projection forces the valve from its seat against the pressure of the water from the main; and when the ball-lever rises, the projection moves away from the spindle, and the pressure of the water from the main closes the valve.

3468.—GIROUD, H., Paris, "Improvements in rheometric gas-burners." Patent dated Sept. 2, 1878.

This invention relates to the construction of gas-burners with which is combined a governor or rheometric apparatus for the purpose of regulating the flow of gas, notwithstanding variations of pressure in the supply. The governor may be either of the wet or dry kind, in the one case consisting of a light bell inverted like a gas-holder in liquid; in the other, consisting of a light disc, free to rise or descend like a piston, within a cylindrical casing. In both cases the supply aperture to the burner above the bell or disc is governed by a conical valve or plug attached to the bell or disc, so as to the more throttle the aperture the greater the pressure causing the bell or disc to rise.

When the wet governor is used, the burner is made in several pieces, the lower piece presenting a cylindrical cavity in which the bell works, resting, when there is no pressure, on radiating ribs at the bottom of the cavity, and guided by side ribs so as to rise or descend evenly.

The lower cavity is covered by a cap screwed on, and having on its under side a diaphragm with a central hole in it, governed by the conical plug on the bell. The cap has one or more branch passages leading up from it to the burner, which may be of metal, steatite, or other suitable material. For the dry governor, the lower cavity is bored truly cylindrical, and closed at the bottom by a screwed cap.

In the cylindrical interior works the disc, which fits loosely so as to allow leakage of gas past its edge. The disc is made of aluminium for the sake of lightness, and secured by a boss of solder on each side of it to a stem that carries a valve governing the aperture above to the branch passages leading to the burner. From under the disc there is a lateral bye-pass for the gas by a passage governed by a screw-cap, which can be adjusted so as to let more or less gas pass to the upper side of the disc, according to the needs of the burner.

In constructing the rheometric burners above described, alloys of tin, lead, and antimony are employed for the casings; for the bell of the wet governor, an alloy of tin, with 5 to 10 per cent. of nickel, and with a little copper, tungsten, platinum, or palladium; and for the disc of the dry governor, aluminium—these metals and alloys not being chemically acted on by the gas.

3474.—GROTH, L. A., Stockholm, "Improvements in the construction of gas-burners." A communication. Patent dated Sept. 2, 1878.

Burners made according to this invention consist of two main parts screwed into one another. The lower part contains a conical sleeve, the small open upper apex of which just enters a small hole formed in a partition above it. The cone sleeve can rise and fall according to the gas pressure. With medium gas pressure the gas lifts the cone sleeve so far that gas enters the hole in the partition, partly from the apex of the cone sleeve, and partly from the chamber in which it works; with high gas pressure, the cone sleeve being in its highest position, and its apex fully entering the hole in the partition, the gas enters the latter only, or mainly from the cone sleeve. When the pressure becomes lower, the cone sleeve sinks down until equilibrium is restored again. The cone sleeve will, by the gas pressure, rise until the pressure in the chamber around it, in addition to the weight of the cone sleeve itself, balances the inner gas pressure in it.

3488.—GEDGE, W. E., Wellington Street, Strand, "Improvements in suspending and adjusting sliding gaseliers or gas apparatuses." A communication. Patent dated Sept. 3, 1878.

This invention relates to the application of a rack to the sliding tube of a gas pendant or gaselier, a pawl or catch arresting the descent at any desired point. In lieu of the pawl or catch, an endless screw gearing with a pinion may be employed. The pinion drives a toothed wheel, which in its turn gears with the rack of the tube, and, by means of a crank, the apparatus may be raised or lowered according to requirements.

3518.—MOLISON, A. R., Swansea, "Improved electrical apparatus for igniting illuminating gas." Patent dated Sept. 5, 1878.

In these improvements a closed vessel is employed, containing the exciting liquid and the battery elements, the latter fitted to the cover thereof. The carbon is insulated from the cover, and a wire passes up through it, and through a tube attached thereto. In the upper end of the tube is a plug of insulating material, which receives a fine tube to which the wire from the carbon is attached. A similar fine tube is soldered to the plug tube, and the two are connected by a strip of platinum foil. Surrounding the plug is an outer tube open at the upper end, and terminating at its lower end in a flange. Pendent from the flange is a rod, which passes through the cover and connects with the zinc element. Surrounding the plug tube, and interposed between the cover and the flange of the outer tube, is a coiled spring, which serves, by pressing on the under side of the flange, to support the zinc element clear of the

exciting liquid, and keep the outer tube raised above the platinum foil until the outer tube is depressed, when the zinc will be immersed in the exciting fluid, and an electrical action set up, the platinum being thereby heated, and igniting the gas.

3639.—PARKINSON, G. J., Balsall Heath, near Birmingham, "Improvements in gas-burner regulators." Patent dated Sept. 16, 1878.

This invention consists in making in two pieces a shell or case, the lower part of which is screwed to connect it with the gas supply, and the upper part is screwed or otherwise fitted to receive a burner. In the lower part there is a fixed disc or seat with a small hole in the centre. Between the upper and lower parts there is a moveable disc of such size as to permit a sufficient quantity of gas to pass between its edge and the shell to supply the burner. The moveable disc has attached to its under part a long conical stem which serves as a valve when rising or falling through the hole or seat in the fixed disc. When the gas enters the regulator it passes through the hole in the fixed disc, and by its pressure raises the moveable disc until the long conical stem or valve closes the hole in the valve-seat below to such an extent as to admit of only sufficient gas passing as is necessary to produce the requisite pressure at the point of combustion. To prevent the possibility of the lights being put out by the moveable disc being suddenly forced up against the flange on the inside of the upper part of the case, notches are cut in it to allow of a passage for the gas.

3694.—WALLACE, R. W., Mark Lane, London, "Improvements in the manufacture of sulphate of ammonia, and in apparatus therefor." Patent dated Sept. 19, 1878.

In carrying this invention into practice, a tank, preferably placed below the surface of the earth, contains the crude ammoniacal liquor, which is pumped up to a tower, passing in its course through a series of sulphuretted hydrogen condensers, by which it is heated. As the liquor descends within the tower, steam at a high pressure is admitted at the bottom, thereby causing the crude liquor to give off nearly the whole of the free ammonia gas, consisting of carbonate and sulphide of ammonia, which then passes off to the saturators. The remaining liquor is then carried, by means of a pipe provided at the lower part of the tower, to one or more blowers or tanks, to which steam is admitted. From these tanks the liquor is blown into the ordinary steam boilers through a connecting-pipe, where the remainder of the free ammonia is eliminated. From these boilers the liquor is afterwards blown off through another pipe to a tank containing lime, which is agitated by means of a perforated pipe connected with the steam-boilers. The fixed ammonia or sulphocyanide of ammonia left in the liquor is here eliminated, and is taken back to the tower through a pipe provided for the purpose, the pipe also serving as an overflow-pipe to prevent the tower from becoming too full, if there should be any obstruction in the pipe at the bottom. It is then taken away to a saturator or saturators, in which, by being combined with sulphuric acid, it becomes sulphate of ammonia.

The sulphuretted hydrogen generated in the saturators is passed through the condensers, which are constructed of wrought iron, and are provided with a number of small tubes arranged vertically. Within the surrounding space there is a continual flow of the crude ammoniacal liquor passing from the liquor tank to the tower. This liquor condenses, and at the same time is heated by the sulphuretted hydrogen passing through the vertical tubes, from whence the uncondensed sulphuretted hydrogen is conveyed to the boiler furnaces to be burnt. The spent lime in the agitating tank is blown off through pipes to a series of precipitating tanks.

According to another part of the invention, a considerable portion of the above-described apparatus is dispensed with, and within the tank containing the crude ammoniacal liquor is placed a pipe, connected with an air-pump, or with a gas-exhauster worked by a steam-engine, or in any other suitable manner. This air-pump or exhauster exhausts the air from the tank, and the liquor evaporates, giving off the free ammonia gas, which is led direct to the saturator, where it is treated in the usual manner. If necessary, the liquor may be heated by steam passing through a coiled pipe or otherwise to ensure the evaporation of the ammonia. The fixed ammonia is then eliminated, agitating with lime in the ordinary way.

3768.—LAKE, W. R., Southampton Buildings, London, "Improvements in apparatus for the manufacture of gas." A communication. Patent dated Sept. 24, 1878.

This invention relates more particularly to that class of generators which produce fixed illuminating gas from liquid material, such as petroleum or other hydrocarbon oils; and it partly consists in the employment of one or more retorts provided with safety escape seals or valves upon the end or ends thereof, in combination with an external chamber enclosing the ends. Also in the peculiar combination of straight and curved retorts; and in certain details and combinations of parts in the internal construction of the retorts.

3915.—CUTLER, S., Millwall, "Improvements in apparatus used in the manufacture of gas." Patent dated Oct. 4, 1878.

This invention has reference to the mouthpieces of gas-retorts, and has for its object the production of means for the prevention of undue strain upon the retorts, consequent upon the mouthpieces overhanging the retorts, the weight being ordinarily sustained simply by the bolts that connect the retorts and mouthpieces together.

The invention consists in fixing to the buckstaves a cast-iron bracket or brackets sufficiently long to reach a little beyond the centre of the bottom of the lowest and nearest retort. That part of the bracket immediately below the mouthpiece is made with two inclined planes, and between it and the mouthpiece are inserted two cast-iron blocks, the bottoms of which have also inclined planes. These blocks have each a hole through which a screwed bolt is passed, and upon turning the nut or head of the screw the blocks are brought together and made to take a bearing upon the bracket, and by virtue of their bottoms and the upper parts of the bracket having inclined surfaces, the two blocks as they approach rise and wedge themselves under the mouthpiece, thus relieving the strain upon the retort by affording another and independent support. Instead of a bracket, a pillar resting on the floor, and having its upper part fashioned in the manner before described, may be used to support the lowest retort, or the bracket may be extended from one buckstave to the next, so as to form a girder upon which projections with inclined surfaces may be formed, as before mentioned. The upper retorts are supported by saddles resting on the next lowest retorts, the saddles in some cases being connected together by bridge pieces. Each of the saddles, however, is made with a doubly inclined surface, so as to take the blocks and screw before mentioned, and conjointly render the needed support.

Instead of having the brackets made with two inclined surfaces, one only may be used, and in that case one block only will be needed in each bracket, the bolt being made to pass through both the bracket and block.

3925.—CARSON, W., Egremont, Chester, "Improvements in and relating to the generation and application of illuminating hydrocarbon gases, and in apparatus connected therewith." Patent dated Oct. 5, 1878.

This invention consists, first, in the system of generating and applying illuminating hydrocarbon gas by means of the direct application of air under pressure superior to atmospheric pressure, the gas being supplied from porous material saturated with hydrocarbon spirit, and the pressure

of the air and the supply of the gas being regulated and equalized by the amount of consumption. Secondly, in the construction and arrangement of an aerometer, generator, and valves, and the combination of these parts forming an apparatus for the generation and supply of illuminating hydrocarbon gas. Thirdly, in the system of applying illuminating hydrocarbon gases by means of suction or induced draught applied to the burners supplied with gas from the gas apparatus.

3937.—LAKE, W. R., Southampton Buildings, London, "Improvements in gaslight extinguishers." A communication. Patent dated Oct. 7, 1878. These improvements relate to devices for extinguishing gaslights by changing the pressure of gas in the main-pipe, and the apparatus employed consists of two inverted cups of different sizes arranged upon a stem, one within the other, to operate corresponding cells containing quicksilver. The cups are raised by a lever pivoted to an enclosing case, with an inlet passage extending from the gas-pipe to the interior of one cup, and an outlet passage extending from the interior of the other cup to the burner, and they are so weighted as to be held up in a position with one cup out of the quicksilver, or dropped by a change of the gas pressure in the main-pipe into a position with both cups in the quicksilver.

3972.—WEATHERHOGG, G. W., Lambeth, London, "Improvements in gas motor engines." Patent dated Oct. 9, 1878. In a single-acting compound gas motor engine constructed according to this invention, the exploding materials, when ignited, give motion to one piston at the same time that fresh air and gas are drawn in behind a second piston, connected with the first within the same cylinder, the air and gas being compressed during the return stroke and afterwards transmitted to the back of the first-named piston ready for a subsequent explosion, so that an explosion may be made at every revolution of the engine. The cylinder is made of two diameters, and equal to double the length of the

stroke, with pockets or reservoirs, and the pistons fit into each part of the cylinder, the larger piston forming a trunk in which the connecting-rod works. The latter piston also acts as an air-pump or compressor.

APPLICATIONS FOR LETTERS PATENT.

- 305.—KINGSFORD, C., Upper Clapton, London, "Improvements in apparatus for the generation of steam, the manufacture of coke and gas, and for similar purposes." Jan. 23, 1880.
330.—LINFORD, C., Leicester, "Improvements in and connected with gas-engines." Jan. 24, 1880.
332.—FIELDING, J. R., and BUTTERWORTH, B., Rochdale, Lancs, "Improvements in or applicable to gas burners or lights." Jan. 26, 1880.
343.—ABEL, C. D., Chancery Lane, London, "Improvements in gas motor engines." A communication. Jan. 26, 1880.
353.—SMITH, R., Edinburgh, "New or improved water supplying and regulating apparatus for water-closets and other analogous purposes." Jan. 27, 1880.
390.—BRADSHAW, J., and HAWORTH, J., Blackburn, Lancs, "Improvements in gas-lighting apparatus." Jan. 29, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

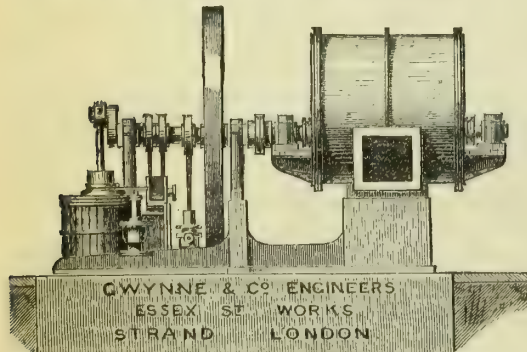
- 3148.—LOWRIE, R., Newcastle-on-Tyne, "An improved union joint or coupling for pipes and tubes." Aug. 5, 1879.
3177.—SILBER, A. M., Whitecross Street, London, "Improvements in gas-burners." Aug. 7, 1879.
3183.—CLELAND, W., Linacre, Lancs, "Improvements in means and apparatus used in the manufacture of gas from coal, cannel, shale, and like materials." Aug. 8, 1879.

Share List of Gas and Water Companies.

(Corrected by Mr. ARTHUR G. PRATER, 23, Cornhill, from the latest Stock Exchange Quotations.)

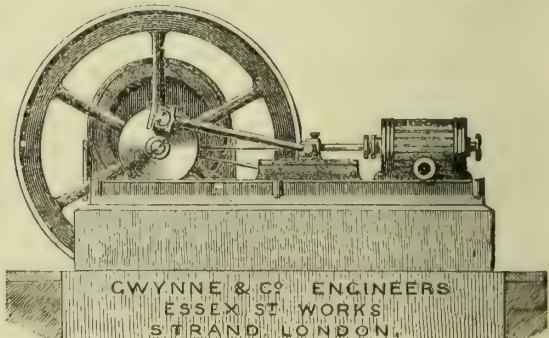
Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.
589892	£	GAS COMPANIES.	£ s. d.	£ s. d.	£	6200	£	GAS COMPANIES.	£ s. d.	£ s. d.	£	12500	£	GAS COMPANIES.	£ s. d.	£ s. d.	£
10000	20	Alliance and Dublin	10 0 0	10 0 0	15½-16	300000	100	Georgetown, Guiana	5 0 0	7 0 0	4½-4¾	2000	5	Singapore (Lim.)	5 0 0	7 10 0	53-61
5000	20	Anglo-Romano	20 0 0	10 0 0	21-23	115000	100	Glasgow Corporation	100 0 0	6 15 0	155-160	500000	Sk.	Do., preference.	5 0 0	7 10 0	53-61
1500	20	Bahia (Limited)	20 0 0	4 0 0	12-13	7600	100	Do., do.	100 0 0	6 15 0	155-160	1000	10	South Metropolitan	100 0 0	11 10 0	198-202
40000	5	Do., 2nd pref.	5 0 0	7 10 0	20-22	5000	100	Grimsby Gas, A.	100 0 0	6 10 0	180-190	5	5	Do., "B"	100 0 0	10 0 0	180-185
10000	5	Bombay (Limited)	5 0 0	7 10 0	5½-6	200000	100	Hampton Court	10 0 0	10 0 0	15-16	1500	10	Tottenham & Edmont	5 0 0	10 0 0	81-83
10000	5	Do., fourth issue	4 0 0	7 0 0	17pm	1000	100	Hong Kong (Lim.)	10 0 0	10 0 0	11½-15½	1500	10	Wandsw. & Putney	10 0 0	10 0 0	14½-15
10000	10	Bournemouth	10 0 0	8 0 0	13½-14½	5000	100	Hornsey	10 0 0	10 0 0	15-16	1500	10	Do.	10 0 0	7 10 0	124-134
229700	10	Brentford	100 0 0	9 0 0	118-53	200000	100	Imperl. Continental	100 0 0	10 p.c. & 178	180	4000	10	Do.	10 0 0	7 0 0	114-12
5400	20	Do., 5 per ct. pref.	100 0 0	5 0 0	95-100	1000	100	Kingston	100 0 0	2 p.c. bonus	121	26000	5	West Ham	5 0 0	10 0 0	8½-93
5000	20	Do., C shares	18 0 0	9 0 0	6-8 pm.	1000	100	Lea Bridge	100 0 0	7 0 0	114-124	2100	5	West Kent	10 0 0	10 0 0	14-16
14000	20	Brighton	20 0 0	10 0 0	32-34	561000	100	Liverpool United	100 0 0	6 10 0	180-185		10	Woolwich, Plumstead, and Charlton	5 0 0	16 0 0	9-10
7223	20	Brighton and Hove	20 0 0	10 0 0	32-34	1691000	100	Do., B	100 0 0	7 0 0	125-135						
1500	20	British (Limited)	20 0 0	10 0 0	33-35	7622	25	London	100 0 0	10 0 0	175-178						
750000	Sk.	Cagliari (Limited)	20 0 0	6 10 0	16-18	1500000	Sk.	Do., 1st pref.	100 0 0	6 0 0	123-126						
700000	Sk.	Colney Hatch	10 0 0	5 0 0	9-10	266927	25	Do., A shares	25 0 0	6 0 0	29-31						
20000	20	Commercial	100 0 0	11 0 0	179-182	15000	5	Do., Debent. stk.	100 0 0	5½ & 6½	61						
700000	Sk.	Do., 7 per cent.	100 0 0	8 0 0	135-40	6000	5	Malta and Mediteranean (Limited).	5 0 0	2 10 0	13-24						
20000	20	Continental Union	20 0 0	6 10 0	18-3	29000	20	Do., preference	5 0 0	7 10 0	5-5½	615600	100	Water Companies.			
2000	20	Do., new	14 0 0	6 10 0	3-2 dis	8000	10	Mauritius (Limited)	2 5 0	1 0 0	14-14½	1624700	50	Chelsea	100 0 0	6 10 0	198-202
10000	20	Do., preference	20 0 0	7 0 0	22-23	30000	5	Monte Video (Lim.)	20 0 0	6 0 0	134-14	10798	50	East London	100 0 0	6 10 0	208-210
750000	Sk.	Crystal Palace District	100 0 0	10 0 0	170-5	10000	5	Nichteroy, Brazil (Limited)	10 0 0	5 0 0	33-4½	5840	25	Grand Junction	50 0 0	5 0 0	150-122
1250000	Sk.	Do., 7 per cent.	100 0 0	7 0 0	125-50	27000	20	Do., new shares	3 10 0	9 0 0	1-1½pm	6160	25	Do., 4 shares	25 0 0	5 0 0	59-61
500000	Sk.	Do., preference	100 0 0	6 0 0	118-123	1400000	100	Ottoman (Limited)	5 0 0	3 0 0	2-2½	5551807	100	Do., new ditto; max. div., 7½ p.c.	25 0 0	5 0 0	47-50
25000	6	Do., ordinary 7 per cent.	1 4 0	7 0 0	3-2	30000	5	Pará (Limited)	10 0 0	4 10 0	5½-6	7818000	100	Kent	100 0 0	8 0 0	283-288
7100	25	Edinburgh	25 0 0	10 0 0	46-48	10000	5	Phœnix	20 0 0	10 0 0	35-37	3261507	100	Lambeth	100 0 0	6 10 0	208-211
23406	10	European (Limited)	10 0 0	10 0 0	18-20	27000	20	Do., new max. 7½	90 0 0	7 10 0	111-115	442	100	Do., max., 7½ p.c.	100 0 0	6 10 0	183-188
12000	10	Do., new shares	7 10 0	10 0 0	4-5pm	3600000	100	Do., capitalized	100 0 0	5 0 0	87-92	4475	100	New River	100 0 0	10 0 0	3820-350
35406	10	Do., new shares	5 0 0	10 0 0	2-3pm	1400000	Sk.	Do., new 1876	16 0 0	10 0 0	14-15pm	400000	100	Do.	85 0 0	10 3 8	280-300
4096300	Sk.	Gaslight & Coke A.	100 0 0	10 0 0	178-80	37500	20	Richmond (Surrey)	10 0 0	10 0 0	16-17	6668007	100	Do., deb. sk., 4p.c.	100 0 0	4 0 0	101-103
1000000	Sk.	Do., B.	100 0 0	4 0 0	73-77	1500	32½	Rio de Janeiro (Limited)	20 0 0	10 0 0	25-27	1265007	100	Do., D shares	100 0 0	6 0 0	174-129
50000	10	Do., do., 5th do.	10 0 0	5 0 0	16-16½	135000	100	Shanghai	32 10 0	12 0 0	11pm	700007	100	Do., pref. stock	100 0 0	5 0 0	127-129
2000000	Sk.	Do., C 10 p.c. pref.	100 0 0	10 0 0	205-210	9700	100	Sheffield, A	100 0 0	10 0 0	197-198	1600	100	Do., D shares	100 0 0	6 0 0	174-129
3000000	Sk.	Do., D do. do.	100 0 0	10 0 0	205-210			Do., C	100 0 0	10 0 0	195-197	15073	61	Do., new ord.	40 0 0	4 10 0	6
1650000	Sk.	Do., E do. do.	100 0 0	10 0 0	205-210									Do., nw. ord. No.1	40 0 0	4 10 0	6
300000	Sk.	Do., F 5 do. do.	100 0 0	5 0 0	101-4									West Middlesex	61 0 0	6½ p.sh	182-185
600000	Sk.	Do., G 7½ do. do.	100 0 0	7 10 0	150-156												
13000000	Sk.	Do., H	100 0 0	7 0 0	125-128												

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THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, FEBRUARY 10, 1880.

Circular to Gas Companies.

WE are at present without any further information as to the progress of the scheme which is to sanction the amalgamation of the Phoenix and South Metropolitan Companies. It is, we believe, understood that everything required by the Board of Trade has been acceded to by the Companies, and the only reason we can imagine for the delay is that the officials of the Board are so much occupied with the preparations for the parliamentary campaign that they have no time to devote to the final consideration of the scheme, before recommending it for confirmation by the Privy Council. An announcement may, however, be expected in a few days that the scheme has really been sanctioned. The opposition made by Local Authorities has been small—confined, in fact, to that of one Vestry, who saw as the possible consequence of the

union a delay in the reduction of price in the original district of the South Metropolitan Company. This purely selfish view of the matter has very properly been disregarded, and when the amalgamation is effected we shall find the combined undertaking with one initial price and one charge for gas.

As our readers know, the South Metropolitan and Phoenix Companies are promoting Bills for, to a certain extent, identical purposes. For instance, the Phoenix Company will, in the course of time, require extensive additional works, and land upon which to erect them. They have chosen a site in the parish of Greenwich, nearly opposite Beckton, which may possibly, in the future, be designated "Hornerton." This land is admirably suited in every respect for the purposes of the Company, and we hope they will be enabled to acquire it; but supposing they should fail, there is another "shot in the locker." The South Metropolitan Company are in Parliament to obtain the same site. There is, besides, a proposition on the part of both of the Companies conceived to raise additional capital to the extent of £1,000,000, with borrowing powers to the amount of one-half that sum. Against both of these Bills the Metropolitan Board of Works, at their meeting last Friday, decided to petition, on the ground, first of all, that such an extent of land as is proposed to be taken is not required for the purposes of the Companies; and, secondly, that the amount of capital asked for is excessive. On both these points we would join issue with the Board. In the first place, land in the neighbourhood of the Metropolis is being so rapidly covered, that the Gas Companies cannot too soon seize upon vacant spots which may, at a no very distant future, be required for the sites of new works. Then with respect to the new capital of £1,000,000, which the Metropolitan Board regard as excessive, no one can look upon the rapid development of the gas industry in the Metropolis, and contemplate the possible wants of future gas consumers, without recognizing the fact that a large amount of capital must be required to enable the Companies to keep pace with the ever-growing needs of their districts. An attempt will also be made, as regards the South Metropolitan Company, to get their present initial price for gas reduced. Opposition to the Bill of the Phoenix Company was, of course, to be expected; but as we hope it will not be necessary to proceed with this measure, the proposed opposition to it need not now be further dwelt upon.

With regard to the London Gaslight Company's Bill, the Metropolitan Board very charitably refrain from opposition, further than asking Parliament to limit the capital to be employed in the stove business to £25,000; while, as a matter of course, the Board seek to have the Wandsworth and Putney Gas Company brought under the most recent legislation. With respect to the Bill of the Corporation of the City of London, a severe snub is administered to the promoters, who are told in plain terms to attend to the affairs of the City, and leave the interests of the outside districts to be taken care of by the Metropolitan Board of Works. How far the Board will succeed in their obstructive policy remains to be seen. We have little doubt that the South Metropolitan Company will carry their Bill—most certainly so if the amalgamation scheme is sanctioned. The Wandsworth and Putney Bill will no doubt be altered—not exactly at the bidding of the Board, but in deference to Earl Redesdale and Mr. Raikes. Thus it will be seen that the Board have cut out for themselves a good deal of work, with relation to gas affairs, during the present session of Parliament.

The report of the Directors and the accounts of The Gaslight and Coke Company for the past half year have been issued, in anticipation of the ordinary meeting to be held on Friday next. It goes without saying that the Company, now the largest in the world, is in a highly prosperous condition, and is likely to progress at a still more rapid rate in the future. Every day adds to the number of the customers, and this must continue to be the case, so far as we can see, for long years to come. Perhaps the best indication of the increase in the number of consumers is afforded by the considerable addition to the receipts for meter-rents—viz., £633—during the past year. A further proof is evidenced in the amount of coals carbonized. Thus we find that in the last half year the quantity of coals carbonized was 598,477 tons, being an increase of 30,237 tons upon the amount of the corresponding half of 1878. The make of gas has, of course, in like manner increased. The figures which show us the amount of gas made are formidable; but here we shall simply mention that the increase in the quantity of gas manufactured during the past half year over the corresponding period of the previous year was no less than 266,514,000 cubic feet. It should be said that from every ton of coal carbonized, 10,160 feet of gas were obtained. Of the prodigious quantity of gas

made, the greater part is accounted for, the loss amounting to only about $5\frac{1}{2}$ per cent. The revenue account further illustrates the progressive prosperity of the Company. The increase in the amount received for gas sold for private consumption was no less than £31,221. We may note here a curious fact, that while a large number of additional public lamps were erected, there was a decrease of £225 in the sum received for gas supplied to them. This may, perhaps, be accounted for by the parsimony of the parishes who burn by meter, and who have reduced the hours of consumption, much to the dissatisfaction of many of the inhabitants. This and an unfortunate decrease in the amount received from the sale of coke (£15,202) form the only discouraging features in an otherwise highly satisfactory balance-sheet. It is much to be regretted that the efforts which the Directors have made to promote the sale of coke have not been more successful; but the fact is the quantity produced is now so enormous, that it is scarcely to be wondered at that an outlet cannot be found for anything like the whole of it. We have more than once recommended the Company to try the manufacture of artificial fuel, as one means of getting rid of a portion of this important residual, and we may here repeat the suggestion. The practice of working up tar for products, which we pressed upon the attention of the Company for several years, has turned out, as we were certain it would do, highly successful. The receipts for tar and tar products have increased by £53,025. "Tar products" for the past half year figure in the accounts for £34,615, which seems to indicate that their manufacture must be very profitable. We may presume that the Company have not the means of working up the whole of the tar produced at all their stations, otherwise the receipts under this head must have been much more considerable. Ammoniacal liquor and sulphate of ammonia yielded a considerable increase—viz., £3314; but this increase is easily accounted for by the additional amount of coal carbonized. The total receipts for the half year amounted to £1,301,049, which is an increase of £72,158 over the same period of the previous year. Naturally, under the circumstances we have stated, the additions made to the income have involved additional outlay. Thus, coals cost £19,186 more than they did in the corresponding half of 1878. The more coals carbonized and the more gas made, the greater is the cost for wages and for purification, under both of which heads an increase in expenditure is shown. The total expenditure for the half year was £896,618, being an increase of £38,648 over the corresponding half of 1878. Thus the balance to be carried to net revenue account amounts to £404,430, which, with the balance carried over from June last, gives a total sum of £516,357. The amount required to pay interest on debentures, preference shares, &c., is £147,164, which leaves a sum amounting to £369,193 applicable to dividend on the ordinary "A" stock. When the dividend recommended in the report, at the rate of ten and a half per cent. per annum, has been paid, there will remain a sum of about £150,000 to be carried to reserve. It is very satisfactory to see that all the reserve-funds of the Company show a considerable increase.

We may here take a glance at the capital engaged in this huge concern. Briefly stated, the amount of share capital paid up on Dec. 31, 1879, was £7,372,745, which leaves £892,255 still to be issued under the authority of their Act of 1876. The Company have been very successful in raising capital under both the auction and tender systems. The public auction in June last had not, perhaps, all the success that could have been desired; but whatever was deficient was amply made up when an experiment was made with the "tender" system. In this case £100,000 of ordinary "A" stock was offered at a reserve price of £176 for every £100 issued, and brought applications for nearly twice the sum offered. The outside public, we understand, did not tender freely, and the greater part of the sum was allotted to existing proprietors, from whom the bulk of the applications came. This shows the confidence the proprietors have in the stability of the undertaking. The auction and tender systems have brought a new item into the capital account—viz., "premium capital"—which already amounts to £80,516; and this, as our readers know, bears no interest. The sum already borrowed by the Company amounts to £1,643,510, leaving £917,990 still to be raised by way of loan.

The gas accounts of the Corporation of Birmingham for the past year are not yet ready, but at a meeting of the Town Council last week the estimates for the present year were discussed, and it was stated that the accounts relating to the gas undertaking would probably this year show a surplus of £25,000, which it was proposed to hand over towards the improvement rate. We shall not again, as we have done previously, dispute the propriety of this appropria-

tion, for it may be said that the Corporation of Birmingham have a right to do what they like with their own. Some members of the Council seem to regard the appropriation as a simple payment of rent for the use of the roads. The Gas Companies who formerly supplied Birmingham of course did not pay anything by way of rent, and thus, in the eyes of some, sold gas "unfairly cheap." On this point we need only remark that if the Companies were in possession of the gas supply at the present time, gas in Birmingham would in all probability be "unfairly" cheaper than it is at present. However, there is nothing any one could possibly allege against the management of the undertaking. The Gas Committee have their hearts in the work, and if all their doings are not exactly in accordance with our views, we must perforce credit them with the utmost honesty of purpose.

The Cambridge University and Town Gaslight Company recently held their half-yearly meeting, at which full dividends were, as usual, declared. We are always disappointed, on these occasions, when we do not have a speech from the eminent Chairman of the Company—the Rev. Dr. Phelps—whose knowledge of gas affairs is so intimate, and whose defence of gas interests is so vigorous. But at present there is not, out of the Metropolis, any "burning question" at issue, and we have no doubt that the Doctor's last speech, on the economic use of gas for other than illuminating purposes, had its effect in adding to the prosperity of his Company.

The York United Gas Company last Thursday held their half-yearly meeting, at which, as usual, full dividends were declared. The Company enjoy the continued prosperity they deserve. The increased demand for gas in York has necessitated the remodelling of a portion of the retort-house, and urges the Directors to press on their new works at Layerthorpe, a commencement of which seems to have already been made. We are glad to find that the Company have obtained better railway accommodation for the carriage of their coals to the works, so that the cartage of 25,000 tons a year through the streets is now avoided, to the great satisfaction of the citizens and the preservation of the highways.

It appears likely that the Bill promoted by the Eastbourne Gas Company will be allowed to pass without serious opposition. The Local Board wish for a pressure higher than that proposed in the Bill; but as the Company know their own business best, they very properly refuse to comply. They state that the pressure at which gas is generally supplied in London should satisfy the inhabitants of Eastbourne, and they might explain to the Local Board that excessive pressure means leakage, and leakage necessarily adds to the cost of manufacturing, and therefore of supplying gas. Tradesmen in the town object to the Company's proposal to furnish gas-fittings, &c., to their customers. On this point we hope the Company will persevere, and thus give the gas-fitters some instruction as to what constitutes good apparatus.

DEATH OF MR. F. BROTHERS, OF CHORLEY.—We have just learned of the death, on Tuesday last, of Mr. Francis William Brothers, the Manager of the Chorley Gas-Works. He died somewhat suddenly, after an illness of only a few hours, though he suffered periodically from ague, contracted whilst in India a few years ago. He was a young man of much promise.

THE REPORTED EXPLOSION AT THE WINDSOR GAS-WORKS.—In reference to the paragraph which went the round of the London papers last week, purporting to be an account of an explosion at the Windsor Royal Gas-Works on the previous Sunday night, we hear that no such accident happened. The facts of the case are that one of the old gasholders at the works was thrown out of use for the purpose of being pulled down, and a small quantity of gas remaining in the holder, accidentally became ignited, at a hole which had been broken in the crown, through coming in contact with a fire used for the purpose of thawing ice in the tank. When the gas became ignited it burnt with much brightness for a few minutes, and then went completely out. Mr. Wadeson, the Manager of the works, assures us that no explosion was caused and no damage done.

SALE OF SHARES IN THE GREAT YARMOUTH GAS COMPANY.—An esteemed correspondent—Mr. R. P. Spice—sends us particulars of the prices realized at a sale of shares in the above-named Company, on Thursday, Jan. 9. Mr. Spice writes: "I thought it might be a matter of interest to some of your readers to know how shares in well-managed country gas undertakings are appreciated in these days of false alarms and Edisonian impulsiveness. The old shares are entitled to no more than $8\frac{1}{2}$ per cent. dividend; and the new, $7\frac{1}{2}$ per cent." There were 27 shares sold at the following prices:—

10 original	£30	0	shares,	average price	£53	0	0	per share.
5	"	30	"	"	52	10	0	"
5	"	7	10	"	13	3	9	"
7	"	30	0	"	48	0	0	"

YESTERDAY'S PRICES OF GAS AND WATER SHARES.—Mr. A. G. Prater, Stock and Share Broker, of 23, Cornhill, gives the following as the closing prices yesterday of some of the principal gas and water shares:—

Gas Companies.		Water Companies.	
Commercial	180—183	Chelsea	200—205
Continental Union	183—19	East London	199—202
Crystal Palace District	170—175	Grand Junction	115—118
European	171—174	Kent	280—290
Gaslight and Coke "A"	179—181	Lambeth	200—205
Imperial Continental	177—179	Southwark & Vauxhall	199—202
London	175—178	Do. 5 per cent. pref.	126—129
Phoenix	35—35½	West Middlesex	178—182
South Metropolitan	195—200		

Water and Sanitary Notes.

On Thursday evening last Mr. Cross announced in the House of Commons his abandonment of the private Bill which was advertised last November to be promoted for the acquisition of the Metropolitan water undertakings, and which has been referred to in these columns, and stated his intention to proceed by a public measure, which he hoped to introduce at an early date. This measure he proposes should be read the first and a second time, and then be referred to a hybrid Committee, before whom all opposing parties can be heard. Although Mr. Cross made no statement as to the terms which had been arranged between the Government and the Companies, it is understood that these are the capitalization of dividends, due regard being had to prospective profits on an increasing business. It is not surprising that the Companies should have acceded to these terms, but possibly their acquiescence is merely provisional. A great deal more will have to be settled before the undertakings are vested in that Trust which has yet to be constituted. As to its constitution, we have at present no intimation from the Home Secretary; but there is a curious idea put forward, which may perhaps suggest the composition of the Trust. The Shareholders in the Water Companies are to receive in exchange for their shares the equivalent of their capitalized dividends in "Water Stock," to be provided by the Government. But in some quarters there are evidently doubts whether the profits of the undertakings in the hands of a Trust will be equal to meet all the pecuniary obligations involved. It will, therefore, be necessary to give the Stockholders some guarantee for the regular payment of their interest, beyond the doubtful profits of the undertaking. This guarantee is, we know, in all cases of Corporation purchases, the security of the borough rates. Now, the idea to which we have above alluded is to make the local rates of the Metropolis the necessary security. We do not notice that this proposal has yet got abroad, but when it does, and it is seen that the Trust is not to be a representative body, we can easily imagine that a considerable uproar will ensue. We regard it as improbable, that with good management there will ever be occasion to call upon the rates to supply any deficit. But the vestrymen will say that unlikely things do sometimes happen, and it may be that, after a few years, a "precept" will be issued by the Trust, calling upon the Vestries to furnish a certain sum of money to make up a deficiency in revenue. If the Trust is to be composed of Government nominees, it may be considered as certain that great dissatisfaction would be expressed by vestrymen when money was asked for. We shall be told once more that "representation and taxation must go together;" and for our own part we shall share the feelings of the vestrymen.

Mr. Cross has also renewed his assurance that when the actual price to be paid for the water undertakings is settled, no regard will be given to the inflated prices of shares, such as have obtained since the announcement of the intended purchase was made. But is it certain that Mr. Cross's valuers can settle the terms when the Bill is to come before a hybrid Committee? We quite agree with him that no regard should be paid to the fancy prices given for shares by mere speculators. Only the interests of real investors are to be considered in the transaction; and, so far as we can see, these are satisfactorily provided for in Mr. Cross's scheme. This announcement may cause a flutter upon the Stock Exchange; but we believe that the resolution of the Home Secretary will give general satisfaction to the Metropolitan public, and also to *bonâ fide* investors. We may leave the matter here, for in the course of a week or ten days we are promised a full revelation of the intentions of the Government with respect to the purchase, and when these are announced, the subject will require a fuller discussion than we are able to give it to-day.

There is one phase of this matter to which we have not before referred, but to which we may now devote a few words. How is the Metropolitan householder to benefit by the transference of the water undertakings from, as has been said, one "despotism" to another? The same, or possibly higher rates will have to be paid; more stringent regulations, involving much domestic *espionage*, will most certainly be insisted upon; expenses for altering fittings to receive a "constant" supply at such a pressure as will take the water to the top floors of the highest houses in the district, and even over the roofs, will have to be incurred, and a heavy public rate will perhaps be added to the domestic rate. This is what the Metropolitan ratepayer has to look forward to, under the projected new *régime*. Perhaps, however, the change may not come so soon as is commonly expected.

We notice that the Metropolitan Board of Works have resolved to petition against the Bill of the Southwark and Vauxhall Water Company, which is promoted to allow of the amalgamation of all or any of the Metropolitan Water Companies, and to enable the Company themselves to raise further capital. It might be expected that, in the present position of water affairs in the Metropolis, the Bill would be withdrawn; but we hope such will not be the case. It may be, as hinted above, that a continued existence is before the Companies, and we trust the proposals of the measure we now refer to will be put fairly before the House.

The annual report and statement of accounts of the water-works department of the Manchester Corporation have been presented to the City Council, but we are at present in possession of only a mere abstract of them. From this, however, we gather that the undertaking was last year a losing concern—a circumstance which is not to be wondered at when we consider that depression of trade seriously affected the supply for trade purposes, which fell off to the extent of 105 million gallons. The deficit, however, is comparatively inconsiderable, amounting to only £5306—a sum scarcely worthy of notice when we find that the rental for the past year amounted to £137,231. The works of the Corporation are, for the most part, in excellent order; but in the Torside reservoir there is a troublesome crack, which, we may take it, will speedily be effectually stopped. The Denton extensions are progressing favourably. These works are very extensive, and will, when completed, prove of great service to the district. But for all this the Water Committee must be longing to commence the Thirlmere scheme, respecting which we shall probably find something when we have the full report of the Committee before us. However, what we already have is sufficient to show the wisdom of the Corporation in promoting that scheme.

The York Water-Works Company held their ordinary half-yearly meeting on Thursday last; and the proceedings were most satisfactory. It is hardly necessary to repeat what we have often had occasion to say before, that the position of the Company is one which must be gratifying to all concerned, whether Shareholders or Managers. The former will be satisfied with receiving liberal dividends, ranging from five to eight per cent., free of income-tax, after which a considerable balance is left to be carried forward. The works of the Company are maintained in an admirable state of repair, those recently constructed at Acomb Landing being completed, and are now, indeed, in actual use. The Company, for the most part, live very happily with their customers and the Corporation, and very few complaints are heard of. Grumbling naturally occurs about the breaking up of the streets, but it is shown that the disturbances last complained of were rendered necessary by the effects of the frost.

Political economy is generally called the Dismal Science; but we very much question whether the Science of Meteorology may not be considered as still more dismal. We have spoken of meteorology as a science, but we cannot help thinking that its claim to be recognized as such is not fully substantiated. At the present time meteorologists can do little more than record occurrences which are of vital interest to humanity, but over which man can exercise little or no control. Thus accurate registers are kept of the amount of rainfall in different parts of the country, and these have a certain value, but they do not assist us in preventing either droughts or floods. We know, after the event, that a low rainfall may occasion much discomfort and even famine, while a high one may produce devastating floods, which sweep away crops, flocks, and even homesteads.

We should remark here that we have before us the valuable compilation by Mr. M. Ogle Tarbotton, the eminent Borough Engineer to the Nottingham Corporation, on the meteorology of Nottingham and its district during 1879. We have records of the force of the wind which may prove of great value to engineers, but no one can say that a stronger gale than the last may not strike the projected Tay Bridge, and effect a similar demolition of the new as of the original structure. Nevertheless it is well that engineers should know to what force the wind may extend, in order that they may provide against calamitous consequences when buildings are constructed of insufficient strength to resist the wind-pressure. Again, it is quite as well to know the thermometrical readings, but these do not afford us any possibility of changing the temperature one degree outside our houses. In fact, when man finds himself face to face with the powers of Nature he is utterly helpless. And yet meritorious attempts are being made to collate daily records obtained in different parts of the globe, and from them draw inferences as to the probable weather to be expected within a certain

number of hours, and even days. In these, the observations of the barometer and the direction of the wind play an important part; and we are bound to say that the vaticinations of the meteorologists are sometimes fulfilled. But here again we have to notice the powerlessness of man to cope with the elements. Notice is sent to various ports that a storm will probably arise on a certain day. Ships in harbour may lie safe at their anchorage; but how do the prophecies avail those who have to encounter in mid-channel a violent storm, such as may have been predicted? So, at home, rainstorms may be prophesied; but who is to prevent their coming, and of what use are the prophecies except to caution a man to carry his umbrella? It must not be supposed, however, that we at all despise the labours of the gentlemen who make the observations and record them. Their efforts to provide materials which may some day lead to the constitution of a science of meteorology are beyond all praise. Among these, Mr. Tarbotton holds a prominent place, and the annual record of the observations made by him and his friends in the Valley of the Trent constitutes a really valuable compilation.

We may also notice that observations of the rainfall at their several reservoirs are diligently made by the officers of the Corporation of Halifax, and duly recorded and published. The report for the past year shows that in the course of the twelve months, as might have been expected, Halifax was well provided with water. From the report of the work done during the same time, it is shown that the water undertaking is in a highly satisfactory state.

The Corporation of Liverpool are now carrying out an idea which was projected a year or two ago. The town refuse is of too extensive a character to be dealt with by ordinary means, and moreover we believe there are enormous accumulations which require removal. Under these circumstances, the Town Council have resolved to embark the refuse, and take it—not exactly out to sea, but far enough down the Mersey to prevent regurgitation to Liverpool. The steamer which the Corporation have specially had built for the purpose, made its first trip a few days ago, and successfully shot a cargo of refuse into the water. What rigid economists will think of this waste we shall not pretend to say.

URBAN WATER SUPPLY.

In the last article under this head (*ante*, p. 163) we placed before our readers a summary of the facts recorded in the recently published Return on this subject, so far as regards the towns on the Severn in that part of the drainage area of the river situated on the right bank. We now proceed to consider the state of the water supply in the towns on the left bank, many of them populous and important. They are on sub-drainage areas for the most part situated on the new red sandstone, the rivers rising in and flowing over that rock. In the small valleys of the northern feeders, however, and also in that of the Lower Avon, the rocks near the river sources are older and of different geological date.

The Vyrnwy is the first tributary of the Severn. In its drainage area are three towns, of which only Oswestry appears in the return. Oswestry has a constant supply of about 34 gallons per head per day from reservoirs collecting surface water at a distance of nine miles from the town. The water is, no doubt, excellent. The works have cost a sum equivalent to 36s. per head of population, and the charge is 2½d. per thousand gallons. It is said that extra storeage is required.

Of the water supply of the various towns in the Perry, Tern, and Worf sub-drainage areas, which include a large tract of country, chiefly agricultural, in the northern part of the Severn catchment, no detailed account is given in the return. There are eight towns in this district. Three of them—Ellesmere, Whitchurch, and Dawley—are supplied by wells, but have no works. Wellington is supplied from a small rivulet, but the quantity taken is not stated. Newport (in Salop) is named, but no information given. Market Drayton, Wem, and Shifnal are omitted altogether.

We come next to the Stour, a small but important drainage area, on which is a crowded population grouped into several towns connected with important mining and manufacturing industries. Wolverhampton is built on the line of watershed separating the Stour from the sources of the Tame, and about half the population is within the Severn drainage, and the other half belongs to the Trent. The water supply is drawn partly from the little river Worf, a tributary of the Severn, and largely from deep wells sunk in the new red sandstone, one of them to a depth of 918 feet. The Worf water is strained, but not filtered. There is a constant supply to the town of 17½ gallons per head per day for domestic purposes.

The cost of works has amounted to nearly £3 per head of the population supplied, and the average charge for water appears to be at the rate of about 6½d. per thousand gallons. Besides the town itself, Wolverhampton supplies several towns in the Trent drainage area. Additional pumping plant and storage are required. The works were long since purchased by the Corporation from a Company by whom they were started. Dudley is still in the hands of a Company, who are supposed to supply 20 gallons per head per day, but no information is given as to details. Stourbridge, also a Company's town, has a constant supply from wells in the new red sandstone, the water being pumped into a service reservoir. The quantity available is said to exceed the rate of 40 gallons per head per day, but the actual quantity supplied is not stated. The works, which supply beyond the immediate town, have cost £22,000 (rather less than 40s. per head of the population), and the charge, as far as it can be deduced from the water-rate, and estimated on the population of the town, appears to be 4½d. per thousand gallons. This, however, is little more than an approximation. Additional works are now in construction. Kidderminster has a constant supply from a well in the new red sandstone, the water being pumped into a reservoir. The yield is said to be 630,000 gallons per day, and the demand only 400,000, being at the rate of 20 gallons per head per day. The cost of works has been about 22s. 6d. per head of population, and the charge is 3½d. per thousand gallons. Halesowen, in the same watershed, is not referred to.

We come next to the important drainage area of the Upper Avon, with its numerous towns and large population. Rugby has a constant supply of filtered water from the Avon, a trial having been made without success to obtain good spring water. The quantity supplied is 20 gallons per head per day. The works have cost about £3 per head, and the charge is at the rate of 4½d. per thousand gallons. Leamington takes its water from the small stream on which it stands, the water being filtered, and a constant supply of nearly 30 gallons given. The cost of permanent works has been only about 13s. 6d. per head of the present population, and the charge for water is 3½d. per thousand gallons. Coventry has a constant supply of about 20 gallons per head from artesian wells in the new red sandstone, at a charge of 4d. per thousand gallons. The cost of works was less than 20s. per head, calculated for the present population. Warwick is supplied by tapping a deep sand-bed at a distance from the town, and conveying the water thence by gravitation. The supply is constant, and somewhat exceeds 20 gallons per head per day. The cost of land and works has been about 40s. per head. The charge is 2½d. per thousand gallons. Of other towns, Kenilworth, Stratford-on-Avon, Evesham, and Redditch are supplied by wells, but are without public works of any kind. Pershore, Alcester, and several smaller towns, are not included in the return. The town of Cheltenham, till lately supplied by a Company, has now, by purchase, passed into the hands of the Corporation. Hitherto there has been an insufficient supply of spring water from the Cotswold Hills, supplemented on occasion by well water from the town. No arrangements for future supply are completed. Stroud, on the Stroud Water, has an intermittent supply from springs, collected into reservoirs. Only about 8½ gallons per head per day are distributed, at a charge of nearly 9d. per thousand gallons. The cost of works was about 20s. per head of population. Minchinhampton and Painswick, in the same sub-drainage area, are not included in the return.

We come now to the drainage area of the Lower Avon, the sources of which are chiefly derived either from the oolitic hills of the Cotswolds, the newer rocks to the south, or the mountain limestone of the Mendips. The number of towns in this district is large, and several populous towns are included, some of them important for manufactures. Very little information, however, is given in the returns with regard even to those included, while seven of the number are not alluded to. Bristol is the largest and most important town in the district. It has a constant supply from springs, the water being collected into reservoirs before distribution. No information whatever is given with regard to this important town. The populous suburb of St. George and the town of Horfield are supplied from Bristol. Bath, the next largest town in this district, has an intermittent supply of 25 gallons per head from springs from the oolitic sand, collected into reservoirs. The cost has amounted to nearly £2 10s. per head of population, and the charge for water is 4½d. per thousand gallons. Trowbridge, also a large town, has a constant supply from the Biss springs, flowing from the chalk about six miles from the town. The springs are said to yield a minimum of 600,000 gallons per day, but the quantity used is stated at

only 5 gallons per head per day. A capital exceeding £3 per head of the population has been expended in works and other expenses, and the water-rate raised shows a cost of 1s. 5½d. per thousand gallons on that small amount. No explanation is afforded of this anomaly. Chippenham receives a constant supply of nearly 18 gallons per head per day from an artesian well which yields 210,000 gallons per day. The cost of works has rather exceeded 30s. per head of population, and the charge for water is nearly 3d. per thousand gallons. This completes the list of towns of which any details of water supply are given. We learn, however, that Malmesbury is negotiating for works, and that works are projected for Bradford, Tetbury, Calne, Midsomer Norton, and Radstock are supplied from wells, and no public works exist or are in contemplation. Frome, Wootton Bassett, Corsham, Melksham, Keynsham, and some smaller towns, are not included in the returns. The town of Yeovil, situated on the Yea, within the drainage area of the Severn, is in like manner not included in the returns.

Beyond the drainage area of the Severn, but entering the Bristol Channel from the north, there are rivers of inconsiderable magnitude, within the catchment areas of which are some large towns. The most populous of these towns are Neath, Swansea, Llanelli, and Carmarthen. The towns of Bridgend, Aberavon, Kidwelly, Llangadock, Llandilo, and Llandovery are smaller, but not without importance. Neath has a constant supply—except in dry summers, when water is most needed—from the natural drainage of a tract of about 300 acres, the water being collected and stored in reservoirs, and filtered previous to delivery. In ordinary times the allowance is nearly 40 gallons per head per day. The cost of works is equivalent to about £3 12s. per head, and the charge is 4½d. per thousand gallons. Swansea has an unfiltered intermittent supply of nearly 30 gallons per head per day from two streams, the waters being retained in reservoirs in the upper country, and sent down by gravitation. The cost of the works has been about £5 per head of population. The charge per thousand gallons is 3½d. Llanelli is said to be supplied with 60 gallons of water per head per day, the works being calculated to yield more than twice that quantity. Two streams are utilized, the waters being collected into reservoirs for distribution. The cost of works was £5 6s. 6d. per head of population, and the charge appears to be 3½d. per thousand gallons. Carmarthen has an intermittent supply of nearly 20 gallons per day, derived from land springs and surface water conducted into reservoirs, one of them being estimated to hold 50 days supply. There are also wells—thirteen of them tube wells, and two of them dug. The cost of works has been very small, equivalent to only 13s. per head of population. The charge is also unusually small, being only 1½d. per thousand gallons. Of the other towns, Bridgend is to some extent supplied by a Company, but has other resources, and the particulars of supply are not given. Aberavon is constructing works. Llandilo and Llandovery have supplies, the former from wells, the latter from springs. At Llandilo there are distributing works which have cost about £2 per head of population, but no further information is given. Llandovery has not any works.

The whole number of towns in the drainage area of the Severn, for which satisfactory returns have been made, is thus only 28, out of a total of at least 128. In rather more than half of these the quantity supplied is normal, or between 15 and 30 gallons per head per day; in nine it is excessive, varying from above 30 to 55 gallons; while in four it is altogether inadequate. The cost of works per head of population is not excessive in any, the highest being Malvern (95s.), accounted for by the exceptional requirements of a watering-place. The charge per thousand gallons is very large at Trowbridge only, and that owing to the very small quantity of water supplied. It generally ranges between 2d. and 6d., rising above 8d. in only three towns. About forty towns provided with sanitary authorities have either no public provision whatever for water, or have not made any return. In the drainage area of the Welsh rivers draining into the Bristol Channel there are four important towns. In two of them the supply is normal, and in the other two excessive. The cost of works is high in three of the four, and the charge for water moderate. In one (Carmarthen) the cost and charge are exceptionally low.

PRESENTATION TO MR. C. BROADBERRY, OF HARWICH.—On Wednesday, the 28th ult., on the occasion of his leaving Harwich, where he had been Manager of the gas-works for nine years, Mr. C. Broadberry was entertained at dinner by a number of his friends, and afterwards presented with a handsome electro-plate cruet frame and stand, as a mark of the respect in which he was held in the town. Mr. Broadberry is going to Waltham Abbey to take charge of the gas-works there.

A STATEMENT BY MR. EDISON.

We had occasion, in a recent number of the JOURNAL, to draw attention to an article in *Scribner's Monthly Magazine*, wherein domestic lighting, heating, and power were temperately discussed. In the current number of the same magazine there is a contribution of somewhat different character, dealing with the Edison electric light. This communication appeals to public notice on the ground of special authorization by Mr. Edison himself, who, in a brief note prefixed to the article, states that it is the first correct and authoritative account of his invention which has been published. The writer of the article, moreover, is Mr. Francis R. Upton, who is described as Mr. Edison's mathematician—a qualification which should be borne in mind when the merits of his communication are weighed. At the outset, then, we may fairly consider that we are treading on firm ground in criticizing the statements before us, and that the plea of incorrectness and unauthenticity, which has so frequently been urged on Mr. Edison's behalf, when any newspaper accounts of his progress in perfecting his system of electric lighting have been examined by incredulous critics, cannot in this instance be made available. At the same time we may express some surprise that the first authoritative account of such an epoch-making discovery as Mr. Edison's is claimed to be, should have been penned by any subordinate worker in the Menlo Park establishment, and further that, under his name, it should be confided to the columns of a popular magazine, where it claims the attention of readers in company with articles on bicycling and Sunday-schools. But we must take things as they are, and leave Mr. Edison to be the best judge of what befits his own dignity, and that of his labours.

It is stated at the commencement of the article that "the crowning discovery of Mr. Edison—the electric light for domestic use—is at last a scientific and practical success." And the means by which this end is achieved are generally described in terms equally terse and comprehensive: "A small glass globe from which the air has been exhausted, two platinum wires, a bit of charred paper, and we have the lamp. The generator of the electricity is simpler than a gas-generator, and the wires for its distribution are more manageable than are gas-mains and pipes. The light is equal to gas in brightness, and whiter in colour; it is enclosed, and, consequently, perfectly steady; it gives off no appreciable heat; it consumes no oxygen; it yields up no noxious gases, and, finally, it costs less than gas. The difficulty of subdivision Mr. Edison has also overcome." In his method of illumination, a number of separate lights can now be supplied from the same wire, and each one, being independent, can be lighted or extinguished without affecting those near it." Such are the general results claimed by Mr. Edison himself; whether he can make his claim good before all the world is another matter.

We may notice that the lamp itself is precisely the same as that described in previous reports of Mr. Edison's doings. We have the high vacuum glass, the fragile cardboard carbon, and the platinum connections. Everything hangs on the efficiency and durability of the piece of charred paper, which is so delicate that it looks like fine wire. The horseshoe shape is declared to have been adopted in order to approximate its appearance, when incandescent, to that of an ordinary gas flame, and to secure the advantages of considerable area in the lighting body. Reference is made to the difficulty experienced with the earlier lamps, of the glass cracking round the wires, and admitting air, to the destruction of the paper; but this is stated to have been surmounted in the later specimens. No further drawbacks are admitted, the whole thing being considered to be perfect.

The generator, entitled "Faradic" by Mr. Edison, presumably to show that he is quite willing to allow that there were great men before Agamemnon, consists of an armature of wood covered with iron wire, upon which are longitudinal loops of insulated copper wire terminating in exposed blocks of copper acting as the commutator, from which the currents generated when the armature is rapidly revolved by steam or other power between the poles of an enormous electro-magnet, are taken off by copper brushes, and conducted to the main wire. "It is proposed to mass a large number of such machines [illustration given], and have them all pump electricity up from one wire into a second. The two large wires, held on supports above the floor, are intended, the one to carry the electricity away; and the other to bring it back after it has been used." We must submit this remarkably lucid description as it appears in the original. Comment on it is clearly unnecessary. To proceed: "It is proposed to establish such stations, in the course of a few months, in the heart of several of our large cities. These will supply houses for quite a distance [*sic*] round them. One thousand horse power is thought to be a sufficient amount for a unit, and the stations will be at such distance from one another that each district will require about this amount. The engines will be divided into four groups of 250-horse power each, with a spare one in each station of the same power." The vague way in which engines of 250-horse power in groups of five, with their appurtenances of boilers, houses, and the not insignificant establishment arrangements connected therewith, are "thought" to supply a line of wire innocently described as "quite a distance," is somewhat remarkable in this passage.

The wires are to be laid in bundles under the edges of the side walks, for ease of access. There would not be any need to put them beyond the reach of frost, for "the colder the wires are the less is the waste of electricity, thus giving a decided advantage over gas in winter, when most light is needed." This paragraph is about as vague as the last quoted, or else betrays a certain confusion of ideas, which, in a mathematician, is deplorable. One would have thought that leakage, or waste, must be as objectionable in summer as in winter. Waste is waste all the year round, and a gas-works would be in a curious position if, by reason of the leakage from the mains, there were a difficulty in maintaining the supply during the winter.

We are not told how much average waste of electricity must be expected, or even "thought of."

The system of measurement devised by Mr. Edison, whereby the consumption of electricity—we are forced to speak of it as a substance after Mr. Upton's "pumps"—in any house may be measured, is next fully explained. That it is ingenious is only what might have been expected; but that the plan of charging for the light by the foot, as for gas, and determining the quantity by the deposition of copper on a plate, will satisfy the suspicious mind of the householder, to whom the comparatively baby-task of reading a gas-meter is a profound mystery, we do not for an instant believe.

Domestic power, for the turning of sewing-machines, lathes, and other appliances, up to several horse power, is to be readily available from the same source and at the same expense as the light. Mr. Edison's dynamometer is also described, but the results arrived at as to the power of his Faradic generators are not stated; and then the article ends in the true "Hail, Columbia!" vein, slight displays of which, as a matter of course, occur throughout.

Now we have gone through the whole statement, stamped as it is with Mr. Edison's approval, what does it all amount to? Practically nothing that was not known before, and nothing whereby any judgment may be formed respecting the value of the invention from a commercial point of view, however ingenious it may appear as the work of a highly original and laborious experimenter in physical science. There is not a single datum of cost, power, or dimensions (except the remarkable one of the 1000-horse power unit) given in the whole communication. The cost of the lamp is said to be "trifling," the power of the generator is "immense," and the distribution is "simple;" but nothing that one can lay hold of, and submit to close examination and comparison, is afforded. This circumstance becomes all the more striking when it is remembered that it is a mathematician who writes the article—a man whose daily study must consist of those very facts and data which he withholds in this, the *first* official utterance to which an expectant world is treated. He begins his statement in a manner as strictly orthodox as a problem of Euclid—the proposition first, and then the construction; but the proof is altogether wanting. We cannot follow his remarks, descriptive and incidental, and rise from their perusal with a Q.E.F. on our lips. Perhaps the demonstration is to follow, although the peroration is as grand as if the writer felt it to be his last effort; but it would have been better if some signs of willingness to satisfy curiosity in this respect had been shown in the article itself.

The uncertainty which still prevails as to the practical fitness and durability of the vacuum lamp itself, the soul of the system, admitted as it undoubtedly is by some of Mr. Edison's warmest partisans, is not so much as brought forward for removal by Mr. Upton in this article. Perhaps the drawback of the liability to leakage, and consequent destruction of the necessary vacuum—referred to by *The Times* Philadelphia correspondent, in a letter, dated Jan. 20, which appeared in last Wednesday's issue of that paper—has sprung up in a fresh form since the article was written, as it is stated to have been discovered only within the past fortnight—that is, the second and third weeks of the present year. But, if this is the case, it shows how little reliance can be placed upon the sanguine prophecies of the writer of the article. In all probability, if the question of the importance of this, the most recent obstacle to the immediate establishment of Mr. Edison's system beyond the region of Menlo Park, were submitted to the inventor himself, or to his mathematician, it would be dismissed in the customary airy fashion, as being unworthy of more than a passing remark; but its practical bearing on the money value of shares in the Edison Light Company is shown by their having fallen from 3500 dols. to 1500 dols. per share. There may be no sufficient reason for this tremendous drop, as there was no solid consideration to warrant the former premium at which the shares were held; but there again we get the impression that the public generally have a right to facts as they are, and not merely to Mr. Edison's anticipations of what the future may have in store—if things go on precisely as he wishes and expects.

Scarcely any man in the present century, apart from the ranks of political celebrities, has enjoyed a greater notoriety than Mr. Edison, and this effect appears to have been produced by the efforts of others rather than by his own seeking; yet it would seem as though he had become not altogether unwilling to take advantage of the prestige which has long attached to his name, when we find his *imprimatur* on a series of astounding statements, the bearing of which on the private finances of all nations is fully admitted, and yet whose basis of fact is evidently intended to be supplied by his assertions alone. Wherever and whenever published, Mr. Edison certainly owed the public the privilege of drawing conclusions for themselves from authenticated facts. If his conclusions are well founded, the data on which they are based could well have been expressed in a very few sentences by Mr. Upton or any one else. If there is any doubt in the matter, a true philosopher would give the world the benefit of it, or have kept his proceedings to himself until it had been solved in one way or the other. Perhaps Mr. Edison means to come forward himself, at his own convenience, and publish a memoir that will completely establish his position, and strike his critics dumb. But, if such be his intention, why allow premature and incomplete disclosures to discount the interest which would otherwise centre in himself? The world will not always

"stand at gaze,
Like Joshua's moon in Ajalon,"

on Mr. Edison or any one else. The only way open for him to atone for the disturbance of the investment markets of the world, and the consequent disquietings of the minds of the legion who have invested their savings in gas property, which, however unintentionally, he

has caused, is to justify it, and that can only be done by proof infinitely more conclusive than the mere *ipse dixit* which is all he has hitherto vouchsafed to all inquirers.

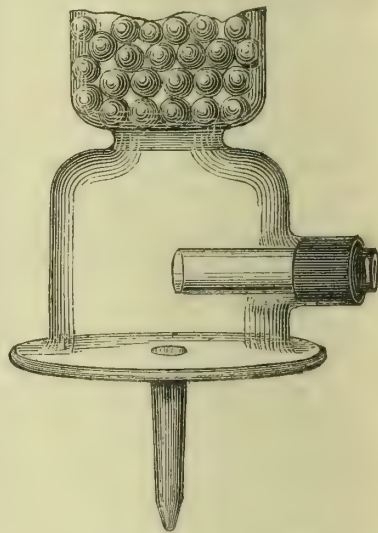
Communicated Articles.

NOTE ON THE GAS REFEREES SULPHUR TEST.

By Mr. H. LEICESTER GREVILLE, F.C.S., &c., Chemist to the Commercial Gas Company.

It will probably have been noticed by all who have had much experience in the use of the Referees Sulphur Test, that the liquor obtained from the combustion of a fixed quantity of gas is somewhat variable in amount. I have frequently observed that, without any great fluctuation of temperature, the liquid obtained would vary by as much as $1\frac{1}{2}$ ounces, and that different apparatuses would give different quantities of liquor.

An accidental occurrence placed me, a short time back, in possession of a fact which explains that which had previously puzzled me. A sulphur apparatus which had been recently set to work gave more than usual fluctuations in the amount of liquor which it yielded, and I had also reason to suspect that the sulphur indications were not so high as they should have been. I satisfied myself that no leakage existed, and had, therefore, to look to some other cause for these variations. I eventually noticed that the ammonium carbonate remaining after the test was complete, seemed to have suffered abnormal diminution in bulk, and felt moist when handled. I also noticed at the same time that there were marks on the trumpet tube, such as would be produced by drops of liquid trickling down the inside of the glass. It then occurred to me that part of the liquid combustion product which condensed in the cylinder and outlet tube was finding its way into the tubulure of the cylinder, and then running down the trumpet tube on to the ammonium carbonate surrounding the burner. This surmise proved correct, and as the initial cause in my apparatus was that the tubulure was so fixed to the cylinder that its extremity bent *slightly downwards*, I selected a piece of glass tubing slightly smaller in its external diameter than the inside of the tubulure, and about $2\frac{1}{2}$ inches in length. By slipping a piece of rubber tubing over the glass tube, I was enabled to insert it in the tubulure, making a tight joint. The tube was so arranged that one end was level with the opening of the tubulure, while the other end projected into the sulphur cylinder. The accompanying sketch will illustrate the method used. Any liquid condensing in the cylinder and trickling down the sides could not, therefore, possibly get into the tubulure.



I find now that the quantity of liquid which I obtain is fairly regular, and its total amount is larger than the average yield generally obtained from the test.

Since adopting this modification, the amount of liquor in ounces obtained from the combustion of 10 feet of gas on nine successive days has been as follows:— $8\frac{1}{2}$, $8\frac{1}{2}$, $8\frac{1}{2}$, 9, $8\frac{1}{2}$, 9, $8\frac{1}{2}$, $8\frac{1}{2}$, $8\frac{1}{2}$; showing an extreme variation of only $\frac{1}{2}$ ounce, and a mean quantity of (nearly) $8\frac{1}{2}$ ounces. The sulphur determinations have also been very satisfactory.

I believe that the variations in the amount of liquid produced by different apparatuses, and even in some cases by the same apparatus, are in great part explained by the fact which I have pointed out. Of course the behaviour of the apparatus in this particular detail would be dependent on the position, shape, and inclination of the tubulure, and there are no doubt in use many apparatuses which allow of no escape of liquid. On the other hand, there may be many in which the converse is the case, and inaccurate results are obtained. I therefore think it would be a good plan if the tubulure and trumpet tube were so proportioned in size that the end of the latter would slide into the former for a distance of about 2 inches, as this arrangement would ensure more accuracy than is obtainable under the present system.

Should any of your readers be using sulphur tests which yield a less quantity of liquid than is given by mine, and think it worth while to try my idea, I shall be glad to hear of the results.

THE CORROSION OF IRON.

By Mr. WILLIAM FOSTER, M.A. (Cantab.), F.C.S., &c.,
Professor of Chemistry at the Middlesex Hospital.

FIFTH ARTICLE.

I have now to consider some of the substances employed by engineers for protecting the surface of iron gasholders from corrosion. It is not an easy matter to classify the various bodies which are and have been used for this purpose. For instance, it has been proposed to coat the iron with metallic zinc (galvanize it), to cover it with its own oxide (Barff's process), or to apply a thin layer of Portland cement (Crease's process), as recommended by Mr. Douglas, in his paper published in the report of the proceedings at the meeting of

the British Association of Gas Managers at Newcastle-on-Tyne, in June, 1879. Now, each of these three substances—zinc, black oxide of iron, and cement—and the principle involved in its application, differs from the other two, and all three again differ very considerably from an ordinary protective varnish or paint. Varnishes and paints hold a prominent position, in consequence of the facility with which they can be applied; and I will, therefore, consider them first, and in doing so I shall follow, with a slight modification, the classification adopted by Mr. Douglas in the paper above referred to, because it is a simple and comprehensive one.

Firstly, with reference to varnishes. I think it will simplify their description if they are divided into three classes. A varnish is usually a compound of two or more substances, mixed in such proportions that the whole has a suitable consistency. When applied and exposed to atmospheric influences, a hard and uniform skin is formed. The covering thus produced may be the result of the evaporation of the volatile components, the basis having been originally dissolved by the spirituous component. For instance, if india-rubber (caoutchouc) be dissolved in bisulphide of carbon, and the liquid applied as a varnish, the volatile component readily evaporates on exposure to air, leaving a uniform coating of hard india-rubber. Atmospheric oxygen contributes nothing to the result. Such a varnish illustrates those comprised in the first class.

If ordinary or boiled linseed oil be applied as a varnish, the whole eventually forms a hard coating, but the result obtained in this instance is due to the formation of a solid oxidation product in which atmospheric oxygen plays a necessary and important part. Linseed oil is, therefore, an example of the second class of varnishes.

In the practical application of varnishes of ordinary composition both these processes co-operate. The volatile or spirituous component of the varnish evaporates, whilst another component of the varnish undergoes oxidation, producing a solid substance which is incorporated with the solid basis of the original varnish. The media employed for grinding up metallic oxides, in order to prepare a paint, behave in this way. They, therefore, may be taken as examples of the third class.

The most useful and interesting example of the first class is coal tar. Its method of production is too familiar to my readers to require any description. We may consider it as pitch dissolved and suspended in other substances which can be dissipated at moderate artificial temperatures. Pitch almost entirely consists of hydrocarbon compounds, the amount of oxidized resinous material present being small and of a very stable character—a fact one is prepared for when the high temperature to which the pitch has been subjected is considered. A hydrocarbon compound is wholly composed of carbon and hydrogen. Naphthaline ($C_{10}H_8$) is a familiar example. The hydrocarbon compounds in pitch and coal tar are, speaking generally, of a very stable type. They are practically unaffected by atmospheric oxygen and the presence of water at ordinary temperatures. Some, such as the paraffins, are of an exceptionally permanent character, requiring the strongest chemical agencies to bring about the formation of new substances. The paraffins are known in the gaseous, liquid, and solid state; but those having the first of these three characters are absent in coal tar, and therefore in pitch. There is comparatively nothing known by chemists respecting the individual components of pitch. Many of the more volatile constituents of coal tar are thoroughly well understood. I need but mention naphthaline ($C_{10}H_8$), anthracene ($C_{14}H_{10}$), benzene (C_6H_6), and carbolic acid (C_6H_5O) to show the character and importance of some of these. And the character of the components of pitch, whatever they may be, is but of a more permanent order than that of many of the substances just named. When coal tar is used as a preservative of iron gasholders, it should be employed in a hot state. The reason for this is twofold. Firstly, the tar more thoroughly permeates the interstices of the wrought iron; and, secondly, the volatile constituents of the tar are more readily got rid of, leaving an even surface of pitch. This, as a varnish, has many excellent qualities. It resists the action of atmospheric oxygen, and the gases found in a gas-works. It is also proof against the influence of moisture, since it is incapable of forming hydrated compounds when immersed in water. But it has one great defect—it tends to flow like a liquid. It is a matter of common observation that when a lump of pitch is placed on a level surface, it slowly extends itself, unless adequately supported by lateral pressure. The substance is what the physicist terms "viscous." The weight of its own particles causes them to slide slowly over each other, under the circumstances, and take up new positions. This tendency to assume the fluid character is augmented by increase of temperature. Hence, when an iron gas-holder has been coated with tar, and the operation is in other respects successful, the pitch gradually tends to "run," and form elongated drops or streams, presenting an appearance "which, to the eye of the anxious gas manager, is disgusting." The removal of the pitch from its original position exposes the iron at points to the usual corroding influences. This important defect which pitch possesses places coal tar at a great disadvantage, especially in a hot climate. At home it forms a most efficient varnish, particularly for submerged ironwork, provided it be properly applied. Coal tar, therefore, is the type of a durable, and in some respects efficient varnish. Were we able to prepare a form of pitch devoid of the viscous character, but having the other attributes of ordinary pitch, we should then have realized our ideal of what the basis of a varnish should be. I am not aware that any special attempts have been made to render pitch more useful. Natural forms have been used for purposes such as we are now considering, and it is just possible that some of these may have less of the fluid character than artificial pitch. When dissolved in the more volatile components of coal tar, the natural kinds furnish compounds analogous in many respects to the latter.

The defect which pitch as a basis for a preservative varnish presents is in a great measure avoided by the employment of caoutchouc. This substance is obtained from the milky juice which exudes from the lacerated stems of several tropical trees and arborescent plants. In the natural state (ordinary india-rubber) it is a mixture of at least two hydrocarbons containing the same relative proportions of carbon and hydrogen. It is also noteworthy that these proportions are the same as obtain in rectified oil of turpentine ($C_{10}H_{16}$). Caoutchouc is not viscous, and therefore can be employed in high atmospheric temperatures. It also forms a hard, continuous surface when in spirituous solution and applied to iron surfaces as a varnish. But it has imperfections of such a character that, when employed alone as a basis for a preservative varnish, the result is a coating inferior to that formed by coal tar in its general use. This coating is prone to be affected by natural influences in a curious way. For instance, in the dark, atmospheric oxygen and water exert comparatively little influence on it, but in daylight it is very seriously altered by these agents. Oxidation and hydration products are formed, rendering the surface of the caoutchouc glutinous. Hence, disregarding the question of cost, caoutchouc, as a basis for a preservative varnish, is lower in the scale of general efficiency than pitch.

It is particularly interesting to know that Mallet's experiments and writings of 1839-41 demonstrated that, though caoutchouc varnish might be used with advantage in special cases, coal tar heated and applied to the iron in a hot condition was at that time the most efficient preservative of wrought-iron plates when the latter had to be exposed to air and saline solutions in a warm climate. His views were strongly in favour of the use of a mixture of naphthaline, paraffin, and asphaltum (pitch) in combination with mineral peroxides—that is the highest of the oxides, not of an acid character, furnished by the combination of a given metal and oxygen. Clearly his idea was to use hydrocarbons of such a character and in such proportions that the mixture would need some additional substance as a body. He regarded the mineral peroxides most favourably, since the metal present has already combined with as much oxygen as it possibly can under all ordinary circumstances, and therefore cannot be further affected by atmospheric oxygen. The hydrocarbons he mentions are some of those I have named, and are characterized by great stability. In principle the suggestions are excellent, but I fear that, if carried out in the way they are given, the defect of coal tar, so proverbially well known, would not be obviated. Suppose ferric oxide to be used in combination with coal tar, the whole being applied to the iron in a hot condition. Would the resulting pitch be devoid of a viscous nature? Not unless a relatively large quantity of the oxide were used, which in practice would be found objectionable.

A few months ago there was a brief account in several daily and other papers of some experiments made abroad on the value of euphorbium resin as a basis for a preservative varnish for iron. So far as the experiments had gone, the material had served its purpose admirably, but they had not extended over a sufficiently long period to establish its merits, and, of course, its defects. Euphorbium resin is obtained by evaporation of the milky juice which exudes from the punctured stems of various species of euphorbia—tropical arborescent plants. As found in the markets, euphorbium resin is a mixture, in variable proportions, of at least three different resins, with wax, caoutchouc, organic salts, and water. By treatment with spirituous solvents, the resins, wax, and caoutchouc can be dissolved, and the solution employed as a varnish in the ordinary way. Two of the resins have been partially studied and are said to be of a stable and neutral character—that is, they are devoid of acid or basic properties. But one of the resins is of an acid character forming salts with alkalis. Such a substance is an element of weakness in the varnish. The behaviour of caoutchouc in this instance need not be discussed. Among other things it imparts the needed tenacity to the resinous bodies. So far, therefore, as our knowledge of the chemistry of euphorbium resin extends, it is obvious that its crude condition is not well adapted for the purpose we are now considering. The compounds most desirable as the basis of a varnish are the stable indifferent resins and caoutchouc. If these can be readily and economically removed from the crude substance, there are strong grounds for believing that the varnish prepared with such a basis would be of excellent quality, but not superior to coal tar in its general use as a preservative of iron. At the present time, euphorbium resin is almost entirely confined to the uses of the veterinary surgeon. He employs it as an important ingredient in vesicating plasters, instead of the more expensive cantharides. The price of the resin is such as will not seriously interfere with its use for the purpose of varnish making, should it be desirable to employ it in consequence of confirmation of the good accounts given of it a few months ago.

(To be continued.)

FORTHCOMING EXHIBITIONS OF GAS APPARATUS.—Among the projected exhibitions of gas apparatus during the coming spring will be one at St. Helen's, on Wednesday, Thursday, and Friday, the 10th, 11th, and 12th prox.; a second at Ipswich during the week ending the 3rd of April; and a third at Leicester from the 12th to the 17th of the same month.

SALE OF SHARES IN THE WAKEFIELD GAS COMPANY.—Last Friday there were sold by auction in the town a number of shares in the Wakefield Gas-light Company. The competition for them was unusually keen, and we believe the prices realized were in advance of the amounts previously paid for similar shares. The following were the results:—

Five	£25 shares, fully paid, realized	£59	5s. each.
Twenty-two	5		12 15s. "
Eighteen	5 "B" "		9 0s. "

The first two sets of shares are at present receiving, under the sliding scale, 11 per cent. dividend; and the "B" shares, £8 5s. per cent.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

FROZEN LAMP SERVICES.

SIR,—Much has already been written about the above, and numerous remedies have been suggested. I will therefore be brief. My experience is that the bend at the bottom of the horizontal part of the service-pipe is the cause of all the mischief. It is at this point that a stoppage, under ordinary circumstances, occurs, and when a severe frost takes place, the condensation from the horizontal pipe meets with an obstruction, and is in consequence more readily frozen. I think gas managers will find, as a rule, that the services most affected have been laid some considerable time, and are consequently more or less in a foul condition when John Frost makes his appearance. I have never had any difficulty in getting rid of our troublesome visitor, as I have always found a small quantity of naphtha poured into the pipes a sure remedy. J. R.

Feb. 4, 1880.

A Gas Manager in the Principality writes that his district, being an elevated one, they are greatly troubled every severe winter through the public lamps being extinguished by frost—30 to 40 lamps per night is with them a common experience. Their remedy is a very cheap, simple, and easily-applied one, and it *never fails*. They make a strong solution of common table salt and water, and pour a little of it down the $\frac{1}{2}$ -inch vertical pipe, with the result that in a short time the lamp can be re-lighted. This method has been efficacious with them for more than 20 years past.

[In Mr. Pepy's letter in last week's JOURNAL, the sentence beginning in the fourteenth line from the bottom of page 165 should have read, "On being discharged into the public mains in the evening, it is not cooled down any farther, because the ground at a depth of 2 $\frac{1}{2}$ to 3 feet only freezes after several weeks of intense cold."—Ed. J. G. L.]

Parliamentary Intelligence.

HOUSE OF COMMONS.

THURSDAY, FEB. 5.

THE GOVERNMENT AND THE METROPOLITAN WATER SUPPLY.

In the course of the debate on the Queen's Speech, Sir CHARLES DILKE said that the Metropolitan Water Supply Bill was not mentioned in the speech, but he hoped the Government intended to go on with it, and that an assurance to this effect would be given in the course of the evening.

Mr. FAWCETT also asked whether it was true that the Government intended, as had been recently reported, to carry out the promise, or perhaps he should say the wish expressed last session that they would introduce a measure dealing with the Water Supply of London. He would further like to know in what form and upon what day the matter would be dealt with.

Mr. CROSS, in reply, said: As to the Metropolitan Water Supply question, at the close of last session I promised to consider the subject, and see whether anything could be done to render the supply of water to London better than it has been hitherto—that is to say, that there should be a better supply of water, and, if possible, that it should be under one head, by which, without doubt, a very great saving would be effected. I have had several communications on the subject with the Water Companies; but I am not prepared at the present moment to state the result of those negotiations. I hope, however, to do so at the end of a week, or ten days at the outside, and to submit a Bill which will, I trust, receive the approval of the House. The proper course now, under the circumstances, as no notice has been given, would be that it should be a public and not a private Bill. The bargain, however, had to be arranged between the Water Companies on the one hand and the water consumers on the other; and I do not think any Government ought to be called on to make such a bargain. The Government, however, will be ready to submit the bargain to Parliament, after which the Bill will go before a Committee, where the whole case will be argued out. I hope this proposal will receive the sanction and approval of the honourable members.

Legal Intelligence.

YORKSHIRE WINTER ASSIZES—WEST RIDING DIVISION.

LEEDS, WEDNESDAY, FEB. 4.

(Before Justice LUSH and a Special Jury.)

STANSFIELD v. THE YEADON AND GUISELEY GAS COMPANY.

This was an action by Colonel Stansfield, of Esholt Hall, to recover a penalty of £200 from the defendants for a violation of the provisions of the Public Health Act by the pollution of the Yeadon Beck; and also damages for injury caused by such pollution. At the end of May last year the defendants, wishing to enlarge their gasholder, had to empty the tank; and to do this they laid a syphon-pipe from the holder to the stream, and they also began pumping the water into the stream. The work went on for a fortnight or three weeks, 750,000 gallons of water being emptied into the beck. The beck passes through the plaintiff's garden, and during the time the holder was being emptied the smell of gas was so unbearable that all the windows in plaintiff's house had to be kept closed. The facts were scarcely in dispute between the parties, but there were several points of law raised, the chief of which was whether the plaintiff was entitled to sue for the penalty as the owner of the beck. The plaintiff admitted that the sewage and drainage of Yeadon and Guiseley flowed into the beck, and that in warm weather the stench close to it was almost unbearable.

Mr. WILLS, Q.C., and Mr. Lockwood appeared for the plaintiff; Mr. KAY, Q.C., and Mr. FORBES for the defendants.

Justice LUSH told the jury that they must take it to have been a wrongful act on the part of the defendants to pour the water from the tank into the stream, for they had no right to make even a foul stream more foul.

The Jury gave a verdict for the plaintiff, and assessed the damages at £100.

Justice LUSH said he would not give judgment for the £100 until the question as to the penalty had been decided, as there might be a further question whether the plaintiff was entitled to both the damages and the penalty.

LAMBETH COUNTY COURT.—THURSDAY, FEB. 5.

(Before Mr. J. H. PITT-TAYLOR, Judge.)

BARROW v. THE SOUTH METROPOLITAN GAS COMPANY.

This was an action to recover £19, alleged to be an excess on certain gas bills, and expenses incurred in testing a meter.

Mr. WASHINGTON appeared for the plaintiff; and Mr. LOWE for the defendants.

Mr. WASHINGTON, in opening the case, said his client occupied a 14-roomed house at East Dulwich, and was supplied with gas by the defendant Company. Prior to January, 1878, he had a 20-light wet meter supplied by the Company, but after that time he had a dry meter put up at his own expense; and, although his gas bills up to that time averaged about £10 13s. per year, when the dry meter was substituted the charges kept on increasing gradually until they accumulated to over £19 odd. The meter had been tested by a gas-meter inspector, who found that the Company had charged for more gas than the meter registered. The meter was taken to pieces in the presence of skilled witnesses, and it was found to register correctly, and an inspection of the index showed that 100,000 feet of gas had been charged in excess.

Mr. James Barrow, the plaintiff, confirmed the foregoing statement, and said that in the summer of 1878 he complained to the Company, and they sent their Mr. Schomberg to him, who said the inspector had read the index wrongly, and that he had been overcharged. Having occasion to make another complaint, Mr. Schomberg called again, and said there must be something the matter with the meter. It was taken down by one of the Company's servants, and was duly tested and certified to be correct. On one occasion when the inspector was taking the register, he (witness) pointed out to him that he was putting down 100,000 feet too much, and the inspector replied, "Then there must be something wrong with the hands."

Mr. George Dethridge, one of the meter inspectors appointed by the Metropolitan Board of Works, said when the meter was brought to him to test he read the index at 97,800 feet, but the Company's man who brought the meter said it was 197,800 feet. The meter was afterwards tested in the presence of several witnesses, and found to be correct.

Mr. Earl said that he put up the new meter, leaving all the hands at zero. He saw it when it was taken away to be tested, and it registered 97,800 feet.

Mr. TAYLOR asked where the million hand was.

Witness: Between zero and the figure 1.

Mr. TAYLOR said, if that were so, the register would be 500,000 feet. It was evident the witness was talking of what he knew nothing about.

Another witness gave evidence that he was engaged for ten minutes in turning the index hand round to make it register a million, so as to be sure that nothing was the matter with the works.

Mr. TAYLOR said the feat said to have occupied ten minutes could not have been accomplished in as many days. He could not see the necessity for Mr. Washington struggling further with the case, because no reliance could be placed upon such evidence as that given by the last two witnesses. He could readily understand how the plaintiff had been misled in reading the index, and, believing that the plaintiff had been simply charged for the gas consumed or wasted by him, he should give judgment for the defendants, with costs.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

METROPOLITAN BOARD OF WORKS.

At the Meeting of the Board last Friday, the Parliamentary Committee presented a report in regard to the Bills affecting the Metropolis which it is proposed to introduce in the present session of Parliament.

In the course of it, they say: "In the case of the Bill relating to The Gaslight and Coke, the Commercial, and the South Metropolitan Gas Companies, which has been deposited by the Corporation of London, and which has been before the Board on two or three occasions, your Committee are of opinion that a petition should be presented to the effect that legislation relating to districts outside the City, and under the jurisdiction of the Board, should not be initiated by the Corporation, and that the clause proposing that the Board should pay part of the expenses of the Bill should be struck out."

This recommendation was agreed to.

In reference to the South Metropolitan Company's Bill, the report states: "By the Bill of the South Metropolitan Gas Company power is sought to acquire land in Greenwich Marshes for the construction of additional works, to raise £1,000,000 of additional capital, and to borrow a further amount. Your Committee recommend that a petition be presented against this Bill, and that the question be raised of the necessity for acquiring the ground, raising the additional capital, &c.; and that the requisite alteration of the testing and forfeiture clauses of the Company's Act of 1876 be asked for."

Mr. RICHARDSON moved the adoption of this part of the report.

Mr. ROGERS moved as an amendment—"That the petition do also contain an allegation that the present initial price of 3s. 6d. is too high, and should be reduced."

This amendment was agreed to.

The report continued: "The Phoenix Gas Company applies for power to acquire the same land in Greenwich Marshes as is referred to in the South Metropolitan Company's Bill; to raise £1,000,000 additional capital, and to borrow a further amount. The Company also seeks power to amalgamate its undertaking with that of any other Gas Company within the Metropolitan area on the south side of the Thames, except the Crystal Palace Gas Company. This power should be subject to some limitation. Clauses are inserted in the Bill to bring the Company under the same conditions as regards price, dividends, lighting power, purity, and pressure of gas, as those in The Gaslight and Coke Company's Act of 1876. Your Committee are of opinion that the standard price of 3s. 9d. per 1000 feet proposed to be fixed should be reduced, seeing that 3s. 6d. is the price allowed to the South Metropolitan Company. They recommend that a petition to this effect be presented, that objection be made to the power of amalgamation asked for, and that the question of the necessity for the additional land and increased capital be also raised."

This recommendation was at once agreed to.

As to the London Company's Bill the report says: "The Bill of the London Gaslight Company is somewhat similar to that introduced by the same Company last year. Power is sought by the Company to sell or let to the consumers of gas in its district apparatus of various kinds for the use of gas for other purposes than lighting. The Committee do not propose that the Board should offer any objection to the principle of the Bill, but they recommend that a petition be presented asking that the Company's expenditure of capital for the purposes named in the Bill may be limited to £25,000."

Mr. RICHARDSON proposed the adoption of this recommendation.

Mr. JOHN JONES moved as an amendment—"That the Board specially

oppose the action of the London Gas Company to add the sale of gas-stoves to its present duties."

The amendment was not, however, seconded; and the motion, on being put, was passed.

The only other paragraph in the report in reference to Gas Bills was the following:—"The Wandsworth and Putney Gas Company seeks power to raise further share capital to the amount of £120,000, and to borrow £30,000, the dividend on the share capital to be at the rate of 7 per cent. This Company is not one of those to which the provisions of the Metropolis Gas Act of 1860 apply. Your Committee recommend that a petition be presented, asking that the Company may be made subject to similar provisions as to sliding scale of price and dividend, disposal of new shares by auction, and other matters, as have already been applied to other Companies; and also that any new buildings to be erected by the Company may be governed by the provisions of the Metropolis Local Management and Building Acts."

This proposal was likewise agreed to.

THE AVERAGE METER SYSTEM IN KENSINGTON.—At the meeting of the Kensington Vestry last Wednesday, the Gas Lighting Committee reported that The Gaslight and Coke Company have agreed to reduce the proportion of metered lamps in the parish from 1 in 20 to 1 in 24. The Committee therefore recommended that 40 meters be at once taken out of calculation. This was agreed to.

METROPOLIS WATER SUPPLY.

THE SOUTHWARK AND VAUXHALL WATER COMPANY'S BILL.—The Parliamentary Committee of the Metropolitan Board of Works presented a report at the meeting of the Board last Friday, in the course of which they say, in reference to the above-named Bill: "By the Southwark and Vauxhall Water-Works Company's Bill power is sought to amalgamate the Company's undertaking with those of other Water Companies in the Metropolis, subject to the consent of the Board of Trade. It appears to your Committee that it would be better that any proposal for amalgamation should be brought before Parliament in a Bill, instead of being dealt with by the Board of Trade. The Company proposes to construct an additional pumping-station, reservoirs, and other works, and to raise £600,000 of additional share capital. The necessity for this should be fully shown, and, if the new capital be authorized, provision should be made for its issue by public tender or auction, in accordance with the precedent which was laid down by Parliament in the year 1878 in the case of the Grand Junction Company. It might also be well to ask for conditions securing an adequate and constant supply of water under sufficient pressure. Your Committee recommend that a petition raising the points above mentioned be presented against the Bill." Mr. Richardson moved the adoption of the recommendation, and this was agreed to.

CAMBRIDGE UNIVERSITY AND TOWN GASLIGHT COMPANY.

The Ordinary Half-Yearly Meeting of this Company was held on Thursday, the 29th ult.—the Rev. Dr. PHELPS in the chair—when the Directors presented their report on the working of the Company during the past six months. It recommended that a dividend for the half year of 10 per cent. per annum on the consolidated stock, and of 7 per cent. per annum on the paid-up shares, and on the amount called up during the past half year on the new shares, be paid, free of income-tax.

The Manager (Mr. J. Weeks), in his half-yearly report, stated that the new works had been so far completed as to admit of their being used to meet the still increasing demand for gas. The older parts of the works had been kept in as good a state of repair as possible; but the time had now arrived, he said, when their renewal must receive the serious consideration of the Directors. The illuminating power, pressure, and purity of the gas had, with a slight exception, been kept up to the required standard.

On the motion of the CHAIRMAN, seconded by Mr. SWAN, the reports and balance-sheet were adopted.

The CHAIRMAN proposed that the dividends recommended in the Directors' report be declared.

Mr. E. COLLIER seconded the proposition, and it was carried unanimously.

The Rev. A. T. CRISFORD then proposed a vote of thanks to the Chairman for his conduct in the chair, and to the Directors for the general way in which they conducted the business of the Company.

This resolution having been seconded and carried unanimously, the meeting ended.

CAMBRIDGE UNIVERSITY AND TOWN WATER-WORKS COMPANY.

The Half-Yearly Meeting of this Company was held on Friday, Jan. 30.—Mr. ELLIOT SMITH in the chair—when the following report was presented:—

The Directors recommend that a dividend on the consolidated stock, and the first and second calls on the £2 shares for the half year, and on the third call upon the £2 shares for the quarter ending Jan. 6, 1880, at the rate of 10 per cent. per annum, be paid, free of income-tax. After paying this dividend, there will be a balance of £22 4s. to be carried to the next account, thus reducing the previous balance by £115 14s. 11d.

The Directors refer the Shareholders to the Engineer and Manager's report, which shows the progress of the Company's business.

The 149 unallotted £3 shares were disposed of by public auction in October last, and realized the sum of £593, being a premium of £396. This amount, less the expenses of sale, has been carried to the suspense account. These shares will not receive dividend up to Jan. 6, 1880.

The mortgage of £7500 upon the Company's works was paid off on the 15th of October last, and, in order to effect this, the sum of £5000 was temporarily borrowed of the Company's bankers. The payment of the amounts due on the acceptance of the new shares recently issued has enabled the Directors, since Jan. 6, to repay £2500 of the temporary loan.

In accordance with the recommendation of the Directors in their last report, it will be proposed to convert the £2 shares into consolidated stock.

The retiring Directors are the Rev. Dr. Okes and the Rev. Dr. Perowne, who are eligible for re-election.

The Engineer and Manager (Mr. H. Tomlison) reported as follows:—

During the past half year, water from the Company's works has been laid on to 230 premises, the increased rental derivable from which is £196 per annum. The total number of premises now supplied is 7667.

The work connected with fixing the new boiler at the Company's pumping-station is progressing satisfactorily, and will soon be complete.

The general condition of the Company's works continues satisfactory.

The CHAIRMAN said he thought it very gratifying that they were able to pay the dividend of 10 per cent. He proposed the adoption of the reports of the Directors and Engineer, and the balance-sheet.

Mr. WHITTING seconded the motion, which was agreed to.

The CHAIRMAN next proposed the payment of a dividend at the rate of 10 per cent. per annum.

Canon HOPKINS seconded the motion, which was carried.

Mr. DEATH proposed, Mr. CLAYTON seconded, and it was agreed that the £2 shares of the Company be converted and consolidated into capital stock.

The next business was to elect two Directors in place of the Provost of King's College and the Vice-Chancellor.

Canon HOPKINS thought they could not do better than re-elect the same gentlemen, who had served them so well in the past. He proposed the re-election of Dr. Okes, who joined the Directorate at the time that he (Canon Hopkins) was Chairman, in the early days of the Company. He congratulated them upon the position the Company had gained, and the good that it was doing for the poor, in providing them with an abundant supply of wholesome water at a cheap rate.

The motion was seconded by Mr. C. BALLS, and agreed to.

The MASTER of ST. CATHERINE'S proposed the re-election of Dr. Perowne as one of the Directors, and, in doing so, took the opportunity of referring to the value of the shares of the Company, which had been disposed of at a recent sale at £4 13s. premium, which was the largest price that had ever been realized.

The motion was seconded by Mr. E. FOSTER and adopted.

Dr. PEROWNE returned thanks for his re-election, and spoke in complimentary terms of the way in which business was conducted by the Directors, and promised to do his best to serve the interests of the Company.

Mr. CLAYTON proposed, and Mr. SWAN seconded, a vote of thanks to the Chairman, which was agreed to.

The proceedings then terminated.

ROCHESTER, CHATHAM, AND STROOD GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held last Thursday—Mr. EDWARD WINCH in the chair.

The SECRETARY (Mr. W. Syms) read the report of the Directors, which stated that the business of the Company for the past half year had been more favourable, the profits allowing of the writing off of a few items from the capital account in addition to paying the usual dividends. The new coal-store was about to be erected, and some other improvements made. The usual dividends at the rate of 10 per cent. per annum on the A and D shares, and of 7 per cent. on the B and C shares, were recommended. The statement of accounts showed a balance of profit on the half year, after all payments, of £3049.

The Rev. R. WHISTON moved, and Mr. W. P. HAYMEN seconded the motion for the adoption of the report, which was agreed to.

The CHAIRMAN proposed the payment of the dividends recommended in the report.

Mr. WHISTON seconded the motion, which was carried.

The retiring Director (Mr. J. Levy) was then re-elected; and Mr. W. Homan, who was formerly Auditor, was elected a Director in place of the late Mr. W. B. Black. Mr. W. P. Haymen was appointed Auditor, *vice* Mr. Homan.

A vote of thanks to the Directors, which was acknowledged by the Chairman, ended the proceedings.

EASTBOURNE GAS COMPANY.

A Special Meeting of this Company was held on Monday, the 2nd inst.—Dr. JEFFERY in the chair—for the purpose of considering and, if thought fit, of approving a Bill for conferring further powers on the Company for the purchase of land, the construction of works, the raising of money, and otherwise, in relation to their undertaking.

The SECRETARY (Mr. J. H. C. Coles) having read the notice of meeting,

The CHAIRMAN moved that the Bill be approved. In doing so he reminded the Shareholders that at the last meeting the Directors received their sanction to apply to Parliament for powers to increase the capital of the Company. They had since then, with the assistance of their Parliamentary Agents, their Engineer, and their Secretary, drawn up a Bill which had passed the Examiners of Standing Orders of the House of Commons. The Bill had been presented to the Local Board, and examined by that body, and the only objection they raised was that they wished for increased pressure in the supply of gas. The Directors, after due consideration, had, however, decided to let the Bill remain as it was, as they were of opinion that what was sufficient for London was sufficient for Eastbourne. The only other objection raised was to a clause in the Bill, which, if passed, would give them the power to sell or let on hire gas-fittings, engines, machinery, &c. A memorial had been received from the tradesmen of the town dealing in gas-fittings, &c., who wished to exclude this clause from the Bill. The Local Board, however, had decided not to oppose the Bill, and would not have anything to do with the memorial from the gas-fitters. He (the Chairman) could not see why there should be any objection to the Company supplying with gas-fittings, &c., those inhabitants of the town who asked them; and he might say they had no idea whatever of commencing a gigantic trade in these articles. The Bill, therefore, was an unopposed one, and opposition could only now come from one quarter. An opposition to the Bill meant putting it off for another year; while, at the present time, it would be promoted with a certainty of success. The Directors did what they thought best, not only for the Shareholders, but for the town at large. There was no wish on the part of the Company to monopolize the trade of the gas-fitters in Eastbourne; but they considered it would be to the advantage of the Company to have these powers, and if they obtained them it by no means followed that they would exercise them. The Bill had already, as he had said, passed the Examiners of Standing Orders, and no doubt Parliament would also pass it.

Mr. HILLMAN seconded the motion, and it was carried unanimously.

This was all the business of the meeting.

YORK UNITED GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held on Thursday last—Mr. J. F. TAYLOR in the chair.

The SECRETARY and MANAGER (Mr. C. Sellers) read the notice of meeting and the following report on the Company's operations during the past six months:—

The profit upon the half year's revenue account amounts to £6142 9s. 5d. This sum, added to £53 8s. 6d., interest on money specially deposited at the Company's bankers, and £3 10s., balance of premium upon the unappropriated fractional parts of shares recently sold by auction, makes a net profit of £6199 7s. 11d. Out of this amount the Directors have carried £800 to the reserve-fund, and they now propose to apply the remainder to the payment of the usual dividend of 5s. per share upon the old shares of the Company, and 1s. per share, or 5 per cent. per annum, upon the new shares, the same to be paid free from income-tax. These payments will absorb £5379 17s. 6d., and leave £19 10s. 5d. to be carried forward.

In accordance with the Company's Act of Parliament, a resolution to confirm the forfeiture of 320 new shares, not appropriated in the recent allotment to the Shareholders, will be submitted to the meeting.

The two scrubbers referred to in the last report have been finished, and are now at work. The Directors also in their last report alluded to the remodelling of the remaining portion of the Company's retorts. This has been carried out, and now the whole of the carbonizing space upon the existing works is occupied, and will consequently necessitate the immediate commencement of the proposed new station. The piling of the new site has already been completed.

In anticipation of such commencement, the main from Layerthorpe across Foss Islands has been relaid with a pipe 15-inch diameter, and forward to the Barracks with a 12-inch.

To meet a generally expressed wish on the part of the public that the Company should have offices in the city, the Directors have recently purchased an eligible site for offices in Davygate, which, they think, from its central position, cannot fail to meet with public

approval. This purchase, coupled with the new trunk main and other items, has added considerably to the capital account.

The business of the Company is satisfactory, and the Directors regard its future growth with confidence.

[The total amount of capital authorized to be raised by the Company is—old shares, £100,000; new shares, £80,000. The total amount of loan capital authorized is £20,000, but no money under this head has yet been borrowed. The profit and loss (net revenue) account shows that the amount carried to the reserve-fund was £800, and the balance of net profits, subject to the payment of dividends, was £16,344 1s. 9d. The balance of net profit brought from the last account, after payment of dividend, was £10,944 13s. 10d. The reserve-fund of the Company now amounts to £6806 19s. 7d.]

REVENUE ACCOUNT, FOR THE HALF YEAR ENDED DEC. 31, 1879.	
Expenditure.	
To Manufacture of gas—	
Coals, including carriage and all expenses of depositing same on works	£7,878 6 0
Purifying materials	182 3 1
Salaries of Superintendents and Officers at works	266 11 5
Wages at works	1,480 14 6
Repairs and maintenance of works and plant (including renewal of retorts), machines, apparatus, tools, materials, and labour	780 12 7
	£10,588 7 7
Less materials sold	3 9 4
	£10,584 18 3
Distribution of gas—	
Salaries of Inspector, Assistant Inspectors, and Clerks in Light Office	270 19 10
Repair, maintenance, and renewal of mains and of service-pipes, including materials, laying and paving, and labour	495 1 3
Repairing, renewing, and refixing meters	324 8 4
Public lamps—	
Lighting and repairing	438 16 11
Rates and taxes	159 11 11
Management—	
Directors allowance	300 0 0
Salaries of Secretary, Accountant, and Clerks	288 17 5
Collectors salaries	140 0 0
Stationery and printing	84 16 6
General establishment charges and incidentals	226 6 1
Law	12 4 6
Bad debts	15 0 5
Carting	219 16 10
House property	1 12 1
New mains	25 3 9
Bankers charges	35 1 6
Sales returned	5 19 6
Discounts and abatements	6 17 11
Gas-fitting—	
Goods bought, salaries, and wages	1,866 6 8
Sales returned	44 17 6
Discounts and abatements	2 18 10
Bad debts	2 6 10
Total expenditure	£15,551 12 10
Balance carried to profit and loss account	6,142 9 5
	£21,694 2 3

Receipts.	
By Sale of gas—	
Common gas (87,876,100 cubic feet), at 2s. 6d. per 1000 feet	£10,984 10 3
Public lighting and under contracts	1,616 5 4
	£12,600 15 7
Rental of meters	828 7 8
Residual products—	
Coke, less labour and cartage	3,126 16 1
Breeze	12 2 3
Tar	922 19 5
Ammoniacal liquor, less labour and cartage	879 9 5
Rents	108 13 1
Spent lime	153 13 11
Barrels	9 10 9
Ashes	22 19 1
New mains	25 3 9
Cartage	269 5 3
Breaking coke	123 12 9
Sundries	3 0 7
Amount received on account of bad debts	0 10 10
Interest received from bankers	52 0 9
Gas-fitting—	
Sales of fittings	2,538 13 8
Packages returned	16 7 2
Total receipts	£21,694 2 3

The CHAIRMAN, in moving the adoption of the report, said that during the last half year the consumption of gas had been steadily increasing, and coke was getting into better favour. Its use was becoming better understood, and the breaking machine they had in operation rendered it more applicable and more easy to be used for household purposes. He was sorry to say that public institutions were among the last to make use of coke, but it was hoped they would soon recognize its value as an article of fuel. As to the capital account, the first thing he had to mention was the outlay for the new mains which they had found it necessary to lay, to meet the requirements of the city, more especially in the rapidly increasing suburb of New Fulford and Fulford Road. They had taken up the small main they lately had across Foss Islands, and replaced it with a 15-inch main. They had now a 12-inch main up to the Barracks, and they thought this would be amply sufficient to meet, not only present, but any future requirements, and would give them every facility for supplying the gas required in the new streets that were being formed on the Fulford Road. With respect to property, the first mentioned in the report was a property in Layerthorpe. When the Company went to Parliament this property was scheduled, and, unfortunately, when property was put into the schedule of a Bill in Parliament, its value, in some people's eyes, seemed wonderfully magnified, and in this case the Directors were asked a price for it which they felt they were not justified in giving. They had not long to wait before the death of the proprietor brought the property into the market, and they purchased it, because it completed the square of the ground they bought previously from the Ecclesiastical Commissioners, and gave them a frontage of some considerable length to the Layerthorpe Road, which would be of great benefit when the new works were built. They thought they had done the Company good service by securing the property at a reasonable price. It had often been asked why they had not central offices in the city, and an opportunity occurring, they had purchased a valuable site in Davygate, which had an area of 1100 square yards, and a frontage of 93 feet to the street. It would afford every facility for offices, and perhaps a board-room; for show-rooms, fitting-shops, meter-shops, and, in fact, every convenience for carrying on the business of the fitting department connected with the Company—a business which they found to be increasing. The building would be central, but not too obtrusive on the city. The Foss Islands Railway having been opened, they had now relieved the streets of the carting of 25,000 tons of coal during the year. This must have been a great obstruction, leaving out of account the wear

and tear of the streets. It was not all profit to the Company, however, because they had to pay an extra price to the Railway Company for delivering the coal at the new depot on the Cattle Market side; still it was a matter of satisfaction to the Board to know that they had contributed so far to the comfort of the citizens by removing what must have been an annoyance. The confidence of the Directors in the soundness and prosperity of the Company was undiminished. The Company were in a flourishing condition, and the Shareholders might rest assured that if anything could be done to promote this efficiency and prosperity it would not be lost sight of. They had had many telegrams from across the Atlantic, which had caused uneasy Shareholders to flutter, but the last that had come announced that the pretensions of the hero of Menlo Park were a failure. He moved the adoption of the report.

The VICE-CHAIRMAN (the Lord Mayor) seconded the motion, and it was agreed to.

The CHAIRMAN said the Shareholders would see, from the balance-sheet, that the capital account of the Company showed a debit of something like £4380 on the 31st of December, but on the 1st of January a new call was received, which had put them into funds, and he thought they had something like £1000 in hand at the present time. When they sold the forfeited shares they hoped to raise another £1000, but before long they would want some more money, and they were prepared to tell the course they proposed to adopt. They had power under their Act of Parliament that when £20,000 of capital was raised they could borrow £5000. They might exercise those powers; but there would be no call till July, and perhaps not then. He then proposed that the 320 new shares not appropriated in the recent allotment to the Shareholders be forfeited and sold by the Directors, in accordance with the regulations of the Company's Act of Parliament.

This motion was carried; as was also a motion that a dividend of 5s. per share on the old shares, and 1s. on the new shares, without deduction for income-tax, be declared for the half year ending Dec. 31.

The Rev. C. H. WELLBELOVED proposed a vote of thanks to the Directors for the efficient manner in which they had conducted the business of the Company. He advocated the supplying of gas of good quality and at a reasonable price, so that its use for cooking and other purposes, for which the electric light was not available, might be encouraged.

Mr. FELTOL seconded the proposition, which was supported by Mr. J. R. HILL, and adopted.

The CHAIRMAN replied, and the meeting terminated.

YORK NEW WATER-WORKS COMPANY.

The Ordinary Half-Yearly Meeting of this Company was held last Thursday—Mr. J. F. TAYLOR in the chair.

The SOLICITOR (Mr. J. P. Wood) read the report of the Directors, which was as follows:—

The new works at Acomb Landing are practically completed, but the engines have not yet been actually delivered over to the Company by the contractors.

The Directors recommend that a dividend of 5s. per share on the preference shares, being at the rate of 5 per cent. per annum; a dividend of 8s. per share on the ordinary shares, being at the rate of 8 per cent. per annum; and a dividend of 5s. per share on the new shares, 1878, being at the rate of 5 per cent. per annum for the past half year, be declared, and that a dividend of 6d. per share on the new shares, 1879, from the 1st of October to the 31st of December last, being at the rate of 5 per cent. per annum, be also declared, and that the same respectively be paid without deduction for income-tax.

The following Directors—viz., Mr. Ralph Davison, Alderman Terry, and Mr. John Brown—retire by rotation, and are eligible for re-election. The retiring Auditor is Mr. Henry Sotheron, who is also eligible for re-election.

Messrs. T. and C. Hawksley, the Engineers of the Company, in their report said:—

We have the pleasure to state that the new pumping-engines at Acomb Landing have been in regular use since they were started on the 1st of August last, and continue to perform their duties very satisfactorily. Messrs. Hawks, Crawshaw, and Sons are now engaged in executing certain small rectifications before handing over the engines to the Company on the expiration of the term of maintenance prescribed in their contract.

The diversion of the Acomb Brook for the purpose of conveying the waters of that stream into the River Ouse, below the point at which the water for the supply of the city is taken, has been completed and brought into use, and the railway siding and coal shoots have also been constructed during the past half year. The extension works at Acomb Landing may now, therefore, be considered to have been satisfactorily finished.

[The financial statement showed that the receipts on construction account, up to Dec. 31, had been—Calls on 8000 ordinary shares of £10 each, £80,000; calls on 2000 10 preference shares, £20,000; ditto on 2000 10 shares (1878), £20,000; amount of first call of £2 per share on 2000 £10 shares (1879), £4000; loans on mortgage, £10,000—total, £134,000. The payments had been, up to June 30 last, £128,048 0s. 11d.; since that time the outlay included new works at Acomb Landing, £2498 11s. 2d.; new engines, £1326 19s.; new houses at Acomb Landing, £505 8s. 5d.; pipe-laying, £161 15s.; meters, £20 9s. 9d.; and other items of a miscellaneous character brought up the total to £132,540 8s. 11d., leaving a balance in hand of £1459 11s. 1d. The revenue account for the half year showed that water-rents had realized £6473 8s. 7d.; property-rents, £38 10s. 6d.; sales of plumbers fittings, £261 6s. 4d.; fittings on hand at the close of last year, £111 18s. 6d. The payments included salaries and wages, £364 7s. 6d.; wages at Acomb, £314 17s.; coals for engines, £333 6s. 6d.; rates and taxes, £77 9s. 1d.; Directors, £225; repairs of engines, reservoirs, &c., £744 3s. 10d. After meeting other items of outlay, there remained a balance in hand of £7911 10s. 8d. available for the payment of dividend and for working capital.]

The CHAIRMAN, in moving the adoption of the report, said there had been some difficulty about the future rating of the Company's property at Acomb Landing, in consequence of the authorities of the Ouseburn Union having imposed a heavier charge than the Company thought they ought to pay; but he was glad to inform the Shareholders that the matter had now been satisfactorily arranged. Referring to the revenue account, he said that on comparing the balance-sheet with the corresponding one of 1878, it would be found that the water-rents had increased, though somewhat slowly. The Company had had great difficulties to contend with in consequence of the frost, which caused their pipes to burst, and stopped the supply by meter, from which they were deriving considerable revenue. From the same cause they had been put to additional cost in placing stand-pipes in the streets. So far as the capital account was concerned, it was felt that if ever there was a time when the Directors were called upon to use their best endeavours to maintain the efficiency of the Company, that time was the present. Referring to the new water-works, he said they were all aware that the outlay had been considerably more than was at first anticipated. Although this was so, and although the works put up might for the present be more than were required, they believed the right step had been taken. They had been looking forward to the future wants of the city, which would ultimately call into exercise and full operation all their powers of pumping up and delivering the water into the city. The works were of a very substantial character, and every modern improvement had been taken advantage of. This had called for a large increase of capital, which had been met, and they had made a profit on the half year. He intimated that on the 1st of April they would require a further call of £2 per share, with which they hoped to be able to discharge all the liabilities which they had undertaken. Whatever liabilities might come upon them afterwards would be duly considered, and laid before them.

The DEPUTY-CHAIRMAN (Mr. J. L. Foster) seconded the motion.

Mr. W. C. ANDERSON said the only thing he regretted was that they kept the dividend up so much, because they did not know what might

come upon them, and he thought it was the best way to have a large reserve-fund.

Mr. RYMER said the Directors were able to pay the present dividend, and carry forward a much larger balance than they did five or six years ago. They had, therefore, no reason to be anxious.

The CHAIRMAN said they thought when a dividend was justly earned, as the present had been, the Shareholders should receive it.

The report was then adopted.

On the motion of the CHAIRMAN, seconded by Mr. J. L. FOSTER, the recommendations in the report as to dividend were adopted.

The retiring Directors and Auditor having been re-elected,

Mr. RYMER proposed, and Mr. FELTOE seconded, a vote of thanks to the Directors for their services, which was passed.

The CHAIRMAN, in replying, said there was still some misapprehension existing in the minds of certain people respecting the breaking up of the streets, and he took this opportunity of explaining that when there was an accident in the trunk main they of course attended to it to prevent waste, and this was the only occasion on which the Company opened the streets, for the service-pipes were not the Company's property, but belonged to the householders, and if the Company opened the streets to repair such pipes they did it as the householders servants.

The proceedings then terminated.

WEARDALE AND SHILDON WATER-WORKS COMPANY.

The Annual Meeting of this Company was held on Wednesday last—Mr. H. PEASE, J. P., in the chair.

The report, which was taken as read, stated that the revenue for the past year was such as to leave a disposable balance of £11,444, out of which the Directors recommended a dividend at the rate of 3 per cent., in addition to the interim dividend of 3½ per cent. already paid; which would leave £314 to be carried to the credit of next year's account. The recent depression in trade caused a decrease in the revenue until November, since which time there had been a considerable improvement, which was expected to yield a large increase in revenue. The Durham Water Company were now amalgamated with the Company, the City of Durham being supplied with water from the Waskerley reservoirs of the Company. Extensions of the filtering-beds were needed, and were about to be proceeded with. The statement of accounts showed that during the past year £39,341 had been expended on capital account, and that the gross revenue of the Company had risen to £13,847.

The CHAIRMAN, in moving the adoption of the report, said that the water had now been laid on in the City of Durham from their reservoirs, and in about four weeks the pipes giving increased pressure would be carried on to Gillyate Moor and the neighbourhood of the Cathedral. The capital of the Company was £386,337, and there had been expended on the capital account during the year £39,000. The reservoir service of the Company now comprised 988 million gallons, of which 520 millions were at the Tunstall reservoir and 450 at the Waskerley, with 11 small service reservoirs containing 18 million gallons. The calculation of the Company's Engineer (Mr. Hawksley) was that there would be a supply of 2,750,000 gallons throughout the district, even in the driest season. The water was supplied to 16,081 houses—an increase of 411 during the year—but there had been as many as 2999 houses taken off in the pit district, and he was surprised to find that the number of pit houses at which the water was laid on up to the present time had not been greater. There was, however, a steady increase. It took some time after the men again obtained employment before they were prepared to take a supply of water from the Company. The decrease in rents compared with the previous year amounted to £516. They had, however, to take into account the increased demand for manufacturing, which had been larger by 3 million gallons in December and 4 millions in January. The future of the Company, therefore, gave greater promise.

Mr. J. BURDON seconded the motion, which was carried.

On the motion of Mr. STRINGER, seconded by Mr. DAVISON, Mr. E. Towns was re-elected Auditor.

Mr. BELL moved that a dividend of 7s. 6d. per share be declared, making, with the interim dividend declared and paid in August last, a dividend at the rate of 3½ per cent. per annum for the year ending Dec. 31, 1879.

Mr. CARTER seconded this proposal, which was at once agreed to.

The CHAIRMAN proposed that Messrs. D. Dale, W. C. Stobart, and H. F. Pease be re-elected Directors of the Company; and that Messrs. W. Boyd and J. Rogerson be elected to fill the existing vacancies.

Mr. KAY seconded the motion, which was carried; and, after the usual votes of thanks, the meeting terminated.

BIRMINGHAM CORPORATION GAS SUPPLY.

The Quarterly Meeting of the Birmingham Town Council was held last Tuesday—the Mayor (Mr. R. Chamberlain) presiding—when a report from the Finance Committee was read, which recommended the levying of rates to the same amount as last year—4s. 3d. in the pound, being composed of borough rate, 2s. 1½d.; improvement rate, 2s. 1d.; and street improvement rate, ½d.

Mr. WILLIAMS, in moving that the Council should go into committee for the purpose of considering the borough estimates for the current year, said he thought the outlook for 1880 was hopeful. The municipal debt on Dec. 31, 1879, was £1,241,385, showing a net increase of debt for the year of £74,822. The gross increase was £120,000, in round numbers, but £45,000 of this had been paid for during the year in sinking-fund and repayment of loans. The debt of the Gas Committee was £2,263,157, showing scarcely any increase for the year 1879; the Committee did increase the debt, but they had since wiped off the increase. They last year placed to the credit of the sinking-fund no less an amount than £28,199, which, of course, had been derived out of the profit of the twelve months working.

The motion being agreed to, the Council went into committee to discuss the various estimates—among others, that of the Gas Committee, who estimated that for the year 1880 they would be able to pay £25,000 over to the borough rate.

On the motion for the approval of this estimate,

Mr. BEARD moved, as an amendment, that it be struck out. He said he was aware that if his amendment was carried it would necessitate the levying of rates equal to the amount proposed to be struck off, but he believed the course adopted by the Council was illegal, and not in harmony with the spirit of the Act of Parliament under which the gas-works were acquired. In the form in which the estimate stood it was a practical instruction to the Gas Committee to make a charge that would enable them to carry the £25,000 to the benefit of the rates, and this was not contemplated by the Act. The 36th section of the Act of 1875 set forth the way in which the surplus money should be appropriated. The clause was as follows:—

The Corporation shall keep an account in respect of their gas undertaking separate from all their other accounts, and shall apply all money from time to time received by them in respect thereof (including any annual sum or sums payable in respect of the sale of any portion of the undertaking) except borrowed money, in the manner, and in the order following and not otherwise (that is to say):—(1) In payment of their costs, charges, and expenses of, and preliminary and incidental to the preparing for, obtaining,

and passing of this Act; (2) in payment of the costs, charges, and expenses of the Corporation of, and incidental to the granting and issuing of annuities, mortgages, and debentures; (3) in payment of the working and establishment expenses, &c.; (4) in payment of the interest on annuities; (5) in payment of interest on mortgage loans, &c.; (6) in providing instalments on sinking-fund; (7) in payment of all other their expenses; (8) in providing a reserve-fund, if they think fit, by setting aside such money as they from time to time think reasonable, during the first ten years to £50,000, and after that to £100,000. And they shall from time to time carry to the borough improvement rate or fund the net surplus remaining after the fulfilment of the several purposes aforesaid.

He contended that to make an estimate of the income derived from the gas-works was not contemplated or provided for. He knew he should be told that it was simply a question of account, but he contended to the contrary, and said he was supported in his argument by Lord Chief Justice Cockburn and Justice Mellor, who distinctly said, in the case arising out of the award made in the arbitration between the Corporation and the West Bromwich Improvement Commissioners, that the Corporation were not constituted a trading authority by the Act, and that they had therefore no right to estimate that a profit would be made. They had no report or balance-sheet before them, and yet they were asked to treat the £25,000 as a net surplus. It practically meant that the Gas Committee were to levy a gas-tax until they had produced the estimated result. He would at least ask that counsel's opinion should be taken, for he was advised that the course taken by the Council as it now stood was thoroughly illegal.

Alderman AVERY, Chairman of the Gas Committee, said that Mr. Beard's argument was so singular as to carry with it its own condemnation. He said the estimate should not be agreed to without the statement of the gas accounts for the past year being in their possession. This was exactly what every other Committee of the Council was doing. There was not a single committee that had its accounts at present in the hands of the Council, but long experience taught the Gas Committee to anticipate with great accuracy what their expenditure would be, and there was seldom any wide discrepancy between the estimates made and the actual expenditure. Mr. Beard also said that the Gas Committee were encouraged to make some provision in the shape of £25,000 for the general borough fund and rates. He (Alderman Avery) hoped the Committee would long be encouraged to do so. The course taken by the Council was quite legal, as the words quoted by Mr. Beard himself proved, that the Committee "shall from time to time carry to the borough improvement rate or fund the net surplus remaining." What was net surplus but profit? If Mr. Beard chose to call it a surplus, he (Alderman Avery) had no objection whatever, but the effect was the same. Although it was not for him (Alderman Avery) to question the opinion of so high a legal authority as the Lord Chief Justice, still he said they were plainly told in the statute how the surplus was to be disposed of. The Corporation of Manchester in the year 1878 had contributed no less a sum than £53,000 towards the highway rate from the profits on the gas-works, and it was in the same way that the Birmingham Gas Committee proposed to deal with their surplus of £25,000. He denied that it was a charge on the gas consumers, and maintained that the amount was saved as the result of corporation management and saving, and the gas consumers participated equally in the benefit with the other ratepayers.

Alderman MANTON said he believed that no scheme had excited so much jealousy in the town as the success which had attended the acquisition of the gas undertakings. This success was due to Alderman Chamberlain, M.P., and there were some people who could never forgive him for their great success. He asked Mr. Beard whether he would recommend that the Gas Committee should not add any further sum to the guarantee fund. He did not think he would, and Mr. Beard did not seem grateful for the £33,000 per annum that had been taken from the gas profits and given to the consumers. This point seemed to be overlooked. For himself, he did not consider that the proposed £25,000 handed over to the rates was at all too large an amount of interest upon a capital of £200,000. The gas was as cheap now as ever it had been.

Mr. BRINSLEY seconded the amendment; but at the same time said he thought, notwithstanding it was a very able one, it had better be withdrawn.

Mr. WILLIAMS said the most important part of Mr. Beard's speech was that relating to the Act of Parliament. He (Mr. Williams) often failed to understand what Mr. Beard contended for; but if he understood him rightly on the present occasion, he said that the estimate of £25,000 amounted to a demand upon the Gas Committee for the sum. He (Mr. Williams) denied this altogether. The way in which the estimates were framed was this: They sent to the Gas Committee, the same as they sent to every other committee, and asked for a statement of their accounts. It might be that the accounts would show a demand on the other side; but it happened invariably that they showed the wholesome sum of £25,000 on the right side. The Council made no demand upon the Gas Committee for it. It was the Committee's statement to the Council that they estimated to give them £25,000.

Alderman LLOYD said he did not agree with a previous speaker that they were getting gas as cheaply as they should have done if the Companies still existed in the town. He thought the Companies, who used the roads without charge, were able to supply gas unfairly cheap, and this was done in lieu of paying any rent. Was the sum of £25,000 a year an unreasonable sum, he asked, to draw from the Committee for the use of the streets and roads? He did not think it was. If profits on the gas-works to the extent of £60,000 or £80,000, instead of £25,000, were paid over to the rates, he thought Mr. Beard would have a strong case; but he maintained that £25,000 a year was not an unreasonable rent for the use of the roads.

Mr. MARRIS said the Gas Committee hoped to present their report at the next meeting of the Council, and he thought it would be advisable to defer criticism until then. As regarded the reduction in the price of gas, he pointed out that the Committee had reduced their income by rather more than £33,000, which amount was given to the consumers. He also reminded the Council that when the question of the price of coal was considered they should also take into their calculation the price of coke.

Mr. BEARD, in reply to Alderman Manton, said he had not objected to the sinking-fund or the reserve-fund, but to the transfer of £25,000 to the credit of the improvement rate. He objected to the mode of procedure, considering that it was illegal to employ the surplus profit in the way proposed. If they made an estimate, it followed that provision would be made to cover that estimate, and to make such provision was not in accordance with the Act of Parliament.

Alderman HEATON, alluding to the remarks of Alderman Lloyd, said he considered the large amount derived from the gas department ought to go to the public, and he hoped next year a considerable portion of the £25,000—say two-thirds or three-fourths—would be given to the Public Works Committee.

The amendment was then put and lost, and the estimate approved, there being only two dissentients—Messrs. Beard and Brinsley.

SALE OF SHARES IN THE YORK GAS COMPANY.—Last Wednesday £5 old shares in the York United Gas Company, entitled to 10 per cent. dividend, were sold, *ex div.*, at £10 13s.; and new shares, £3 paid, entitled to 5 per cent., at £3 3s., *ex div.*

MANCHESTER CORPORATION WATER SUPPLY.

The annual report and statement of accounts of the Manchester Corporation Water-Works Committee have just been issued. From them it appears there is an estimated excess of liabilities over assets on revenue account, for the twelve months ending Dec. 31, 1879, of £5306. This has arisen from the fact that, consequent upon bad trade, water supplied for trading purposes through meters decreased, in the quantity used, to the extent of 105 million gallons during the year. The amount of estimated available rates outstanding on the 31st of December last, out of a gross sum of £53,702 10s. 7d., was £104 15s. 1d., and of rentals £107 9s. 5d., out of a gross sum of £137,231 16s. 4d.

The testing and stamping of water-fittings continued to progress satisfactorily. During the past year 43,113 water-fittings were examined and tested, of which 40,474 were passed and stamped; and on subsequent inspection such fittings successfully stood the pressure of the water. The expenses attending the stamping office had, as in previous years, been entirely defrayed by the fees received. During the year the internal water-fittings in 32,478 houses, warehouses, and other premises were inspected, and waste therein prevented, where necessary, by putting the fittings into proper repair, in accordance with the regulations of the Committee. There had been 6412 cases of inspection of rates and 6660 cases of rentals had been examined by the Inspector and his assistants in the course of the year, and such cases had been subsequently dealt with by the Sale and Supply Sub-Committee.

During the year $9\frac{1}{4}$ miles and 214 yards of new iron piping were laid in place of old piping on renewals account. Upwards of 12 miles of iron piping had also been laid, in extensions, in various townships during the year, and the Committee had made connections to 3492 additional houses and other premises, by means of upwards of $4\frac{1}{2}$ miles of lead piping, at an expense of £1141 7s. 3d.

The Longdendale reservoirs had, with one exception, been maintained in good condition. The exception was in the case of the Torside reservoir, respecting which the Water Committee reported: "In the spring of the year the leakage on the Cheshire side, which is usually clear, became a little turbid, pointing to some defect in the puddle lining. As soon as circumstances would allow, the water in the reservoir was gradually drawn off, and at a level of about 64 feet below top water a breach in the lining beyond the embankment was discovered. No time was lost in making the necessary repairs. These were completed in September. The work remained uncovered by water till the end of November, when the water was raised about 20 feet over the site of the repair, and everything appeared to be sound. The extraordinary flood of Dec. 31 raised the water to within about 15 feet of top water level, when the leakage water again appeared unsatisfactory. The water in the reservoir is therefore being withdrawn to the level of the defective part, when repairs required will be at once made, so that the reservoir may be available for this year. The 24-inch syphon-pipe at the embankment, by which water can be drawn off at 26 feet and 41 feet below top water, has been laid, the valves fixed, and all completed except the fixing of the winding gear and the laying of a few pipes on the outer slope, which work is now in hand."

On the subject of the Denton extensions, the Committee say: "The road diversions are finished, and all matters with the Contractors settled. The reservoir works have also made fair progress during the year. The severe weather of this and the last winter and the unusually wet summer have materially impeded the works. The brickwork is nearly completed. The quantity of earthwork and puddle placed in the embankments is about 1,440,000 cubic yards, out of a total quantity of 1,700,000 cubic yards. The stone pitching now done is about 16,000 cubic yards, out of a total quantity of 140,000 cubic yards. The total value of work done to the present time amounts to about £196,595, out of a total of £276,000."

At the Quarterly Meeting of the City Council last Wednesday—the Mayor (Alderman Patteson) presiding—the Water Committee recommended that a public water-rate of 3d. in the pound, and a domestic water-rate of 9d. in the pound, should be made and levied on all property assessed thereto, for the purpose of raising the amount required for payment of the expenses connected with the supply of water within the city during the year commencing on Jan. 1, 1880. This it was reckoned would produce £54,170 0s. 7d.

INSTITUTION OF CIVIL ENGINEERS.—At the meeting of the Institution last Tuesday—Mr. W. H. Barlow, F.R.S., President, in the chair—the monthly ballot resulted in the election of Professor Tyndall, F.R.S., as an Honorary Member; and, among others, of Mr. John Orwell Phillips, Chief Officer of the Chartered Gas Company, as an Associate.

EPHING GAS COMPANY, LIMITED.—The annual meeting of this Company was held on Monday, the 2nd inst., when the report of the Directors, on the operations of the Company during the past year, was presented. They recommended the payment of a dividend at the rate of 5 per cent. per annum; and stated that the debt on loan account had been so far reduced as to render its entire extinction practicable within a short period. The accounts showed a balance in hand, on profit and loss account, of £409 11s. 4d.—the receipts during the twelve months having been £1077 19s. 6d., against disbursements of £668 8s. 2d. The capital and loans of the Company amount to £5830; and the estimated value of the works, plant, land, &c. (after due allowance for depreciation), is £5749. We may state that the Company was formed in 1862, but till within the last few years scarcely paid any dividend. Since then the management of the undertaking has been under the care of Mr. Walter Tweed, the Secretary, who has quite resuscitated the property, so that the £10 fully paid-up shares, which in 1875 could be bought for less than £8, are now rarely purchasable at £12. The whole of the plant, too, is in such good working order that it is anticipated the Directors will be in a position, this time next year, to recommend a dividend of 7 per cent., besides setting something aside for a reserve-fund.

THE PRICE OF GAS AT BIRKENHEAD.—At the quarterly meeting of the Birkenhead Town Council last Wednesday, Captain Hatfield, pursuant to notice, moved—"That in consideration of there being a large accumulation of profits to the credit of the gas and water account, the Gas and Water Committee be instructed to consider what reduction can be conveniently made in the present price of gas, and that the reduction be made accordingly." He pointed out that the price of gas was at present higher in Birkenhead than in Liverpool, and urged that it was the duty of the Corporation to offer every possible advantage to those who could be induced to come and live at Birkenhead. Mr. Laird seconded the motion, saying it was desirable that the Committee should look into the matter and furnish any necessary explanation with regard to the accumulated profits. Mr. Rawcliffe said that a large quantity of land had been purchased and temporarily paid for out of the surplus profits in the hands of the Committee; and, as steps were in contemplation with a view to the improvement of the water supply, he thought it undesirable for the Council to resolve at present upon any reduction. Mr. Willmer also opposed the passing of the resolution. Finally the motion was carried in an amended form, the question of a reduction of price being referred to the Committee, with instructions to report.

THE ALLEGED DESTRUCTION OF LEATHER BOOKBINDINGS BY GAS.

At the last annual meeting of the American Association for the Advancement of Science, a paper, "On the Deterioration of Library Bindings," was read by Professor W. Ripley Nichols, of the Massachusetts Institute of Technology. It dealt with the vexed question as to whether or not the combustion of coal gas has any deleterious influence upon the leather employed in the bindings of books. The paper was as follows:—

Some time since a librarian of my acquaintance brought to me the backs of a number of books, the leather of which had, in some instances, deteriorated to such an extent as to readily crumble to a brown powder when scratched lightly, as with a finger-nail. My opinion was asked as to the part that coal gas or the products of its combustion played in the destruction of the leather. I confess that I had supposed the matter settled long since, having in memory a discussion in the English journals some ten years ago. When I found, however, that a chemist as eminent as Dr. Wolcott Gibbs doubted the influence of coal gas in the matter, I felt that there was room for further investigation. Although I have not done as yet all that I should like to do, or indeed all that I expect to do in the matter, I desire to state the results which I have obtained, in the hope that there may be others here who can throw some light upon the subject.

I may first recall what has been done by others. As long ago as 1854, Dr. Letheby made a report to the City Authorities of London,* in which he took the ground, which he afterwards on other occasions maintained, that the destruction of bindings in libraries, and the destruction of textile fabrics in warehouses, where gas was burned continuously and in large quantities, was due to the products of the combustion of imperfectly purified gas. He noticed that the water produced by burning gas is always acid, and will rot leather, paper, cotton, and linen.

Dr. Odling, in a lecture before the British Association of Gas Managers, June, 1868,† maintains that the amount of sulphur in coal gas is of no great consequence, and shows by mathematical calculation that the amount of sulphuric acid formed is extremely small compared with the amount of air through which it is diffused. In spite of this, every chemist knows that sulphuric acid is formed when coal gas is burned, and that articles of galvanized iron or of zinc, when exposed to the lamp-flame, become corroded with formation of sulphate of zinc. This fact is noted with some quantitative statements by Mr. Charles Heisch, F.C.S., Superintending Gas Examiner to the Corporation of the City of London.‡ From a burner consuming $\frac{1}{2}$ -foot per hour, the products of combustion of which passed into a zinc chimney, he collected in six weeks $\frac{3}{4}$ lb. of sulphate of zinc.

In the *Chemical News* for 1877, Vol. XXVI., p. 179,§ Professor A. H. Church states that he found in decayed leather from the backs of books which had been on the upper shelves of an apartment lighted by gas—

Free sulphuric acid	6.21 per cent.
Combined "	2.21 "

He accepts without hesitation the theory that the decay is due to the sulphuric acid formed by the combustion of the gas. In the same volume of the *Chemical News*|| there is a paper on the subject by Mr. George E. Davis, who examined the leather of some books which had been in daily use in a large office in Manchester from 1855 to 1858. After that time till August, 1877, they remained uncovered on a shelf near the ceiling of the same room. The books had been strongly bound in rough calf, and had red basil lettering-pieces. Upon knocking the books the leather of the backs came off as a mixture of dust and small pieces, which was very acid to test-paper. The leather from the back was treated with water, and the aqueous solution found to contain by weight of leather taken—

Combined sulphuric acid	2.84 per cent.
Free " "	1.92 "

The leather underneath the lettering-piece contained—

Combined sulphuric acid	0.39 per cent.
Free " "	0.76 "

The red basil lettering-piece contained—

Ammonia	1.28 per cent.
Combined sulphuric acid	0.87 "
Free " "	1.04 "

In 1878, Dr. Gibbs examined books in the Boston Public Library, in the Boston Athenæum, in the Harvard College Library, and in the Astor Library in New York City, in some of which gas is used, and in others not. He arrived at the conclusion "that there was no sufficient evidence" that the products of the combustion of coal gas caused the trouble, and seemed inclined to consider the fault to lie in the tanning of the leather. He says: "I analyzed a number of samples of the leather in my own laboratory, and found no free acid whatever."

My own experience is as follows:—I have had a large number of samples of leather in all stages of decay. I found, as others have done, that morocco is but little affected, while Russia and calf are badly acted upon, and ordinary sheep is also attacked. Qualitative and quantitative examinations showed that, in a general way, the more the leather was decayed the more marked was the acid taste and acid reaction on test-papers, and the larger was the amount of sulphuric acid to be found in the aqueous extract. Further, I found that the aqueous extract always contained ammonia, and although the solution had an acid reaction, and required a certain quantity of alkali to neutralize it, in no instance, I think, was the acid in greater quantity than that which would be required for the acid sulphate of ammonium. I examined a number of samples of fresh leather; the aqueous extracts were only slightly acid, not sufficiently so to affect the taste, and contained only a minute amount of sulphuric acid in combination.

I will now give some of the results of quantitative analyses which have been made in my laboratory. The method employed was to soak the leather with successive portions of water until chloride of barium ceased to produce a precipitate, using at first, at any rate, a temperature less than that at which the leather balls together. A portion of the extract was acidulated with chlorhydric acid, and the sulphuric acid precipitated as sulphate of barium. Another portion was distilled with carbonate of sodium, and the ammonia determined by the Nessler reagent. The results were calculated into percentages of the original leather. Under this treatment samples of new leather of good quality gave the following results:—

	Sulphuric Acid (SO ₃).	Ammonia (NH ₃).
Uncoloured Russia . .	0.25 per cent.	0.14 per cent.
Coloured Russia . .	0.42 "	0.21 "
Sheep, oak-tanned . .	0.21 "	0.08 "

A sample of well-worn but not decayed sheep was taken from the side of a family Bible, printed in 1814, and presumably in the original binding.

* See JOURNAL, Vol. III., p. 267.

† Ibid., Vol. XXII., p. 253, et seq.

‡ Ibid., Vol. XXIV., p. 856.

§ Ibid., Vol. XXX., p. 649. || Ibid., p. 884.

The book had never been exposed to gas. The leather was found to contain—

Total sulphuric acid. 1.42 per cent.

A sample of very rotten Russia, which was very strongly acid to taste and to test paper, contained:—

Total sulphuric acid. 8.4 per cent.

Another lot, scraped from a number of books, contained—

Total sulphuric acid. 10.6 per cent.

Ammonia 3.1 "

In this case the "acidity" of the extract was determined. The greater part of the acidity was due to the presence of sulphuric acid, either "free" or as an "acid salt." Reckoned as sulphuric acid, it amounted to 4.2 per cent.

Another sample contained—

Total sulphuric acid. 6.4 per cent.

Free or an "acid salt" 2.4 "

Ammonia 2.4 "

Lime 0.1 "

Alumina. No more than a trace.

These determinations indicated to me that the sulphuric acid was in considerable measure present as sulphate or acid sulphate of ammonium. I then performed the following experiment:—

A quantity—about 20 grams—of the rotten leather was carefully extracted with water, and after dialyzing the extract several times, and allowing the dialyzed liquid to crystallize, I obtained about a gram of white crystals which were but slightly acid to test-liquids, and were found to contain—

Sulphuric acid (SO₃) 56.43 per cent.

Ammonia 23.20 "

Non-volatile matter 10.23 "

The non-volatile matter contained something insoluble in chlorhydric acid, also some lime and an amount of sulphuric acid equivalent to 4.01 per cent. of the original crystals. Leaving out this sulphuric acid which remained in the "ash," the composition of the portion driven off by heat would be—

Sulphuric acid (SO₃) 58.39 per cent.

Ammonia 25.84 "

Water and loss 15.77 "

100.00

The theory for the normal sulphate of ammonium is—

Sulphuric acid (SO₃) 60.60 per cent.

Ammonia 25.76 "

Water 13.64 "

100.00

It would seem, therefore, that in this case the crystalline salt obtained was mainly the normal sulphate of ammonium. In other cases, however, the impure crystals obtained evidently contained some of the acid salt.

In view of these facts, it would certainly seem that bindings of Russia, calf, or sheep, when exposed to the products of the combustion of illuminating gas, do absorb sulphuric acid. It is difficult otherwise to account for the large amount—8 and 10 per cent.—which is found in the rotten leather. A small amount might come from sulphate of lime in the leather, from sulphate of iron used in staining the backs, and from other sources, but the amount in the samples of new leather which I have examined is very small, and the largest amount that I have ever found, except where I knew the leather had been exposed to gas, was in the sides of a dilapidated copy of Athanasius Kircher's "*Magneticum Naturæ Regnum*." The history of the binding was unknown, as well as its age; it was very "greasy," and from it water took out 4.9 per cent. of sulphuric acid. It was somewhat acid to taste, but it is not unlikely that the book had, in the course of its long history, been exposed to sulphurous acid from the combustion of soft coal, or indeed to gas itself. The same leather contained 2.2 per cent. of ammonia, but this could easily be accounted for. As in other cases, more or less ammonia may come from the air, from the decay of the paste, from the leather itself, and some, no doubt, from the gas in certain cases.

With reference to the source of the sulphuric acid, it has been objected that the sulphur compounds burn mainly to sulphurous acid, and not to sulphuric. I analyzed some of the deposit which formed on a galvanized iron plate which received the water condensed on the under surface of a "water-bath" when the gas was first lighted. I found the salts present to be a sulphate, and could obtain no evidence of a sulphite.

As it has been suggested that the alum in the paste might explain the sulphuric acid, I took some of the scraped backs and examined a portion containing the paste and paper of the back as well as some leather. The results were—

Total sulphuric acid 3.55 per cent.

Alumina (with trace of iron) only 0.42 "

It has further been suggested that it is the fault of the leather. I cannot prove that this is not so, and as a part of the investigation I desire to examine some decayed backs which have never been exposed to gas. This I have not been able to do. Although I have been promised such backs, I have never received them. I may say in this connection that some of the books which I have examined were bound by a man now engaged in the same library, and he claims to know that the leather was good when put on.

I think the evidence collected throws such suspicion on the gas burned, that one would be justified in insisting upon better ventilation, and in recommending that the burners should be arranged, when practicable, so that the products of combustion should be drawn by a ventilating chimney or pipe away from each burner, without mixing with the air of the room. In one of the London libraries, referred to by Dr. Letheby, better ventilation was determined upon, and, as I understand it, with gratifying results.

To settle finally the vexed question, I have laid out the following plan:—I propose to have a set of books bound at the same time by the same person, using the same leather and paste. These books are, some of them, to be put in the most exposed situation, one of them to be carefully examined now, one after a year's interval, another after two years, and so on. Meanwhile two of the same set are to be put where they will not be exposed to gas, but where they will quietly grow old. I believe this, coupled with an examination of the air, which I hope to make, will settle the question.

It should be said that the books which are most decayed have been upon the upper shelves of the library, where they are subjected to a high temperature, and it is, of course, possible that the disintegration of the leather has given an opportunity for the absorption of the vapour of sulphuric acid and ammonia rather than that the absorption is the cause of the disintegration.

ANNUAL SOIRÉE OF EMPLOYÉS AT THE PAISLEY CORPORATION GAS-WORKS.

The employés at the Paisley Corporation Gas-Works, together with their wives and friends, held their third annual *soirée* last Friday night. Mr. GEORGE R. HISLOR, Engineer and Manager, occupied the chair, and was supported by a number of the Gas Commissioners and other gentlemen. After tea,

The CHAIRMAN delivered an interesting address, in the course of which he said that, as the programme showed, this was their third annual *soirée*, and he assured the strangers present that *soirées* promoted by the employés of gas-works were considered rather a favourable sign. The fact not only indicated friendly feeling and sympathy with one another, but also showed the condition of things in the manufacture and distribution of gas. Hence it was that up to the year 1876 such a meeting as this was almost impossible. When practicable, however, he held that such meetings resulted in considerable good; they tended to unite the workers together in friendly feelings and associations. Some workmen were distinguished by the name of the "Black Squad," but those whom he addressed had the somewhat exalted title of "Sons of Light." He considered that in the whole range of human industry there was no class of workmen upon whom a larger portion of the happiness and comfort of the community depended than on the employés of gas-works; and whether they might esteem it a privilege or not, Parliament had recognized the importance of their services, by passing an Act to punish every "Son of Light" who deserted the service, or was guilty of a breach of etiquette or good order by becoming a "striker." He need scarcely tell them, as workmen, that on the carefulness with which they discharged their daily duties, and, above all, on the economy they exercised in apparent trifles, would depend the quality and cheapness of the gas supplied to the community. He subsequently went on to speak of the electric light, remarking that he was sure that gas light, like truth, must prevail. The electric light had failed to accomplish a great many things that the light with which the audience were concerned, and with which they were all familiar, had accomplished. When the electric light was brought prominently forward about two and a half years ago, it seemed to threaten to render gas lighting one of the things of the past; but he was bound to say that gas lighting would not be such, so long as they had an abundant supply of coals, and it would not take place as long as they could sell canal gas at 8s. 4d. per 1000 cubic feet; and their price at Paisley just now was 3s. 9d. per 1000 feet. Mr. Edison might live to justify his conduct and obtain his blessing, but he (the Chairman) was sure that he would get the very reverse of that from a large number of gas shareholders, who were frightened from the holding of valuable gas stock in order to save another calamity such as befell the unfortunate shareholders of the Glasgow Bank. Gas was really now so much appreciated as a means of illuminating and for cooking and heating purposes, that they could scarcely conceive how the rival light could be brought forward to supersede it. That being the case, in the face of the extraordinary advantages derived from gas, it would be a difficult matter indeed for the electric light or any other light to supersede coal gas. Therefore, he held that gas stock investment was the most valuable of the present day. The price of gas in America ranged from 5s. to 13s. per 1000 cubic feet, and the illuminating power was only one-half that of Paisley or any other Scotch gas, and they were not at all alarmed or apprehensive of the competition of the electric light. This being so, English and Scotch people might be perfectly calm, and let no electric shock or fearful dreams disturb their rest.

Bailie M'GOWN, Convener of the Gas Committee, subsequently addressed the meeting. He said he thought they had done a wise thing in calling upon their respected Manager, Mr. Hislop, to preside at the *soirée*. It was more especially encouraging to see this, because it was really their own *soirée*, as they had taken it in hand and managed it themselves. The progress of the various Trusts of the Corporation had, as they knew, been very great, but none had shown greater progress than the Gas Trust. It had occurred to him one day to look up what was the extent of the Gas Trust at its commencement, and he was astonished to find that the income for the first year of its existence was only £1850, whereas last year it was £26,600. This, of course, was the growth of 56 years—as it was so long ago as that since Paisley was first lighted with gas. Paisley was early amongst the towns to adopt gas lighting, and he believed it would be another long time before gas would cease to be used there or at any place where it was now employed. He reminded the audience that the year which had passed since their last meeting had not been uneventful even in the history of the Paisley Gas Trust. During the year one of the most successful exhibitions of gas apparatus ever held in the United Kingdom was held in Paisley. He did not speak from his own knowledge of the exhibition, although he had seen it again and again, and had been delighted with it; he spoke from the testimony of those who had taken care to attend many exhibitions, and they had never attended one more successful than that held in Paisley. This was attributable very much to the skill and care of their excellent Manager.

Addresses were also delivered during the evening by Mr. DOBIE, Bailie CLARK, and Ex-Bailie FISHER.

THE WATER SUPPLY OF PARIS.

For some considerable time past the Municipal Council of Paris have had under consideration the subject of the water supply of the city, with regard alike to quantity, quality, and price. This question, which is of so much importance to the public health, has been much deliberated upon, in the desire to procure for the inhabitants of the city a supply of water at once pure and abundant. As the result of the Council's labours, and of the large sums of money they have voted for the purpose, it is believed that in the course of the next three or four years the Parisians will have at their disposal, for domestic purposes, on every floor of their houses, a supply of excellent spring or river water, drawn from the high reservoirs already constructed at Montrouge and Ménilmontant, or from those hereafter to be constructed in other parts of the city; while for industrial purposes, or for gardens and stables, an ample supply will be available from the Canal de l'Oureq.

The present system of water supply is the subject of much complaint on the part of the consumers, and the Municipality have been urged to take action in the matter. And here it may be well to state shortly what is the position of the Municipal Council and the consumers with regard to the private Company who supply Paris with water. Previous to the year 1859 there was no intervening body between the City Authorities and the consumers. The former fixed the price to be paid for the water they sold, and their servants were authorized to tap the mains to lay on the services to the houses. In the communes immediately contiguous to the city the water supply was in the hands of the General Water Company, consisting of several small Local Companies amalgamated into one. The then Prefect of the Seine—M. Haussmann—brought forward a scheme for establishing a kind of partnership between the City and the Water Company. The terms were accepted by the Municipal Commission, a treaty was entered into on the 11th of July, 1860, was adopted by the State Council on the 27th of the following September, and was finally sanctioned by Imperial decree on the 2nd of October. Various alterations

were made in this treaty in 1867 and 1869, among them being one of very considerable importance, inasmuch as it secured to the Water Company the management of the water supply of the city till the 1st of January, 1911. One article (Art. 27), however, anticipated the possibility of the City Authorities, for certain reasons which the Company were not at liberty to inquire into, considering it expedient to take the administration of the water affairs out of the hands of interested parties, and the conditions under which this change was to be effected were defined. The treaty of Dec. 29th, 1869, was one of the last acts of the Haussmann administration.

By virtue of these treaties, therefore, the position of the Water Company in relation to the City appears to have been this: The City to pay to the Company for the entire term of the treaty an annuity of 1,160,000 frs. (£46,400), as compensation for the cession of the sale of water in the various communes, and of the lands, buildings, pipes, reservoirs, and materials of every kind in their possession, lying within the fortifications. The Company, however, have the entire control of the water placed at their disposal by the City; and they also have to arrange with consumers for giving them a supply of water, which has to be charged for according to a tariff annexed to the treaty, and this tariff having been agreed to by both the contracting parties, it cannot be altered without their mutual consent.

The 14th and 15th articles of the treaty of July, 1860, were not altered by the treaty of 1869. In these it was stipulated that all work in connection with the water service between the main and the stopcock should be done under the supervision, and by the agents and servants of the Municipality, but at the Company's expense; the Company, however, were to continue the work from this point into the houses, and were to properly reinstate the pavements, and make good any damage they might cause. It must not be supposed, from the tenor of these articles, that the expenses here referred to would continue to be borne by the Company, for by an agreement made in February, 1860, between the Engineer-in-Chief of the Water Service and the Superintendent of the Company, and confirmed by the Prefect of the Seine in the November following, it was stipulated that the cost of these works should be borne by the consumers, who were also to pay for keeping the water-pipes in repair, according to a scale of charges annexed to the original treaty; these words being added: "The water shall be delivered as soon as the account for the work done at the expense of the consumer shall have been paid." By Article 18 the Company were authorized to receive all moneys, and each week they were to pay them into the Municipal exchequer.

By the treaty of 1860 the expenses of managing the water supply were fixed at 350,000 frs. (£14,000), the Company being allowed, by way of premium, 25 per cent. on the amount of the receipts above 3,600,000 frs. (£144,000). The treaty of Dec. 27, 1867, however, abolished these administrative expenses, and in lieu thereof gave the Company 25 per cent. on the amount received beyond the sum above specified, up to and including 6,000,000 frs. (£240,000); above this sum, and up to 9,000,000 frs. (£360,000), 20 per cent.; from 10,000,000 frs. to 11,000,000 frs. (£400,000 to £440,000), 15 per cent.; 12,000,000 frs. (£480,000), 10 per cent.; and above that amount, 5 per cent.

We now come to the question of the price to be paid for the water, and to the charge to be made by the Company for work done by them on behalf of the consumers. The mode of supplying the water was to be determined by the Company according to the circumstances of the case; but one of the following methods was to be employed:—(1) The water to be turned on for a given time, and the inflow to be regulated by a gauge-cock, of which the Company's servants alone were to have the key. Under this arrangement the water was to be delivered into a cistern placed at a height to be determined by the Company's servants. (2) By a supply direct from the main. (3) By estimate, and without measurement. (4) By meter. The mode of supply most suitable for the ordinary consumer is unquestionably that by estimate, or the constant service; though it occasionally gives rise to waste, in consequence of the taps being left on, and the water being allowed to run away, through sheer negligence.

At the time the treaty of 1860 was entered into, the City had only at disposal the water of the Seine, that obtained from the artesian wells at Grenelle, and the water of the Canal de l'Oureq, the quality of which is far from satisfactory. It was not until after the treaty had been concluded that the important works were undertaken for bringing to Paris the waters of the Dhuis, the Vanne, and the Marne, by the establishment of the water-works at St. Maur. Naturally the water of the Canal de l'Oureq, which cannot be supplied to the higher portions of Paris, was charged for at a lower rate than the spring and river water, and no quantity less than a cubic metre (220 gallons) per day was supplied. The charge per cubic metre per annum for water was determined according to the following table:—

Quantity supplied per Day.	Charge per Annum.	
	Water of the Canal de l'Oureq.	Seine and other Waters.
250 litres (55 gallons)	—	60 frs.
500 "	—	100 "
1,000 "	60 frs.	120 "
1,500 "	90 "	180 "
2,000 "	120 "	240 "
3,000 "	180 "	360 "
4,000 "	240 "	480 "
5,000 "	300 "	600 "
5,000 to 10,000 litres (per cubic metre)	50 "	100 "
10,000 to 20,000 " " " "	40 "	80 "

For quantities above 20 cubic metres the Company make special arrangement, though in no case is the charge per cubic metre less than 25 frs. for the water of the Canal de l'Oureq, and 55 frs. for the other waters; and they will not supply less than 1000 litres (220 gallons) of the former, or 250 litres (55 gallons) of the latter per diem.

To the original treaty were added, in November, 1860, several fresh regulations, among others those specifying the conditions under which an unmeasured supply of either Seine water or of that from the Canal de l'Oureq might be obtained. Looking at the scale of charges for the water from both sources, one would naturally suppose that when employed for like purposes the quantity supplied would be the same, though the price would vary according to which water was used; but this was not the case, as will be seen by the following table of comparative consumptions:—

	Water of the Canal de l'Oureq.	Water of the Seine.
For a resident householder	30 litres.	45 litres.
" workman	5 "	5 "
" student or soldier	10 "	20 "
" horse or cow	75 "	100 "
" 4-wheel private carriage	100 "	150 "
" 4-wheel carriage for hire	50 "	75 "
" shop	100 "	150 "
" courtyard or garden (per sq. yd.)	3 "	6 "

These are extraordinary differences, and some of them are quite inexplicable. It may readily be supposed that man and beast alike would drink more water of good quality than of inferior, such as that from the Canal

de l'Oureq; but how can it be explained that more of the former than of the latter would be acquired for washing carriages and for the watering of gardens?

The foregoing are some of the principal points in the treaties concluded between the City of Paris and the Water Company. For several years past they have, however, given rise to much dissatisfaction. Not only has the tenor of many of the Articles been sharply criticized, but objections have even been raised to their application. These objections have at length found their way to the Municipal Council. It must be confessed that some of the complaints do not lie at the door of the Water Company—those, for instance, relating to the temporary interruptions which occasionally take place in the supply, and for which, under the terms of the treaty of Feb. 27, 1860, the consumers are unable to claim compensation. These interruptions, which have been caused by a scarcity of water, by repairs, or by the breakdown of the machinery, it must be acknowledged, entail serious inconvenience on the consumers, and measures ought certainly to be taken to remedy such a state of things. The Administration are fully cognizant of the necessity for something being done, and it is hoped that the carrying out of the works proposed by M. Alphand, the present Director of Works, in his latest report on the subject, to which reference was recently made in the JOURNAL, will provide an adequate remedy. The Water Company, as we have said, are not altogether responsible for the interruptions complained of; at the same time it cannot be denied that for some years the Company have appeared to be doing all they could to render themselves unpopular. Their servants have been too hasty in cutting off the water in cases where persons, whose solvency was unquestionable, did not happen to pay their water accounts on presentation; and it should be borne in mind that the accounts are payable in advance. These and other grievances on the part of the consumers have from time to time reached the ears of some members of the Municipality, apart from those constituting the Water and Sewers Committee, who did not fail to make reference to them in reports they might have to present to the Council; and as the result, the whole matter was referred to, and considered by that Committee, who proposed that the following alterations should be made in the conditions under which water is supplied in Paris:—(1) That the Company should supply quantities as low as 125 litres per day, and that in each and every case the price charged should be in proportion to the quantity supplied, instead of being, as before, in inverse ratio to it. (2) That the charges not subject to abatement should be considerably reduced, and be liable to revision after a certain number of years.

Taking their stand on the terms of the existing treaties, the Water Company for some time resisted all demands made upon them for a revision of their conditions of supply; and seeing that their position was, to a certain extent, supported by the old Administration, they simply replied that they could not do anything in the matter. As, however, complaints began to be frequent, and the Company found that, in consequence of the death of M. Belgrand, they would have to deal with a fresh Director of Works, who was by no means imbued with the ideas of his predecessor, they showed themselves more amenable to reason. Early in 1878 negotiations took place with the object of modifying the terms of the treaty of 1860, and in the August of that year the bases of an agreement were settled between the Director of Works of Paris and the Manager of the Water Company. The Municipal Council made certain alterations, and altogether the then existing régime was modified thus: From and after the year 1887 the scale of charges for certain works referred to in the 1860 treaty would be no longer in force, and the whole matter was then to be submitted to adjudication. During the intervening eight years these charge were to be subject to an abatement of 25 per cent. The price for water could not be reduced without causing a considerable decrease in the receipts of the Municipality, who, however, were willing to make any sacrifice to ensure for the inhabitants of Paris water of good quality, and in quantity sufficient to meet all their requirements. The constant supply system, it was thought, would be a very great boon to the occupiers of small houses, and it was favourably received by the Council. The supply by meter had been contemplated in the treaty of July, 1860, but that system had not been very extensively adopted, nor would it probably be in the future, the meter being less simple and more costly than the gauge-tap, which had been very greatly improved. However, as many consumers used meters, the Council would have to regulate the charge proposed to be made by the Company for the loan and keeping in repair of these instruments, any consumer being, of course, at liberty to purchase his own, provided it had been approved and stamped by the Administration. From Jan. 1, 1880, constant service was to be abolished, except in cases specified in the treaty, that system being productive of great waste, especially when the taps were fixed on the ground floor. Finally, it was stipulated that thenceforward the draft conditions of consumption should be submitted to the Municipal Council for approval.

A scheme drawn up in conformity with the foregoing propositions was presented to the Municipal Council by the Water and Sewers Committee, the principal points in it being as follows:—

From and after Jan. 1, 1880, all works necessary for the conveyance of water to the houses of the consumers shall be done by the Water Company under the supervision and control of the servants of the Municipality, such works to be done at the cost of the landlords of the houses, and the charges to be fixed according to the scale contained in the treaty of July, 1860, but to be subject to an abatement of 25 per cent.

During the three years 1880-2 the Company are at their own risk and cost to fit up service-pipes in the houses; these pipes to become the property of the landlords. The Company are also to lay on gratuitously a supply to the houses not yet provided with water, and furnish the necessary branch and service-pipes; the landlords undertaking to keep these pipes in repair for a period of five years at least. The expense of laying on these house-services is to be borne by the city to the extent of four-fifths, and a premium of 30 frs. will be awarded to each person taking a supply from a house-service within twelve months from the time of its being fixed. The Municipal Administration are to determine each year the maximum amount of expense to be incurred by the Company in connection with the laying on of water to the houses.

The constant service is to be available for domestic purposes only, and is not to be allowed where any business in which water is required is carried on. The tariff is to be regulated according to the following scale:

For a single tap in an apartment occupied by two or three persons	18 frs. per ann.
For each additional person	4 " "
For each extra tap—	
In a water-closet	4 " "
In a bath-room	12 " "
In any other part of the dwelling	6 " "
For a shower bath	9 " "

Householders may have fixed in any storey on which there is no apartment of the yearly value of 300 frs., an extra tap for the benefit of the occupiers of apartments and lodgings only. The price to be paid for this extra supply is to be 18 frs. per annum.

Beyond the cases above specified, the water will not henceforth be sup-

plied in any other way than by meter or gauge-tap, unless in the public interest it may be requisite. A model of each kind of meter, approved by the Administration, shall be deposited at the Prefecture of the Seine. No meter is to be used until it has been tested and stamped by the Administration, who are to have the power of imposing any tests they may think fit. The fixing of the meters is to be done by the Company on the terms approved by the Administration, and, when fixed, they will be left in charge of the consumers, who will have the option of purchasing them if they so desire. The Company agree to let meters to any consumers who may wish to have them on hire, and the rates to be paid are to be settled according to the tariff agreed upon between the Company and the Administration, and are to be payable in advance. This tariff is to be subject to revision every five years by the Prefect of the Seine, at the instance of the Director of Works.

From and after Jan. 1, 1880, the rates to be charged for a supply of water up to 5 cubic metres (1100 gallons) per day are to be as follows:—

Quantity supplied per Day.	Charge per Annum.	Water of the Canal de l'Ourcq.	Seine and other Waters.
125 litres (27·5 gallons)	—	—	20 frs.
250 "	—	—	40 "
500 "	—	—	60 "
1,000 "	60 frs.	—	120 "
1,500 "	90 "	—	180 "
2,000 "	120 "	—	240 "
2,500 "	150 "	—	300 "
3,000 "	180 "	—	360 "
3,500 "	210 "	—	420 "
4,000 "	240 "	—	480 "
4,500 "	270 "	—	540 "
5,000 "	300 "	—	600 "

No smaller quantity than 1000 litres of water will be supplied from the Canal de l'Ourcq, and 125 litres of the Seine water; and, beyond the purposes of the public service, the former is to be employed exclusively for industrial purposes, stables, courtyards, and gardens. In those streets where the level does not admit of a supply of the water of the Canal de l'Ourcq being furnished, the other water will, if circumstances permit, be given instead. During the three years 1880-2, the above tariff will be applicable exclusively to new consumers, wherever the two kinds of service—the public and the private—are established. The quantity of water consumed is to be ascertained by meter or by a gauge-tap, each of which is to be approved of by the Administration. The consumption by meter shall be based upon a minimum selected by the consumer from the preceding tariff, and payment shall be regulated accordingly. The quantity of water registered by the meter will be taken, and an account thereof furnished to the consumer once every three months. No extras will be charged if the consumption does not exceed the minimum determined upon; but should it do so, the consumer will have to pay *pro rata*. No deduction will be allowed even if the consumption is below the fixed minimum.

The remaining articles specify, *inter alia*, that in the event of the new convention being agreed to by the Company, it is not to come into operation until after its ratification by the Prefect of the Seine, and the Municipal Council, on behalf of the City; by the Board of Directors and a general meeting of Shareholders of the Water Company; and by the Government.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

A continued want of animation is complained of throughout the coal trade of this district, and there is generally less firmness in the market. The advances which were attempted at the commencement of the year are not being maintained, and in some cases there is a slight giving way in the better classes of round coal. In the house-fire coal trade the demand has been considerably less active than last winter, with the result that stocks have been very little reduced, and the summer will be commenced with an abundance of the better classes of round coal in the market. In gas coals there is, of course, at present very little doing; but with the stocks of round coal left on the hands of colliery proprietors, there is a probability of consumers, when the usual period for giving out contracts arrives, being able to secure supplies on more favourable terms than could have been anticipated a short time back, when a general advance was regarded as almost certain. Prices may not be quite so low as last year, nor sellers so willing to enter into long forward contracts; but there is no indication at present that colliery proprietors will be able to command any very materially higher rates. For manufacturing classes of fuel there is a tolerably fair demand. The iron-works and cotton-mills are taking more of the common classes of round coal and slack; but there is no scarcity of supplies, and colliery proprietors are not able to realize the prices they were expecting. Slack, if anything, has been rather easier during the past fortnight, and of this class of fuel there are heavy stocks in the district. The average quotations at the pit mouth are about as under:—The better classes of round coal, such as good Wigan Arley, 8s. 3d. to 8s. 9d.; second qualities, such as inferior Arley and Pemberton four-feet, 6s. 6d. to 7s. 3d.; common round coal, 5s. 6d. to 5s. 9d.; good slack, 2s. 9d. to 3s. 3d.; and common, 2s. 3d. to 2s. 6d. per ton.

The shipping trade has been very dull, the bulk of the coal for steamers use having lately been drawn from South Wales, and the Liverpool market has during the last week or so been overstocked with Lancashire coal, for which sellers have had to take lower prices.

There is a very fair demand for coke, and prices at the ovens range from 14s. to 17s. for large, and 10s. to 12s. per ton for small cokes, according to quality.

There has been less activity in the iron trade, and a good deal of iron held by merchants and dealers is being offered in the market under late rates. Makers quotations, however, are without material change, and for Lancashire pig iron, delivered into the Manchester district, prices remain at about 70s. per ton, less 2½ per cent., with a good demand still reported for large numbers. In the finished iron trade makers continue very firm; but ordinary Lancashire bars, delivered equal to Manchester, can be bought from second hands at from £9 to £9 5s. per ton.

A rather better tone is reported amongst founders, engineers, and machinists. One or two good orders have recently been given out, and there are inquiries in the market, which it is hoped will lead to further considerable business.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

A considerable amount of contracting has been done by gas companies within the past six days. What are called the Baltic orders have been placed in the market. The Riga Gas Company have made their contract for 10,000 tons of gas coals, to be composed of Levenson's, Ravensworth, and New Pelton. The Moscow Gas Company have given an order to Old Pelton for 80,000 tons of coals. Messrs. Joicey also sold gas coals under con-

tracts last week; and other contracts are under negotiations. The rates are higher than last year. The freight to Cronstadt represents 7s. a ton. The price of the larger proportion of the gas coals contracted for will be about 7s. per ton.

The shipments of gas coals to London and coastwise were hindered in the early part of last week through the detention of steamers and sailing ships in dense fogs at the lower end of London river, and upon the southern coast the gas collieries are all very busy. There is an excellent demand for coke. A quantity has been sold at 19s. per ton at the ovens, to be sent to the Middlesbrough iron-works. Cargoes of coke are being shipped to Spain. A number of large sailing vessels have been chartered at pretty high rates of freight. Steam and manufacturing coals are in excellent demand. Best steam coals have advanced 2s. per ton, and small coals 1s. per ton, since last October.

The coasting freight market favours the shipper. The rates are 9d. per ton down. There are scarcely any orders in the market for small coasting vessels. Gas coals were shipped last week on the Tyne by steamers to Dublin and by sailing vessels to Waterford and Cork, &c. The Channel rates have been, for sailing vessels, 7s. 6d. per ton to the principal English ports; London, steamers 4s. 3d., and sailers 5s. 3d.; Boulogne, 5s. 3d.; Havre, 6s.

The Cleveland iron trade, sympathizing with the state of business at Glasgow, was dull last week. The price of crude iron was lower. Manufactured iron was in demand; and all the leading factories on the Tyne were very fully employed last week. They are likely to continue busy over the spring. Most of the factories have orders on hand for large forgings. The foundries are at full work with castings. The lead market shows a slight falling off. Buyers hang back and will not pay the high prices asked by the merchants. There has been some "cutting" speculations in this metal, it is said, and the operators experience a difficulty in keeping prices where they are. Copper is higher.

The fire-brick trade is prosperous. Recent advances are fully upheld. There are likely to be large shipments of bricks to the Continent for furnace work with the opening of the spring.

The timber trade is slow. There is little active business doing in any particular department. Upon the trade transacted there is an advance on previous rates. The tendency is in favour of the sellers.

The chemical market is easy for prompt shipments; but the quotations are better for later on.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

When referring to Falkirk gas affairs in last week's "Notes," I made a slip as to the price of gas, which I hasten to correct. The price is now 5s., and the Falkirk Lighting Company have fully resolved to reduce it to 4s. 7d. per 1000 cubic feet, making a reduction of 1s. 3d. per 1000 feet since they took the works in hand.

The quantity of gas manufactured in Inverness during the month of December, 1879, was 3,763,000 cubic feet, as compared with 3,646,000 cubic feet in December, 1878, being an increase of 117,000 cubic feet. The illuminating power of the gas is stated to have been equal to 27 standard candles.

As affording some evidence of the fact that the city of Perth is not a "Sleepy Hollow," as it has been pictured by many people, especially in Dundee, it has just been publicly stated that the consumption of gas within the area of supply has increased 150 per cent. within the past seven years.

A lecture on "Coal and the Coal Tar Colours" was delivered before the Edinburgh Literary Institute last Wednesday evening, by Mr. W. Ivison Macadam, F.C.S., son of Dr. Stevenson Macadam, in the course of which he alluded to the anticipations entertained as to the introduction of the electric light, and to the effect which it would have on the manufacture of gas; and he said it had often occurred to him that, even though gas lighting were to be superseded, gas companies would still have the manufacture of dyes to fall back upon.

Steps are being taken by the law agents of the Peterhead Gas Company to get its affairs wound up. At a recent sitting of the Sheriff Court upwards of two dozen debtors were called, and against whom decree was obtained in absence; and since then a still larger batch of cases was brought up.

At a meeting of the Town Council of Kilmarnock, held last Wednesday, a minute from the Gas Company was submitted, in which it was shown that the preceding month's sale of gas amounted to 5,037,750 cubic feet, realizing £1154 9s. 8d., as against 5,637,800 cubic feet for the corresponding month of 1878, when the sum realized was £1291 19s. 11d. The illuminating power in the last report was—maximum, 29·7 candles; minimum, 23 candles; average, 28·7 candles.

The Dundee Gas Commissioners have just accepted tenders for the erection of a new gasholder of unusually large size. It will be 60 feet high, 150 feet in diameter, and will contain nearly 1 million cubic feet of gas. According to the specifications, the whole work has to be completed by September, 1881. With the exception of half a dozen holders at the Glasgow Corporation Gas-Works, this new holder will be the largest in Scotland. The holders in Glasgow are 160 feet in diameter, by 60 feet high, in two lifts, and have each a capacity of 1,250,000 cubic feet.

The annual general meeting of the Kilmalcolm Gas Company, Limited, was held on Monday, the 2nd inst.—Mr. George Frederick Bryan presiding. From the balance-sheet which was submitted it was shown that there was a balance of £193 16s. 5½d. on the past year's working, which was equal to a profit of 8 per cent. on the capital of £2400. On the recommendation of the Directors, it was agreed to declare a dividend of 5 per cent., and to carry forward a balance of £70 to next year's account. The Directors stated that they had agreed to supply the West of Scotland Hydropathic Establishment with gas at 7s. 6d. per 1000 cubic feet, with 10 per cent. discount if burning gas to the value of £100 per annum. There will be 700 lights in the establishment, and the opening is to take place in April. There are also 20 new villas nearly ready for gas.

The Burgh Commissioners of Johnstone, sitting as Gas Commissioners, recently devoted two meetings to the reading of the minutes connected with the negotiations which eventually terminated in the acquisition of the gas supply undertaking of the town for the public good. The minutes embodied a report on the condition of the plant and works by Mr. Geo. R. Hislop, of Paisley, who had been requested by the Commissioners to prepare it for their information and guidance. Mr. Hislop reported that in the gas-works there are 31 retorts, well set and in good condition. About 60 per cent. of this number are not required during mid-winter, and the remaining 40 per cent. would be sufficient to meet the growing requirements of Johnstone for some years. The condensers is of modern construction, and in excellent condition—fully able to pass twice the maximum gas required in mid-winter. It is too large, however, as it would have been more economical for the Commissioners if it had only been one-half as large as it is. The engine and boiler were reported on as of sufficient power for present requirements. The washer was stated to be worse than useless. The purifiers are altogether inadequate for the requirements of Johnstone in mid-winter. The station-meter is apparently in fair condition,

but is only capable of measuring 3000 cubic feet per hour, and as the consumption in Johnstone rose to 5000 cubic feet per hour in winter, its accuracy of measurement cannot be relied on. The two gasholders are capable of containing 56,000 and 20,000 cubic feet of gas respectively. This total storing capacity of 76,000 cubic feet is only equal to about three-fourths of a mid-winter day's consumption, and is therefore defective. Storage should be equal to at least one whole day's maximum consumption. The governor is of modern improved construction, and of ample size to meet all requirements for many years to come. The connecting-pipes, Mr. Hislop finds, are too small, and out of all proportion with the apparatus they are connected with. The present coal-store is much too small. The lime-store should be removed and placed in another part of the works; and there should be a workshop erected. Mr. Hislop estimates the cost to put the works in good order at £1548.

A public sale of railway and gas stocks took place at Arbroath on Saturday week. There were sold $6\frac{1}{2}$ shares of the Arbroath Gas Corporation £9 2s. annuities at from £32 12s. 6d. to £32 15s. per share. Glasgow Corporation 9 per cent. Gas Annuities were sold on Monday, the 2nd inst., at £222 5s., and at the same price on Thursday and Friday.

There were frequent and violent fluctuations in the Glasgow pig iron market during the past week, and the course of the market was unusually erratic. As low as 65s. cash was taken on Wednesday, and up to 67s. 7 $\frac{1}{2}$ d. cash was paid on Friday forenoon.

The coal trade shows no marked signs of improvement, but the spring shipping business will open shortly.

MALVERN LINK GAS COMPANY.—At the half-yearly meeting of this Company, on Thursday last, a dividend of 8 per cent. was declared.

TAMWORTH WATER SUPPLY.—At the last meeting of the Tamworth Town Council, a motion—"That the Mayor be requested to sign, and affix the corporate seal to the agreement with the Tamworth Rural Sanitary Authority for providing a water supply"—was carried. The agreement provides that the Joint Committee for the management of the water-works is to be composed of twelve members of the Rural Sanitary Authority and six members of the Town Council.

THE SEWERAGE OF DUBLIN.—At the meeting of the Corporation of Dublin, on Monday last week, the Town Clerk announced that a communication had been received from the Office of Public Works, announcing that they had received the recommendation of the Local Government Board for a loan of £30,000 to the Corporation for the construction of sewers in the city, the money to be repaid in 30 years, with interest at the rate of 3 $\frac{1}{2}$ per cent. per annum.

THE PURCHASE OF THE STROOD WATER-WORKS BY THE ROCHESTER CORPORATION.—A special meeting of the Rochester Town Council was held on Friday, the 30th ult., for the purpose of confirming a resolution passed at a previous meeting of the Council, on Jan. 13, authorizing the Mayor and Corporation to promote a Bill in Parliament for empowering them, *inter alia*, to acquire the Strood Water-Works, and carry on the same. The necessary resolutions were unanimously confirmed.

FAVERSHAM WATER COMPANY.—The annual general meeting of this Company was held on Monday, the 2nd inst.—Mr. S. Higham in the chair. The accounts presented showed the profits for the past year to have been £665 6s., out of which a dividend of 7 per cent. was declared and £22 was added to the reserve-fund. The report which was presented was adopted, and the retiring Directors, Messrs. C. Bryant, J. A. Anderson, and C. Smith, were re-elected; Messrs. H. Anderson and A. Green being re-appointed Auditors.

STARCROSS AND KENTON GAS COMPANY.—The fourth annual general meeting of this Company was held on Monday, the 2nd inst.—the Rev. E. C. Bond in the chair. The Directors report showed that the funds allowed of the declaration of a dividend at the rate of 7 $\frac{1}{2}$ per cent. out of the cash assets, and of £100 being carried to the reserve-fund, which it was considered necessary to establish for the repair of plant. The Directors recommended that the price of gas should be reduced 10d. per 1000 feet. The report was adopted, and the retiring Directors—the Earl of Devon and Mr. John Haydon—were unanimously re-elected.

CHESTER UNITED GAS COMPANY.—The annual meeting of this Company was held on Friday, the 30th ult.—Mr. F. L. Bagnall in the chair. The accounts were adopted, and dividends declared on the preference and ordinary stocks and shares. Resolutions were adopted carrying out the other recommendations in the report from the Board, and re-electing the retiring Directors—Messrs. T. Roberts and J. B. Wilcox. The meeting was afterwards made special, to consider the Bill to be promoted by the Company in the ensuing session of Parliament to authorize the raising of additional capital. The Bill was submitted, and a resolution passed unanimously approving of it.

THE OPPOSITION TO THE LIVERPOOL CORPORATION (VYRNWY) WATER SCHEME.—At the Quarterly Meeting of the Bewdley Town Council, held on Monday, the 2nd inst., the question of opposing the above-named scheme came up for discussion. The Mayor (Alderman Marcy), who presided, thought the scheme should be opposed, but that the expense to which the Council should go, in conjunction with other bodies, should be limited to a certain amount. A resolution was passed, on the motion of Alderman Landon, seconded by Mr. Knowles, specifying that the expenditure in opposing the scheme should not exceed a rate of 3d. in the pound. This decision will have to be approved at a special meeting of the Council, and confirmed by a subsequent meeting of ratepayers called for that purpose.

THE BRITISH GAS COMPANY AND THEIR POTTERIES STATION.—A special meeting of the Hanley Town Council was held on Thursday last—the Mayor (Mr. J. Bromley) presiding—to consider the Bill promoted by the British Gaslight Company for obtaining power to enlarge their Potteries station. The proceedings of the Council were conducted in private, the result being, it is said, that, after a lengthy discussion, Mr. Ridgway moved—"That the Bill in Parliament for the purpose of empowering the British Gaslight Company, Limited, to enlarge their works, and to expend further capital at their Staffordshire Potteries station, and for other purposes, be opposed; and that the cost of the opposition be a charge upon the borough funds." This proposal was seconded by Mr. Baker, and carried; and it was also resolved—"That such steps be taken as may be deemed expedient in relation to such object and purpose."

HUDDERSFIELD WATER AND GAS SUPPLY.—In the course of an article on "Huddersfield Improvements," in a recent number of the *Leeds Mercury*, it was stated that in 1869 the Corporation acquired the water-works, at a cost of £59,000, and the money since laid out has run up the total expenditure on the original works to £66,000. The new and better service is to cost £700,000. The Engineers are Mr. T. Hawksley, C.E., and Mr. G. Crowther, of Huddersfield. Three large reservoirs have been constructed—one at Black Moor Foot, another at Deer Hill, and a third in the Wessenden Valley. The water is of excellent quality. Two million gallons are daily sent to Huddersfield, and the service can be extended to three or four million gallons daily. About £660,000 had been expended on these works up to the end of last August, and they are expected to prove

a good and useful investment to the residents. In January, 1872, the gas-works were acquired by the Corporation at a cost of £144,000, and the total expenditure on these works up to the present time is about £204,000.

THE SEA WATER SUPPLY TO LONDON BILL.—The Parliamentary Committee of the Metropolitan Board of Works have reported in reference to this Bill as follows:—"By the Sea Water Supply to London Bill it is proposed to lay pipes for the conveyance of sea water through parts of the Metropolis. It appears to your Committee that the mode of carrying out the works under the public ways should be subject to the approval of the Board. Among other works, it is proposed to carry a syphon under the bed of the River Thames from Putney to Fulham, and as it is possible that a syphon at that point might interfere with the construction of a new bridge at Putney, should it be hereafter found necessary to replace the present structure by a new one, it may be well to call attention to this point. Your Committee accordingly recommend that a petition be presented against the Bill." This was agreed to.

CROFT AND HURWORTH GAS COMPANY.—The forty-fourth half-yearly meeting of this Company was held on Monday, the 2nd inst.—Col. Scurfield presiding. The Secretary (Mr. J. T. Hall) read the report, which stated that the income during the last half year was £441 15s. 1d., and the expenditure on revenue account £230 2s. 6d., leaving a profit of £211 12s. 7d. available for dividend. It was proposed to declare a dividend at the rate of 6 per cent. per annum. After paying this dividend there would be a balance of £66 17s. 7d., which sum would be placed to the credit of the reserve-fund, which would then amount to £209 11s. 2d. During the past half year a complete set of new purifiers had been erected, and the works were in efficient order. The Chairman moved, and Mr. Brown seconded the adoption of the report, which was agreed to. The retiring Director (Mr. G. J. Scurfield) and Auditors (Messrs. Walton and Alderson) were re-elected, and the usual votes of thanks concluded the proceedings.

ALCESTER WATER COMPANY, LIMITED.—The second annual meeting of this Company was held on Monday, the 2nd inst.—Mr. H. Overbury presiding. The report stated that the works had been extended into the Moors and other parts of the town; that 215 houses were now supplied with the Company's water; and that the Board had arranged with the Alcester Sanitary Authority to flush the town sewers with the Company's water. Preference shares, to the extent of £825, in addition to the original ordinary shares, had been issued during the year. A discussion took place on the accounts, from which it seems that the total present liabilities of the Company amount to about £800, of which £517 is owing to the bank, the remainder being for legal charges, &c. The principal question was how to meet this liability. The subject was eventually adjourned, to admit of the exact amount of the liabilities being ascertained. The report was adopted, and Messrs. J. Jones and R. Sheaf, the retiring Directors, were re-elected.

CLEANING THE CONSETT WATER COMPANY'S MAINS.—During the past fortnight men have been busily engaged in cleaning out the mains between the Consett Water Company's reservoir on the Fells, at Waskerley and the town of Consett. The cleansing process is accomplished by means of a "ferret." The mains were found to be in an exceedingly filthy state, the ferret having forced out, in addition to a thick coating of slimy matter (evidently peat), shovels, sprags, and other articles which seem to have slipped into them either at the reservoir or whilst the pipes lower down have been from time to time under repair. For some weeks past, owing to the absence of a wire gauze at the spot where the water leaves the reservoir and enters the main, young fish (trout and minnows) have entered the pipes, and numbers have, one of the local papers states, actually succeeded in forcing their way alive through the taps, after swimming through the mains for a distance of over ten miles.

DEARNE VALLEY WATER BILL.—Last Wednesday a meeting was held of ratepayers and inhabitants of Darfield, for the purpose of hearing statements from the promoters of the Dearne Valley Water Company with respect to the supply of water to Darfield. It may be remembered that a vestry meeting was held on the previous Thursday, when it was resolved to request the Sanitary Authority of Darfield to petition Parliament to have the township of Darfield expunged from the Bill. Mr. Joseph Mitchell, Engineer, and Mr. Robinson, Secretary of the Company, attended. Mr. Robinson, in addressing the meeting, said it was convened in consequence of the wild statements which had been made at the previous meeting. The Dearne Valley Water Company would supply the district with good and pure water, so far as it was possible, at the cheapest rate. They would either supply it in bulk to the township at 6d. per 1000 gallons, or supply it to consumers direct. Mr. Mitchell explained that the water would be obtained from Wath Main, Mitchell's Main, and Darfield Main, and the supply would be large and constant. A number of eminent chemists had certified as to the quality of the water.

THE DAGENHAM SEWAGE UTILIZATION BILL.—In the course of a report which was adopted at the meeting of the Metropolitan Board last Friday, the Parliamentary Committee state: "By the Dagenham and District Farmers (Optional) Sewage Utilization Bill it is proposed to form a Company to take the sewage from the northern main outfall sewer, and convey it for the fertilization of land in the county of Essex. It is provided that the Board and the Company may enter into contracts with respect to the sewage. It appears to your Committee that the time for the compulsory purchase of the land should be reduced from five to two years, and for the execution of the works from seven to four years from the passing of the Act. It would also be well to require the Company to deposit a substantial sum, say £15,000, in the hands of the Board, to be forfeited at the end of two years in the event of the Company not having by that time acquired the ground requisite for the purposes of the Act, and not having expended upon the works a sum of not less than £50,000. It would also be better that a royalty should be reserved to the Board than that a fixed charge per 1000 gallons should be made, as proposed in the Bill. The Board should also have full power to enter upon the works, and to examine the books of the Company; and upon the failure of the Company to complete the works within the time named in the Act, the Board should be entitled to appropriate without payment all the works upon the Board's land. Your Committee recommend that a petition be presented against the Bill."

SOCIETY OF ENGINEERS.—The first ordinary meeting of this Society for the present year was held on Monday, the 2nd inst., in the Society's Hall, 6, Westminster Chambers, Victoria Street. At the conclusion of the ordinary routine business, Mr. R. P. Spice, the Past-President, presented the premiums of book which had been awarded to the following gentlemen for papers read during last year, viz.:—To Mr. Charles John Alford for his paper on "The Mineralogy of Sardinia," and to Mr. Thomas Andrews for his paper on "Wrought-Iron Axles." On the motion of Mr. H. P. Stephenson, seconded by Mr. T. Porter, a cordial and unanimous vote of thanks was passed to Mr. Spice for his services as President during the last two years. Mr. Spice then introduced the newly-elected President, Mr. Joseph Bernays, who delivered his Inaugural Address. He first expressed his thanks to members for the honour they had conferred upon him in electing him President. After alluding to the efficient manner in which Mr. Spice had filled the presidential chair for two successive years, and the hesitation he, as a foreigner, felt in following such a successor, he gave some

good hints to young members on the writing of papers. Mr. Bernays next referred to the work and use of the Society, and finally selected "The Position of the Society in its Relation to the Profession at Large" as his subject. Glancing at the interesting papers which had been read during the year 1879, and the visits made by the Society to various works of interest during that year, Mr. Bernays, in a most able manner, proved that the Society was of the greatest use and benefit to all classes of Engineers, and to the furtherance of engineering science and knowledge, without clashing with any other society. Mr. Bernays said he regretted the loss of the valuable services of Mr. P. F. Nursey, their late Secretary, who was now, however, still useful to the Society as a Member of Council, and concluded with some general remarks concerning the financial and numerical position of the Society.

BIRMINGHAM CORPORATION WATER SUPPLY.—The minutes of the Water Committee presented to the Quarterly Meeting of the Birmingham Town Council last Tuesday contained a report by the Engineer (Mr. Gray) respecting additional pumping-engines at Aston. In it he states: "In 1860 the total quantity of water supplied to the district was 1408 millions of gallons; in 1870 this quantity reached 2508 millions of gallons; and this last year 3584 millions of gallons; so that the increase has been, from 1860 to 1870, 1100 millions of gallons per annum; from 1870 to 1879, 1076 millions of gallons per annum; together, 2176 millions of gallons per annum, in 19 years, being nearly 6 million gallons per day. During the year 1865 the supply at Aston had so much increased that it was necessary to have additional engine power, and in 1866 the two engines, 'Eagle' and 'Hawk' were started, which relieved the great strain on the four engines then at Aston. In 1873 the supply delivered from Aston was, I considered, too much to be depending solely on the engine power at that station, and I recommended the dividing of the district, so that the engine power at Plants Brook and Whitacre should supply a portion direct. This was done in 1874 by carrying a 24-inch main from Aston through Nechells, and by this means the Aston engines were relieved. There are now at Aston six engines, and the supply to them is furnished by Aston well, Perry well, Perry pool, Witton pool, King's Vale engine and half Short Heath engine. I consider the Aston engines are quite equal to distribute the quantity derived from all these sources, but as the supply increases the maximum increases at a greater ratio than the average, and during the last frost I was for a short time compelled to have at work all six engines at Aston, a circumstance that never occurred before, and could not have been if the new 30-inch main, which was constructed in 1879, had not been laid. In order, therefore, to make proper provision for the increased and increasing requirements for water, I beg to recommend that further engine power be erected at Aston, on the north side of the present engines." The Committee requested authority to proceed, without delay, with the works recommended. The statement of the water-works accounts showed that the income last year was £114,132 18s. 8d., including £111,841 5s. 8d. from water-rents. The gross profit for the year was £77,967 15s. 3d., and the surplus profit £10,702 10s. 7d. The reserve-fund account amounts to £18,215 7s. 3d.

THE GAS SUPPLY OF LONG EATON.—On Monday, the 2nd inst., a meeting of the Long Eaton Local Board was held for the purpose of further considering the question of purchasing the works of the Long Eaton Gas Company, Limited, or opposing the application of the Company for a Provisional Order. Mr. Fletcher occupied the chair. The Clerk reported that he had received a letter from the Secretary of the Company, in which he said: "The Directors are not unwilling to sell the concern if the Local Board desire to purchase of the Company; but inasmuch as the Local Board are not prepared to name the sum, the Directors suggest that the matter be referred to arbitration." He also said that in answer to a requisition, the Local Government Board had directed an inquiry to be held on the matter; and in reply to a question, stated that although an offer of £18,000 in an unofficial manner had been made for the works, no real and legitimate action had been taken. In the course of the discussion which followed, Mr. Hooley said he would vote for £18,000 being paid for the works, being at the rate of £7 10s. per share; but the Clerk said it was preposterous to offer this, as he could assure the Board that he had recently offered £9 per share, and could not effect a purchase. A letter was subsequently read from one of the townspeople, who suggested that the Board should offer a reasonable price, say £8 10s. per £5 share, which he considered a fair value at the present market price. He said he would rather give a little more than come to litigation, which would cost not less than £500. Mr. Hooley then proposed that the Board oppose the Provisional Order, and that the expense of doing so be paid out of the general district rate of the parish. Mr. Dickson seconded the motion; and, on a show of hands, there were two for and two against (Shareholders in the Company not voting), and the resolution was declared not carried. Mr. Mackern then proposed that a Committee of the Board, composed of members who were not Shareholders, meet the Directors of the Company, with a view to the purchase of the works. Mr. Newsum seconded this proposal, which was carried, and the deputation was appointed.

Register of Patents.

3997.—DOWSON, J. E., Claverton Street, London, "Improvements in apparatus for the manufacture of gas." Patent dated Oct. 10, 1878.

This apparatus for making water gas for heating, illuminating, or other purposes, consists of one or more gas generators arranged vertically or otherwise with special furnace-bar appliances, and through the incandescent fuel a blast of superheated steam is forced. The grate is formed so that the whole or a portion can be moved open, slid out, or withdrawn so as to allow of the removal of the clinkers. The steam blast is arranged so that it may play when required into an opening in the generator, through which air can be drawn, the diameter of the hole being larger than that of the hole in the nozzle or pipe, which is fitted with a moveable cap to regulate the admission of steam. The heating power of the water gas may be increased by introducing hydrocarbons into the generators. Retorts, with one or more partitions running nearly the whole length, so as to increase the heating surface, are arranged to make illuminating gas by converting the vapours of hydrocarbons into permanent gas, either before or after mixing with the water gas made in this apparatus.

3999.—GOODSON, H. E. T., Fulham Road, London, "Improvements in pressure-reducing valves for gas, steam, or water pipes." Patent dated Oct. 10, 1878.

According to this invention a valve-box, containing a double-acting valve, is placed between the main and service pipes. This box is in two parts, one containing a pressure valve opened by the pressure from the main, and connected (by a spindle on its back side) with a circular flexible valve of india-rubber or other elastic material, the surrounding portion of the valve being secured between the meeting flanges of the valve-box, and perforated internally close to the box with a ring of holes for the passage of the fluid. This valve is of larger area than the pressure valve. Round the latter is a moveable ring perforated with holes, and on the top edge is

carried a plate, in which is a stuffing-box for the connecting spindle, its upper projecting edge forming the seat of the flexible valve. Projecting from the inside of the other part of the box is a second ring perforated with holes, and its lower edge taking on to the flexible valve where it rests on its seat. The pressure from the main opens the pressure valve and passes through the holes in its surrounding ring, and through the holes in the second ring into the valve-box and service pipe above the flexible valve, which being of larger diameter than the pressure valve, the pressure of the fluid on its upper side is greater than that on the under side of the pressure-valve, and this latter is consequently closed, and the pressure in the service-pipe thereby reduced.

4003.—M'DOUGALL, A., Penrith, and HEPPORTH, J., Carlisle, "Improvements in the purification of gas and separation of products therefrom." Provisional protection only obtained. Dated Oct. 10, 1878.

This invention relates in the first part to the removal of carbon disulphide from gas used for illuminating and other purposes; and in the second part to the separation of the carbon disulphide, and its collection for use in any of the processes to which it is commonly applied.

In carrying out the first part of the invention the gas is passed through sawdust, spent bark, or such other material as will present a large surface to the contact of the gas. The material so used is previously to be charged and intimately mixed with oil, and then placed upon grids or supports perforated or provided with holes for the passage of the gas. These grids are then placed in scrubbers or purifiers furnished with inlet and outlet junctions, also with a perforated plate in the interior immediately beneath the top, to admit and spread the oil over the material on the first grid. The oil percolates through the material on the first or highest grid on to the material on the second, and so on through the series, and meeting the gas as it passes upwards, separates and carries down with it the carbon disulphide. The oil so charged passes finally through the tube at the lower part of the scrubber or purifier into the vessel placed for its reception, whence it overflows into a second vessel, for the purification or separation therefrom of the carbon disulphide. After purification by the separation of the carbon disulphide, the oil is used a second time, and so on continuously.

In carrying out the second part of the invention, the carbon disulphide is separated from the oil used in purifying the gas by distillation, or by hot air or steam, and is afterwards prepared for commercial use by any well-known method.

4097.—HACKNEY, W., Newport, Mon., "Improvements in regenerative gas furnaces." Patent dated Oct. 15, 1878.

In this furnace a flame is obtained commencing only in the working chamber of the furnace, and directed downwards on to the matters to be heated, either by introducing the gas into the working chamber in one, two, or more horizontal or inclined (and preferably parallel) streams, and directing the air downwards upon it in, say, an equal number of vertical streams, or streams more steeply inclined than those of the gas, which air streams are immediately over the streams of gas. Each of the ports through which the air is admitted is so much wider than the corresponding gas port, that the stream of air laps round the stream of gas and partly mixes with it, instead of simply beating the gas down and remaining altogether above it.

4102.—WIRTH, F., Frankfurt-on-the-Maine, Germany, "Improvements in automatic gas-burners." A communication. Patent dated Oct. 16, 1878. This invention consists in automatically lighting a gas-burner flame by means of a sudden increased pressure, such increase being effected at the gas-works, so that any number of gas-jets can be ignited or extinguished at will. The apparatus has two burners—the burner proper, and a small burner, which serves to turn on and light the large burner. The extinguishing of the light of the large burner is accomplished in the same manner—that is, by a sudden enlargement of the small flame, which afterwards subsides to its original size. As the small flame shoots up it causes a liquid to expand and give off vapours, which (the liquid being contained in a cylinder) lifts a piston and turns on the gas to the large burner and ignites the same, whereupon the small flame sinks to its normal size.

4204.—HADDAN, H. J., Strand, Westminster, "Improvements in valves and cocks." Patent dated Oct. 22, 1878.

This invention consists, firstly, in combining the elements of a screw stem guided to an axial position relatively to the valve-seat, with an ordinary loose disc or flexibly attached valve; secondly, in the provision of a locking device, whereby such valve-disc, when worn unequally, can for the time being be rigidly united with its stem, for the purpose of being ground or re-ground to its seat through the instrumentality of the stem; also in securing such discs to the stem for re-grinding, whereby the loose disc valves are locked through the medium of the stem.

4223.—JOHNSON, J., Pendleton, Lancs., and HILTON, M., Prestwich, "Improvements in arrangements and apparatus for the manufacture of gas." Provisional protection only obtained. Dated Oct. 23, 1878.

This invention relates to improvements upon the mode of making gas described in patent No. 4576, Dec. 3, 1877 [See JOURNAL, Vol. XXXIV., p. 226], and consists in employing, instead of revolving retorts, stationary ones, formed of any section and material; but constructed so as to enlarge from the end at which the coal is fed to the opposite end at which the coke is discharged. The coal, in small lumps, is placed in a hopper closed by a lid and sealed by a water-joint, and descends from the hopper to a chamber communicating with the small end of the retort. In this chamber is a screw which propels the coal into and through the retort; or a reciprocating piston or other arrangement may be used for the purpose.

The coke discharged at the large end of the retort falls into a chamber from which the gas generated ascends by a pipe. The lower end of this chamber cones or contracts into a hopper or shoot, and descends into a well having water in it to act as a seal to prevent the escape of gas, the hot coke dropping into this shoot and accumulating to a given height in it, so that the upper surface is hot coke. At the lower part of the shoot in the well is a screw arrangement which propels the coke from the well up an incline, and discharges it above the surface of the water in the well into a wagon or other receptacle.

When several of these retorts, up to, say, seven, are combined together, each retort has a separate feeding apparatus as described, but they are all arranged to discharge the coke into one common chamber and shoot.

4253.—RAMAGE, P., Edinburgh, "Improvements in valves for controlling or regulating the passage of fluids and liquids." Provisional protection only obtained. Dated Oct. 24, 1878.

According to these improvements, that part of the pipe at which the controlling medium is to be situated is provided with a butterfly or puppet valve, arranged to open in the direction of the pressure of the fluid or liquid in the pipe or valve. When shut, the valve is held down on its seat, and against the pressure, by a cam or eccentric formed on a spindle passing through the walls of the pipe behind the valve, and so arranged that when the spindle is caused to perform a quarter, or nearly a quarter of a turn, the cam or eccentric acts upon the back of the valve, and by forcing it down upon its seat cuts off the supply of liquid or fluid.

APPLICATIONS FOR LETTERS PATENT.

- 422.—LYON, T. G., Peckham, London, "Improvements in the construction of water-pipes for the purpose of preventing injury to the same by the action of frost." Jan. 30, 1880.
- 432.—BROUARDEL, E. P., Paris, "Improvements in gas-pressure registers." Jan. 31, 1880.
- 444.—VAUGHAN, G. E., Chancery Lane, London, "Improvements in the construction of gas-generating furnaces." A communication. Jan. 31, 1880.
- 457.—MEWBURN, J. C., Fleet Street, London, "Improvements in or applicable to gas lamps and burners." A communication. Feb. 2, 1880.
- 463.—BUDENBERG, A., Manchester, "Improvements in apparatus for lifting and forcing water and other fluids." A communication. Feb. 3, 1880.
- 469.—BROUGHAM, F. J., Westminster, "Improvements in or connected with globes or lanterns for lamps or other lighting apparatus." A communication. Feb. 3, 1880.
- 484.—BROWN, T., Rood Lane, London, "Improvements in and apparatus for uniting lead piping." A communication. Feb. 4, 1880.
- 490.—BEAN, W. J. and A. T., Westminster, "Improvements in water-closets, and in waste-preventing cisterns and supply-valves for discharging measured quantities of water or other liquids." Feb. 4, 1880.
- 499.—BOWER, G. and A. S., Saint Neots, Huntingdon, "Improvements in lighting with compressed gas, and in the apparatus employed therein, especially applicable to railway and other carriages, ships, buoys, and isolated buildings." Feb. 4, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 3232.—GEDGE, W. E., Strand, London, "Improvements in kilns, ovens, or furnaces in continuous firing heated by gas or by solid fuel, for firing, baking, or burning ceramic ware, cement, plaster, lime, and other manufactures." A communication. Aug. 12, 1879.
- 3233.—SIMON, R., Nottingham, "Improvements in gas-engines worked by the combustion or explosion of a compressed mixture of gas and air or hydrocarbon and air." Aug. 12, 1879.
- 3470.—LAKE, W. R., Southampton Buildings, London, "Improvements in and relating to apparatus for supplying cities and other places with water." A communication. Aug. 28, 1879.
- 3562.—LAKE, W. R., Southampton Buildings, London, "An improved method of and apparatus for manufacturing carburetted hydrogen gas." A communication. Sept. 4, 1879.

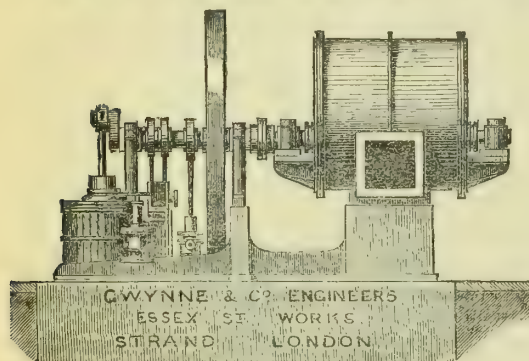
PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

- 227.—PAWSON, W., "Improvements in and connected with water-closets." Jan. 17, 1877.
- 252.—CLERK, D., "Improvements in motive-power engines working with hydrocarbon gas or vapour." Jan. 19, 1877.
- 259.—TASSIE, P., "Improvements in means or arrangements for closing the mouth-pieces of gas-retorts, and in tools for applying the same." Jan. 20, 1877.

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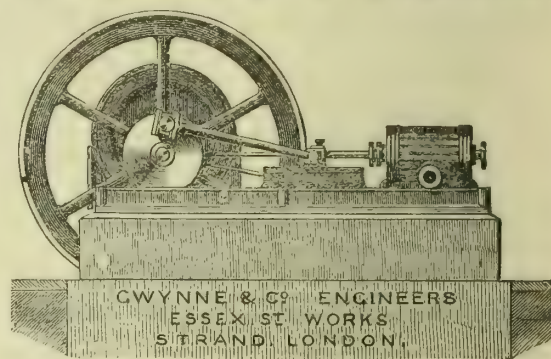
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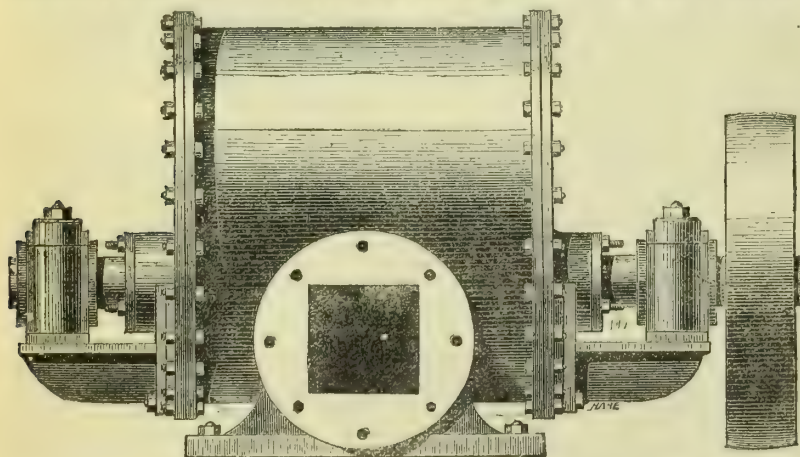
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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, FEBRUARY 17, 1880.

Circular to Gas Companies.

WE can only repeat what we said last week, that we have as yet no information as to any further progress made with the scheme for the amalgamation of the Phoenix and South Metropolitan Gas Companies. It is quite understood that, the Companies having complied with every requirement of the Board of Trade, and no objection being sustained by any Local Authority, the scheme will be sanctioned, and, as a matter of course, passed without further question. Why it hangs fire we are utterly at a loss to conjecture. We cannot suppose that the permanent officials of the Board are neglectful of the obvious duty of sending forward for confirmation by the Privy Council, at the earliest possible opportunity, a document of so much importance. Much at the present time depends on the position which the project occupies. There are, for example, two Bills which await, it may be said, the completion of the amalgamation scheme. One Bill, that of the South Metropolitan Company, has passed the Examiners of Standing Orders, and will, of course, go forward; but the consideration of the Bill of the Phoenix Company by the Examiners has been twice postponed—for what reason we are

not informed. The Bill is somewhat complicated, but that does not concern the Examiners, who have simply to decide whether certain formalities have or have not been complied with. We may assume that the Parliamentary Agent of the Phoenix Company is sufficiently acquainted with the requirements of Standing Orders, that nothing on his part has been neglected to ensure success. It must therefore be guessed that the Company are waiting in expectation of the confirmation of the amalgamation scheme, which will save them the necessity of proceeding with their Bill. It will obviously not be needed, if the South Metropolitan Company persevere and succeed with their measure. All necessary powers, except that required for the purchase of land and the raising of further capital, are to be found in the present Acts of the Company, and the variations proposed in the Phoenix Bill would prove of doubtful utility. We feel satisfied that the initial price of 3s. 9d. per thousand feet with the sliding scale would not be granted, although, under the circumstances, we cannot consider it too high, if the Phoenix Company were left to stand alone; but on this point we need not speculate. The name of the Phoenix Company—we say it without any disrespect—is, we hope, destined to become historical; while a better future awaits both the Shareholders of the Company and the consumers in their district. It cannot be disguised that the South Metropolitan Company are assuming a grave responsibility; but we have not the smallest doubt of the ultimate result. Increased prosperity and augmented dividends are, we believe, certain to follow from a combination so desirable.

The meeting of the Shareholders of the Chartered Company, reported in another column, it will be seen, passed off, if not quite harmoniously, yet with very little to disturb the serenity of the Board of Directors. The Governor's lucid statement of the affairs of the Company seemed to satisfy everybody except Sir Mordaunt Wells, whose objections, however, to the management of this great undertaking were easily answered. But we are somewhat anticipating. In our last we gave a tolerably full *résumé* of the accounts of the Company, and have but few additional items to refer to. One is that of £329 for experiments in improved public lighting. This, what we might almost call Quixotic attempt on the part of the Company to induce the Vestries to improve the illumination of our streets, has, we need hardly say, signally failed, as all attempts of the kind have previously done. Increased illumination means, of course, increased cost, and the vestryman, seeing that this means increased rates, at once sets his face against the proposed improvement. Nothing could have been more successful than the experiments made by the Phoenix Company in the Waterloo Road, and by the Chartered in Waterloo Place; but the money was, so to speak, thrown away. The Vestries, in fact, are now all intent on the electric light, which they expect will prove the ruin of Gas Companies and the salvation of ratepayers. It is a foolish notion; still it has entered the heads of a number of innocent men, and will not be dislodged. Some of the speakers at the Chartered meeting disabused the public of any idea that the electric light could, under any possible circumstances, enter into competition with gas. We hope that they were successful; but recent fluctuations in prices show that some adverse influence is occasionally affecting the price of gas property. The general stability in the price of gas stock, however, is a proof that nothing is disturbing the value of perhaps the most substantial investment to be found.

But to return to the Chartered Company's meeting. Sir Mordaunt Wells objected to the reduction of price recently announced, which was obviously due to the consumers, while being made in the direct interest of the Company. The effect of the reduction made at the commencement of this year will not be seen till after next June. The reduction of twopence per thousand feet is a very serious matter with the Chartered Company. It means, the Governor tells us, a decrease of no less than £100,000 in their annual income. Increased consumption in consequence of a lower price will, however, we have no doubt, soon make up for the deficiency, and indeed add to revenue. With regard to the dividend, we may express a hope that the Directors will proceed cautiously. At the present selling price of gas—3s. 4d. per thousand feet—the Directors may, at the end of this half year, pay eleven and a quarter per cent.; but we quite agree with some of the Shareholders that it would be far better to add to the reserve-fund than pay an enhanced dividend. There is every indication that coal will increase in price, and, let us say what we may, the price of coal must, after all, govern the profits of gas manufacture. It would be well, then, for the Directors to provide what we may call a nest-egg of ample size for future contingencies. Perhaps the Shareholder who recommended

the appropriation of £500,000 to the fund was not so far wrong. The estimate was high, but, after all, the amount cannot be considered excessive.

As a matter of course, the electric light attracted some attention, but happily not much. We shall deprecate all allusions to this invention as a competitor with gas, until we have something tangible to deal with. The Jablochkoff system is, as we know, a reality; but Mr. Edison's crudities are little more than myths, which even his own countrymen hold up to scorn. It was certainly not worth the trouble of any Shareholder in the Chartered Company to refer to the matter. It may, however, be mentioned that the Metropolitan Board of Works have extended their contract with the Société Générale d'Electricité for another two months, at the expiration of which time we suppose we may expect a report, as to the cost, &c., of the light, by the Board's Engineer and Chemist.

As already mentioned, the meeting of the Chartered Company was of a very satisfactory character; the complaints as to the cost of management being easily satisfied. As a matter of fact, we believe that the Directors of Gas Companies do more actual work than falls to the lot of any Board of Railway Directors, who have highly-paid officials to whom they entrust the management, while they themselves meet for the transaction of business perhaps once a month only. The Directors of Gas Companies meet weekly, and in the interim have committee work to attend to, which occupies them another day or two. We are certain, then, that no reasonable Shareholder would begrudge the remuneration allotted to the Directors. Altogether, the management of the Chartered Company is everything that can be desired, and none but an unusually exacting Proprietor can have any cause to grumble.

To our great astonishment, the Corporation of the City of London are persevering with their Bill to effect alterations, which have been described in our columns, in the Acts of the Chartered, the Commercial, and the South Metropolitan Gas Companies. It is a perfectly gratuitous business, for only a small portion of the Chartered Company's district lies within the limits of the Corporation, while those of the two other Companies proposed to be affected lie entirely beyond their control. Perhaps before these lines reach the reader's eye the whole thing will have fallen through. The Bill stood for second reading last evening, and Colonel Makins was to move its rejection. We have a strong suspicion that the Bill would find but few friends in the House, and that, strong as the Corporation of London are in parliamentary influence, the measure would receive but little support. It is a significant fact that the Metropolitan Board of Works decline to join the Corporation in the attempt they have made to alter recent gas legislation. As a matter of course, the Companies interested will, if necessary, strenuously oppose the measure in all its stages; but we cannot think that any opposition will be necessary.

[Since the above was in type, we learn that the consideration of the motion for the second reading of the Bill in the House was adjourned from yesterday till this afternoon.]

The report of the Directors and the accounts of the Barnet District Gas and Water Company have been issued in anticipation of the half-yearly meeting to be held on the 27th inst. The circumstances of the Company are rapidly improving. In the past half year the increased receipts for gas amount to £392 12s. 8d., and for water to £333 9s. 10d., which is a considerable advance upon the corresponding half of the previous year. The balance of receipts over expenditure is £3827 9s., which allows of the payment of a dividend of five per cent. per annum, free of income-tax. We might complain that the report is meagre, giving us really no information as to the condition of the works; but we shall say nothing about this, hoping for details at the coming meeting.

We have now the gas accounts of the Corporation of Birmingham before us, and find that the consumption of gas in the borough goes on developing. Up to the present time the out-districts share in making that increase, and this is of some importance, as soon several of them will drop off, and then Birmingham proper will be left almost to itself. There is, however, sufficient evidence to show that a rapid increase of consumption will continue to be maintained. During the past year the increase in the gas sold has amounted to 150 million feet, or about six per cent., which proves that the Gas Committee are not in at all too great a hurry in undertaking the extensive additions to their Windsor Street works. The total income of the undertaking from all sources amounted to £464,064. Against this has to be placed the total expenditure of £321,803, which leaves a gross profit amounting to £142,261. From this has to be deducted interest on loans,

and the payment of annuities, after which there remains a balance of £51,165, which is to be allocated as follows:—£25,000 is to be handed over to the borough improvement rate, and the remainder carried to the sinking-fund to pay off the purchase-money. It is success like this which tempts Corporations and other Local Authorities to covet gas undertakings, and to obtain them wherever they can; but it must be admitted that all Corporations have not had the good fortune which has attended that of Birmingham. It is due to the energy and skill of all concerned in the management of the undertaking that the results which we have detailed above have been obtained. The Committee labour with a will, and the Engineers and Managers bring to their work an amount of skill which is beyond all praise.

The Jarrow works of the South Shields Gas Company are so advanced that the Directors, on Monday in last week, invited a large party of Corporate Officials and Shareholders to inspect them. There are special features in these works which merit attention. They were fully described to the assembled visitors by Mr. W. J. Warner, the Engineer, and on a future occasion we shall give a further account of them. It is sufficient now to say that nearly every operation is effected by the aid of machinery designed by Mr. Warner, and constructed under his supervision; manual labour being, to a great extent, dispensed with—all, in fact, but what is necessary to work the machinery, some of which is of so simple a character that it can be managed by a child. As stated above, we hope, in a future number, to give a full account, with illustrations, of Mr. Warner's inventions. On Thursday next another party of Engineers and others will visit the works; so that doubtless we shall have further details to publish in a subsequent issue.

The gas consumers of Tring bring grave complaints against the local Gas Company, both as to the quality of the gas and the price at which it is supplied. The Company are non-statutory, and apparently not over successful, for although they charge 5s. 10d. per thousand cubic feet for gas, they only divide seven and a half per cent., though it is true that some small extensions have been made out of profits. The protest of the consumers at a public meeting recently held was of a mild and respectful character, and we hope the Directors will take it into their serious consideration. There are some people in the town who think that the price of gas should be at once reduced to 4s. 6d. per thousand feet, while others, more reasonable, would be content to see it brought down to 5s. 3d. In all cases of this kind it should be borne in mind that Directors and Managers of Gas Companies know their own business best; but perhaps matters at Tring are susceptible of some improvement.

There is also an agitation at Gloucester, to obtain a reduction in the price of gas and the abolition of meter-rents. The Company there have a grievance, which perhaps justifies them in keeping up the price for the present. They were compelled by the Corporation to remove their works and erect new ones at an expense of £40,000—an outlay which, we believe, has not yet proved remunerative. The reduction in price asked for is not large, but if the Company cannot afford to make it, there is, so far, an end to the matter. With regard to the abolition of meter-rents, they constitute an important addition to the income of the Company; still, we agree with a correspondent, whose communication we publish in another column, that it might be well to discontinue them wherever circumstances allowed. Consumers in general regard the rate as a vexatious charge, and think that a Company ought not to make a profit out of the instrument which measures the article they retail. We should, however, be glad to hear the opinions of our readers as to the policy or impolicy of charging meter-rents.

SALE OF SHARES IN THE KINGSTON-ON-THAMES GAS COMPANY.—On Tuesday last, Mr. Nightingale sold by auction ten £50 shares in the above-named Company, who are at present paying 10 per cent. per annum dividend; also three other £50 shares, the dividends on which are limited to 7½ per cent. per annum. The 10 per cent. shares were all quickly sold for £106½, the prices of the shares varying from £102 to £108 each, or an average of just £106 10s. For the three 7½ per cent. shares, £82, £82, and £84 were made. The total amount of the sale was £1313.

YESTERDAY'S PRICES OF GAS AND WATER SHARES.—Mr. A. G. Prater, Stock and Share Broker, of 23, Cornhill, gives the following as the closing prices yesterday of some of the principal gas and water shares:—

Gas Companies.		Water Companies.	
Commercial	180 —183	Chelsea	207 —212
Continental Union	19 —20	East London	210 —213
Crystal Palace District	170 —175	Grand Junction	117 —120
European	17 —18	Kent	288 —293
Gaslight and Coke "A"	180 —182	Lambeth	207 —210
Imperial Continental	176 —178	Southwark & Vauxhall	213 —217
London	175 —180	Do. "D"	173 —178
Phoenix	35½ —36½	West Middlesex	183 —188
South Metropolitan	195 —200		
Do. "B"	178 —183		

Water and Sanitary Notes.

MR. FAWCETT has in vain endeavoured to elicit from the Government the date at which the public Bill that is to authorize the purchase of the Metropolitan water undertakings is to be introduced to the House of Commons. In the face of the announcement made by the Home Secretary, that the intentions of the Government would be disclosed in the course of a week or ten days, the inquiry of Mr. Fawcett must be regarded as a little impertinent. The Government may be safely trusted to make known their intentions when they have any to make known. So far as we can see at the present time, Mr. Cross and his advisers are in a fog. Nothing can be easier than to calculate the value of dividends which are payable; but when this has been done the entire valuation of the Metropolitan water undertakings has not been completed. For instance, we are now told that the valuers estimate of the Companies works will not be concluded until the middle of June next; but, in the interval, it will be perfectly competent for the Government to arrange terms for the purchase of the dividends, and also to constitute a Trust for the future management of the undertakings. The sum which will be required for the purchase has been variously estimated at widely different amounts; but as we shall soon have Mr. Cross's statement, we do not think it worth while to quote mere guesses which have been made as to the total. It is now admitted on all hands that prospective profits must be paid for—some say up to the maximum dividends, which will make the price very high. It would, however, be nothing more than simple justice, for we may take it as certain that every one of the Metropolitan Water Companies would, if left alone, at no distant date pay maximum rates. We have to remain for some time longer in doubt as to the course the Government will pursue; but, in the meantime, it is evident from the prices now obtained for shares in the Companies, that nothing like the confiscation which was hinted at by the Home Secretary last August is feared.

As we predicted, the Metropolitan Vestries are anxious to be represented on any Trust or Commission which may be created for the management of the Metropolitan water undertakings. We are not quite certain of the position taken up by the Chelsea Vestry; but if they petition to be represented, on the ground that the local rates are to be made liable for deficiencies in water revenue, we cannot but think that they have reason on their side. A mere Government commission must not be trusted to tax the Metropolitan ratepayer, should they fail in making a profit out of the water supply.

The Bill of the Southwark and Vauxhall Water Company has passed the Examiners of Standing Orders, and will now, we hope, go forward. We confess to some strong sympathy with the promoters of the measure, who have done what should have been done long since—viz., made an attempt to effect the amalgamation of all the Metropolitan Water Companies. Some few years ago but little opposition would probably have been made to the proposal, and it may be that should the Government fail in achieving their professed object, difficulties will only arise in one particular quarter. The New River Company we feel assured will refuse to take any secondary position; but they might be left out of the combination, without any disadvantage to the scheme. Supposing the Bill to be carried, we would suggest the commencement by amalgamating the three Companies south of the Thames. Several advantages would ensue from such a combination. The works all united, a scarcity of water would be hardly possible; but it is useless to speculate. Metropolitan water affairs are in such a position that it is difficult to guess what may or may not happen.

It would seem that a deficiency of water is already threatened in various parts of the country. The Liverpool Corporation are just now in alarm, for their stock of water decreases every week, and no rain comes to fill up the gradually exhausted reservoirs. The stock of water in the Rivington reservoirs is lower now than it has ever been since the dry season of 1868. At Bristol, too, a very deficient rainfall is noticed, which, if continued, must produce serious inconvenience. To Liverpool a deficiency in the water supply would be a most important matter. The vast population depending upon the Corporation for a supply would suffer greatly if it should be necessary to impose restrictions on the employment of the water. By great care and diligence, Mr. G. F. Deacon, the Borough Water Engineer, has succeeded in reducing the consumption to 22·80 gallons per head of the population; but even this decreased quantity must be considered to involve great waste. Sixteen gallons per head per day is quite sufficient for any population; and even when Liverpool obtains, as we hope it will, the additional supply

from the Vyrnwy, we trust that continued efforts will be made to keep down waste.

We always expected that considerable opposition would be made to the Vyrnwy scheme of the Corporation of Liverpool. It is natural that the various towns and cities lying in the Valley of the Severn, and who draw their supply of water from that river, should take alarm at the prospect of seeing abstracted some of the best water which flows into it. The Vyrnwy water is, we believe, admitted to be the purest which finds its way into the Severn, and accordingly opposition to the Liverpool water scheme comes from such towns and places as Tewkesbury, Shrewsbury, Worcester, Gloucester, Cheltenham, and others, which are indebted more or less to the Severn for their water. An influential deputation from the above-mentioned places waited on the President of the Local Government Board last week, to urge that the Government should interfere to prevent Liverpool from going for a water supply to a watershed which did not geographically and naturally belong to it. It was represented that other sources were available, which would leave the Severn unaffected. There were, for example, the sources of the Dee, about the appropriation of which much was said some years ago. Then the deputation expressed an opinion that Liverpool might share with Manchester in the advantages of the Thirlmere scheme; and, if neither proposal suited, there was the possibility of obtaining an independent supply from another of the Cumberland Lakes—say Haweswater. From Mr. Sclater-Booth's reply to the deputation, it seems certain that Government interference in the matter is not to be expected. The Bill of the Corporation of Liverpool must go through the constitutional process of being referred to, and reported upon by a Parliamentary Committee, before whom the opponents of the measure may bring their several allegations. Will, for example, the commerce of the Severn be at all interfered with, if the scheme of the Liverpool Corporation be carried out? Will the salmon fisheries be at all affected? And, lastly, how far is it likely that the water supply of the towns down the river will be either circumscribed or damaged if the Vyrnwy waters be stopped out? All these questions will be thoroughly discussed before a Committee, who will, in the end, decide for or against the scheme. The contest will be a long and, we fear, expensive one. The comparatively small towns along the Severn have to fight a rich and powerful Corporation, who will call to their assistance all that money can purchase in the way of learning and talent—legal, engineering, and chemical.

The Local Government Board have, as a matter of course, ordered an inquiry to be made before they sanction the Provisional Order applied for by the Lower Thames Valley Main Sewerage Board. The object of the Board is to obtain power to take land compulsorily, on which to utilize the sewage of the joint district. The Local Boards interested now appear to offer much opposition. Teddington, which endeavoured to escape from the combination, is held fast by the fiat of the Local Government Board, who refused to allow them to go. Now they resolve to oppose the scheme of the Joint Board, but grumble dreadfully at the expense in which they will probably be landed. East Molesey also opposes, and the Corporation of Kingston are loud in their opposition. Altogether, things do not look promising for the issuing of the Order. We strongly suspect that even without the opposition of landowners and occupiers of villas, &c., which must be anticipated, the scheme of the Joint Board will collapse. It is expected that the inquiry will be opened in about a fortnight's time, and may last a week or two; so there will be ample opportunity for engineers and lawyers to reap a fair harvest.

WIDNES LOCAL BOARD GAS AND WATER SUPPLY.—At the meeting of the Widnes Local Board, last Tuesday, a report was presented by the Engineer (Mr. J. Roberts), which stated that the total amount of water pumped during 1879 was 492,956,894 gallons; during 1878, 484,028,451 gallons; showing an increase of 1·80 per cent. for 1879. The total rainfall for the year 1879 was 29·16 inches, against 33·71 for 1878. The total quantity of gas made during 1879 was 71,075,000 cubic feet; during 1878, 70,175,000 feet; or an increase of 1·28 per cent. for 1879. The average illuminating power of the gas for the past month was 17·14 candles; and for the whole of 1879, 17·2 candles.

THE GAS SUPPLY OF RAWMARSH.—At the monthly meeting of the Rawmarsh Local Board, on Wednesday last, the Clerk stated that he had received the award made by Messrs. George Wilson Stevenson and George Livesey, who were appointed on behalf of the Rotherham Corporation and the Rawmarsh Local Board, to arbitrate with regard to the value of the gas-mains belonging to the Rotherham Corporation, in the district of the Local Board, which are to be transferred to the Board under the powers of the Rawmarsh Gas Act, 1879. The Arbitrators fixed the sum to be paid by the Local Board for the purchase from the Corporation of all mains, pipes, apparatus, and other things in connection with the supply of gas referred to, at £3236 14s. 5d., each party to pay their own costs, and one-half of the costs of the award, which amounted to £127. On the motion of Mr. Jackson, seconded by Mr. Goodinson, it was resolved that the transfer of the mains from the Corporation be completed.

BOARD OF TRADE REPORT ON THE
GAS AND WATER BILLS AND PROVISIONAL ORDERS
FOR THE SESSION OF 1880.

The "Report of the Board of Trade upon all the Railway, Canal, Tramway, Gas, and Water Bills of Session 1880," was presented to the House of Commons on the 5th inst. From it, it appears that the number of Bills this session of which the Board take cognizance amounts to 172, against 194 in the session of 1879. The total amount of money proposed to be raised is £31,042,900, against £29,967,386, or an increase in the session of 1880, as compared with the session of 1879, of £1,075,514.

The number of Bills which relate to the supply of gas is 27. There is no Scotch Bill, and only one Irish—Cork. It should be stated that of these 27, in 3 there are included provisions relating to the supply of water. The capital asked for amounts to £4,416,250—viz., £2,831,000 by shares, and £1,585,250 by loan. There are, in addition to the 3 above mentioned, 20 Water Bills—15 English, 1 Scotch, and 4 Irish. The capital asked for by these Bills is £5,084,900, the greater part (£4,240,200) by loans, only £844,700 being proposed to be raised by shares.

The Provisional Orders deposited with the Board, under the provisions of the Gas and Water Works Facilities Act, include 7 in reference to gas, and 8 to water supply. The capital proposed is—for gas, £117,500 by shares, and £46,000 by loans; and for water, £185,000 and £43,750, respectively.

Of the 47 Bills, 24 relate to the supply of gas only (if we except those which contain provisions also for the use of the electric light) and 3—Lancaster Corporation, Oldham Improvement, and Wigan Improvement Bills—to the supply of both gas and water; 8 being proposed by corporations or local boards, 2 by new companies, and 17 by existing companies. The remaining 20 Bills, which are solely in reference to water supply, are promoted—14 by corporations and local boards, 2 by new companies, and 4 by existing companies.

An analysis of the Bills and Orders is appended to the report, showing, for the Gas Bills, the object of each Bill, the capital proposed to be raised by shares and loans, the special rate of dividend (if any), the proposed standard of illuminating power, and the proposed maximum price per 1000 cubic feet; and for the Water Bills, the object of each Bill, and the capital proposed. A grouping list is also added, dividing the Bills into those promoted for the North and South of England, Scotland and Ireland.

Communicated Article.

THE THEORY OF DISSOCIATION.

By Mr. H. B. DIXON, M.A.,

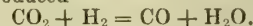
Millard Lecturer on Chemistry at Balliol and Trinity Colleges, Oxford.

By Dissociation is meant the breaking up of a compound body, by an increase of temperature, into two or more simpler bodies, which, as the temperature is allowed to fall, recombine to reproduce the original compound. The term was introduced into chemical science by Henri St. Claire Deville. In 1857 he wrote to the French Academy:—

When heat acts on any matter it produces a dilatation, which is attributed to a force that has been named *the repulsive force of heat*. By choosing suitable matter for the experiment, and raising the temperature sufficiently, the distance between the molecules can be increased to such a degree that they separate, and pass into the elementary state. There is a spontaneous decomposition, in the sense that no chemical phenomenon intervenes to determine it. This I have proposed to call the "dissociation of compound bodies."

The experiment of Grove on the decomposition of water by a white-hot platinum wire was the starting point of Deville's classic researches on this subject. He began by repeating Grove's experiment on a large scale. He melted a quantity of platinum in the oxy-hydrogen flame, and poured the mass into water. The molten metal produced an abundant disengagement of an explosive gas, consisting of hydrogen and oxygen, together with a small quantity of nitrogen previously held in solution by the water. The water is partially decomposed by the heat of the platinum into its constituent elements. The temperature produced by the chemical union of oxygen and hydrogen to form water is sufficiently high to melt platinum. The white-hot wire used by Grove cannot have so high a temperature as the oxyhydrogen flame, and cannot, therefore, when placed into water, raise its temperature to a degree higher than that produced by its formation from oxygen and hydrogen. How is it that water is decomposed at a temperature certainly not higher than the temperature at which it is formed? Such is the paradox which St. Claire Deville set himself to explain. He found that many compound substances are partially decomposed by heat at a temperature considerably below that required for their complete decomposition into their constituents, just as liquids begin to volatilize at a temperature below that of their fixed boiling points. Not only is water partially decomposed at the temperature of the oxyhydrogen flame, but even at the melting point of silver, about 1000° centigrade. When silver is melted in an atmosphere of steam, it dissolves a considerable quantity of oxygen, and the equivalent quantity of hydrogen is found in the free state when the vessel cools. This decomposition, Deville shows, cannot be attributed to the chemical affinity of the silver for oxygen, for oxide of silver gives up its oxygen at the temperature of melted silver. The silver acts as a filter to separate the oxygen from a mechanical mixture of hydrogen and oxygen. By passing steam rapidly through a white-hot platinum tube, Deville failed to obtain any permanent gas, owing to the complete reunion of the dissociated oxygen and hydrogen on cooling. By taking advantage of the superior *diffusive* power of hydrogen over oxygen, Deville succeeded in separating hydrogen from heated

steam in the following way:—A tube of porous earthenware was enclosed in a larger tube of glazed porcelain; through the inner porous tube a current of steam was passed; and in the annular space outside it a current of carbonic acid. The gases which escaped from the tubes were collected in separate vessels over a concentrated solution of potash, by which the carbonic acid was completely absorbed. The porcelain tube was placed in a charcoal furnace, and heated to about 1200° C. From the inner porous tube an explosive mixture of oxygen, hydrogen, and nitrogen was obtained in one receiver; from the outer tube an explosive mixture of oxygen, hydrogen, carbonic oxide, and nitrogen was obtained in the other receiver. The steam is partially dissociated into oxygen and hydrogen in the porous tube; and since hydrogen diffuses through a porous diaphragm four times as fast as oxygen, the outer tube receives continually, by diffusion from the inner tube, a supply of gas in which the proportion of hydrogen to oxygen is greater than that in which these gases unite to form steam. The inner tube, which contains oxygen in excess above that required to form steam with the remaining hydrogen, also receives by diffusion from the outer tube a supply of carbonic acid. In the outer tube the carbonic acid and free hydrogen undergo a chemical reaction, whereby steam and carbonic oxide are produced—



This reaction is limited owing to the reverse action of steam on carbonic oxide to re-form carbonic acid and hydrogen. In the outer tube there will thus be carbonic acid and steam, and, in small proportions, free hydrogen, free carbonic oxide, and free oxygen. In the inner tube the same gases will be present in different proportions. When the gases in the two tubes cool, the oxygen and hydrogen present combine in fixed proportion to form steam, leaving in the inner tube an excess of oxygen, in the outer an excess of hydrogen. A certain portion, therefore, of whatever carbonic oxide is present in the outer tube escapes oxidation on cooling; while whatever carbonic oxide is present in the inner tube is oxidized to carbonic acid by the excess of oxygen. The small quantity of nitrogen found in the receiver was due to a small admixture of air in the carbonic acid and steam, and to the passage through the white-hot porcelain of some nitrogen from the furnace.

In a second experiment, Deville passed nitrogen through the outer tube, and found free hydrogen in the outer, and free oxygen in the inner tube, on passing a current of steam through the inner porous tube at a white heat.

Instead of submitting the dissociated gases to diffusion, Deville found that he could prevent complete recombination of oxygen and hydrogen by mixing them with a sufficiently large volume of an inert gas, such as carbonic acid or nitrogen. A glazed porcelain tube was filled with fragments of porcelain, and heated to whiteness in a furnace; through the tube a current of carbonic acid was passed, together with steam. The gases coming from the heated tube were collected over potash, by which the undecomposed carbonic acid was absorbed. An explosive mixture, consisting of oxygen, hydrogen, carbonic oxide, and nitrogen, in the following proportions, was gradually collected:—

	(1)	(2)
Oxygen	46.1	46.8
Hydrogen	35.4	31.9
Carbonic oxide	12.0	10.7
Nitrogen	6.5	10.6
	100.0	100.0

In this case the complete recombination of the oxygen and hydrogen is prevented by their great dilution with carbonic acid. The cooling is sufficiently rapid to reduce the temperature of the mixture below the point at which oxygen and hydrogen unite before all the scattered molecules can find their mates in the crowd.

In a later experiment, Deville passed pure carbonic acid alone through a porcelain tube filled with fragments, and heated to whiteness. The issuing gas was not completely absorbed by potash, but a small quantity of an explosive mixture of carbonic oxide and oxygen was collected, the complete reunion of the two gases being prevented by the large volume of inert carbonic acid with which they were mixed during the time they were cooling and were within the limits of temperature between which the gases exhibit a chemical affinity one for the other.

In the above-described experiments on the dissociation of gases, the actual amount of decomposition proved to have taken place is exceedingly small. Deville endeavoured to determine the amount of dissociation undergone by a given weight of steam at a temperature of 1100° C. by taking its vapour density in a porcelain vessel. In decomposing into oxygen and hydrogen, steam increases in bulk by half its volume, and consequently becomes lighter. An accurate determination of its density should thus afford the information required. The density of steam determined at this high temperature showed no sign of any diminution. The amount of steam dissociated must accordingly be inconsiderable. This experiment of Deville had an important bearing on the controversy which was first raised in 1862 on the condition of gaseous compounds at a high temperature—a controversy which has lasted till the present day, and the progress of which, as it has exerted a great influence on our ideas of matter in the gaseous state, I propose to briefly chronicle in the pages of the JOURNAL.

Wishing to obtain more exact measurements of the decomposition effected by rise of temperature, Deville experimented with compounds which are non-volatile at ordinary temperatures, but which give off a gas when strongly heated. He found that when certain salts, of which one of the constituents was volatile, were heated in a closed tube, they suffered partial decomposition, the amount of which varied

with the temperature. The volatile constituent, filling the tube, acquired an increasing tension as the decomposition progressed, until at a given temperature an equilibrium was established between the tension of the gas and the tendency of the compound to break up; such that on raising the temperature further decomposition of the salt occurred, and on lowering the temperature a recombination of the separated constituents took place. Whether with a falling or rising thermometer, the amount of decomposition was a function of the temperature. At any particular temperature the tendency of the salt to break up was prevented by a sufficient accumulation of the volatile constituent round it. When powdered chalk is heated in an iron tube, exhausted of air by means of a pump, no decomposition takes place until the temperature reaches dull redness. Then, as the temperature is raised, the vacuum in the tube is gradually impaired, showing that the chalk is undergoing decomposition. At the temperature of boiling cadmium (about 800°C .), the tension of the gas in the tube reaches 85 mm. of mercury ($3\frac{1}{4}$ inches). Decomposition then ceases. The tendency of the carbonic acid to leave the lime is balanced by the pressure of the atmosphere of carbonic acid in the tube. On placing the iron tube into the vapour of boiling zinc (somewhat over 1000°C .), more carbonic acid is given off by the chalk until its tension reaches 520 mm. ($20\frac{1}{2}$ inches) of mercury, when the decomposition is again arrested. If the pump is now worked, and some of the carbonic acid carried out of the tube, decomposition sets in until the equilibrium is restored by a fresh supply of carbonic acid to the atmosphere of the tube. On allowing the tube and contents to cool, the carbonic acid is re-absorbed by the lime, and when the ordinary temperature is reached the vacuum is completely restored. If the temperature being kept constant, the pressure of the gas in the tube is increased by mechanical means, such as lessening the space above the chalk, equilibrium is re-established by an equivalent absorption of the carbonic acid by the lime, so that, *ceteris paribus*, the amount of decomposition of a given weight of chalk depends on the size of the vessel in which it is heated.

The same partial decomposition occurs in the case of many hydrated salts. When heated in an exhausted sealed tube connected with a pressure-gauge, they give up their water till the tension of the steam reaches a certain degree, which is constant for a given temperature. On raising the temperature more steam is given out by the salt, and on lowering the temperature the steam is re-absorbed.

(To be continued.)

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

METER-RENTS.

SIR,—I have found, from experience, that one drawback to the more general use of gas by small consumers, for domestic purposes, is the charge for meter-rent. Supposing a company in the financial position to abolish this charge, what argument can be used in favour of its retention? I believe some companies have discontinued charging for meters, and I should be glad if you or any of your readers can give me some data on the subject. A tradesman does not charge separately for the use of his weights or measures. Why should a gas company do so?

A PROVINCIAL SECRETARY.

THE ALLEGED DESTRUCTION OF LEATHER BOOKBINDINGS BY GAS.

SIR,—With reference to the article on "The Alleged Destruction of Leather Bookbindings by Gas," given in the last issue of your JOURNAL, I send with this a reprint of a paper read before the Library Association at Oxford in 1878, by which you will see that the destruction of the binding of the books in the Literary and Scientific Institution of Bath by sulphuric acid was found to take place equally in the rooms that were not lighted by gas and in those rooms that were. Consequently, so far as this instance is concerned, no case has been made out as against gas, and the mischief would appear to be due to the use of sulphuric acid in the manufacture of certain kinds of leather, notably calf.

Bath, Feb. 14, 1880.

CHARLES EGIN, F.C.S.

The paper referred to was one by the Librarian of the Royal Literary and Scientific Institution, Bath (Mr. C. P. Russell), in which he says: Upon many of the volumes in the library of the Bath Royal Institution, especially upon those bound in calf, I have observed a white deposit, which, upon being applied to the tongue, I found to be of a sharp acid flavour. The thin basil labels, to my great annoyance, constantly became loose, and dropped from the backs of the books without being touched. I found that under these loosened labels there was a larger accumulation of the same white powder. Hoping to find a remedy for this state of things, I collected some of the powder, and sent it to Mr. Ekin, an Analytical Chemist in Bath, who kindly undertook to examine it. His report is as follows:—

"Analytical Laboratory, 8, Argyle Street, Bath, Sept. 25, 1878.

"Dear Mr. Russell,—I have examined at your request a dirty-looking crystalline powder taken from under the labels of books bound in calf, and one of the labels themselves—these books not having been exposed to the action of gas. Also a similar-looking powder from under the labels of books in the reading-room, where gas is burnt.

"The powders consist of sulphate of ammonia, with a large proportion of free sulphuric acid. The washings from the label give a very acid reaction to test-paper, and also contain sulphuric acid.

"There can be no doubt that it is the uncombined sulphuric acid that is occasioning the damage to your bindings, but inasmuch as books that to your knowledge have not been exposed to the action of gas for many years are equally affected with books that have been kept in rooms where gas is burnt, and moreover as it is only certain materials, such as calf, that are affected in this way, it does not appear that a very clear case has been made out against gas. It may be that the books were exposed to the products of the combustion of gas before they came under your supervision, although it is hardly likely in that case that the action of the acid would

not have shown itself sooner. It is possible that sulphuric acid is used to dress calf and the other materials that are affected, and gradually brings about decomposition. The whole subject is worthy of further investigation.—Yours truly,

"CHARLES EGIN, F.C.S."

As the larger accumulation of the acid is under the label, and not on its surface, I am disposed to think with Mr. Ekin that the dressing of the leather has much to do with it.*

THE GAS REFEREES SULPHUR TEST.

SIR,—With the experience of more than 16,000 tests made by the Referees Sulphur Test, I beg to be permitted to say that I have never had such an accident as Mr. Greville described in last week's JOURNAL. I may, however, say that similar appearances have always been observed when the burner has been "alight underneath." I find that the lost experiments average under $\frac{1}{2}$ per cent., and are chiefly due to stoppage of the gas supply in the services, the rubber connections breaking, and the burners lighting underneath; but I have never yet lost a test from liquor running down the tubulure and trumpet tube, except when the burner has been alight underneath.

When working the sulphur test according to the Gas Referees plan, I have found the amounts of liquor vary very much according to the temperature of the outside air. In very cold weather I have had over 12 ounces, and in warm rooms as little as $6\frac{1}{2}$ ounces.

To any one interested in this matter I would suggest two simple experiments which will perhaps give some information on the influences of varying quantities of liquor upon the results. Instead of giving the eduction pipe a fall into the cylinder, let it incline the other way, so that its outlet is a little below the top of the cylinder, and place a beaker so as to catch the liquor condensing in the eduction pipe. Test this liquor separately from that and the washings of the other parts of the apparatus. Also leave off the eduction pipe altogether, so as only to obtain about $\frac{1}{2}$ -oz. liquor in the bottom of the cylinder; and find whether the results are the same as in a sulphur apparatus with the eduction pipe. These two experiments will show the value of the eduction pipe and the liquor condensed by it. I satisfied myself on this point four or five years ago.

The secret of good sulphur results I believe to be good ventilation. I could say much on this point, but will be contented with stating that most of the very low sulphur results—say under 6 grains per 100 cubic feet—that have come under my notice (not explainable by leakage) have been due to bad ventilation. The large quantity of liquor condensed by Wright's Sulphur Test with the Liebig condenser, and the low sulphur results this test gave, will be in the recollection of many of your readers.

Any experiences others may be able to give will be appreciated by
Feb. 11, 1880. ANOTHER F.C.S.

THE RECENT FIRE AT THE DUBLIN THEATRE ROYAL.—We regret to learn that this melancholy occurrence was attended by two accidents to persons in whom we are specially interested. Mr. Thomas Cotton, Assistant Secretary and Superintendent of the Alliance Gas Company, on hearing of the fire, proceeded immediately to the theatre with the view of securing the gas-meters. He made his way to the stage and ascertained that the gasman had previously turned off the gas from all the meters. The smoke was, however, so suffocating that Mr. Cotton was dragged out of the blazing building in a state of exhaustion. In order to prevent the chance of an explosion, he gave directions at once to have the street-valves in Poolbeg Street turned off; and while engaged in this service Mr. John Waterfield, son of the Gas Company's Engineer, sustained a fracture of the leg by the fall of a portion of the wall of the theatre. The latest accounts state that Mr. Waterfield is progressing favourably.

THE MALTON GAS COMPANY'S BILL.—On Thursday, the 5th inst., a meeting of owners and ratepayers of Malton was held for the purpose of considering whether the town should support the Local Board in their opposition to the Bill now being promoted in Parliament by the local Gas Company. The Chairman of the Board (Mr. H. Hartley) presided, and after having explained the portions of the Bill which the Board think inimical to the interests of the ratepayers, submitted a resolution consenting to the Board's opposition to the Bill. On being put to the meeting, the resolution was passed by a large majority; whereupon a poll was demanded, and this will be taken in a few days. On the following Saturday a public meeting was held on the subject, when the accompanying resolution was carried unanimously:—"That this meeting approves of the action of the Local Board in opposing the Bill set down to be passed through Parliament by the Gas Company, and pledges itself to support them to the utmost of their power; also to advocate the purchase, as soon as possible, at a fair and reasonable price, of the gas-works, so that the ratepayers can have the advantage of being their own gas producers."

KILDWICK PARISH GAS COMPANY.—The ordinary half-yearly meeting of this Company was held on Tuesday, the 3rd inst., when the report presented by the Directors stated that the total receipts on capital account, including £18,544, the proceeds of £9 10s. per share paid up on 1952 shares of £10 each, first issue, and £9956, the proceeds of £9 10s. per share paid up on 1048 shares of £10 each, second issue, were £28,798 6s. 4d. The disbursements, which included £2919 12s. 10d. for land and law charges, £14,744 16s. 4d. for new buildings, works, apparatus, &c. (of which sum £333 15s. 11d. was expended during last half year), £7666 18s. 2d. for new mains and service-pipes, and £2364 1s. 5d. for law and parliamentary charges, amounted to £27,879 13s. 5½d., thus leaving a debit balance of £918 12s. 10½d. The revenue account showed receipts from sale of gas and meter-rents, £64 19s. 4d.; sale of residual products, £124 5s. 11d.; sundries, £9 19s. 9d.—total, £777 5s. The payments were for the manufacture of gas, £336 7s. 10d.; management, wages, rates, and taxes, £70 19s. 5d.; leaving a balance in favour of the Company of £369 17s. 9d. The net amount of profits available for the half year was £365 18s. 10d., which represented a steady increase on previous returns. The Directors recommended the balance to be disposed of as follows:—"To pay a dividend of $1\frac{1}{4}$ per cent., free of income-tax, which will require the sum of £356 3s. 7d., leaving a balance of £9 15s. 3d. to be carried to the contingent-fund, which, with a previous amount of £184 13s. 9½d. brought forward, will now stand at £194 9s.

* I find upon reference to the article on "Tanning" in the *Encyclopædia Britannica*, that sulphuric acid was formerly largely used in many of the processes employed for dressing the skins as there described. The hides were in some cases submitted to a scouring operation, and immersed for a certain time in a pit containing "water strongly impregnated with vitriolic or sulphuric acid." This would be quite sufficient to account for the presence of the acid in the old leather bindings, and the decomposition caused by its action upon the leather.

No. 2.—STATEMENT OF LOAN CAPITAL.

Acts of Parliament authorizing the Loan Capital.	Total Amount authorized.	Description of Loan.	RATES PER CENT. OF INTEREST.				Total Amount borrowed.	Remaining to be borrowed.
			4 per Cent.	4½ per Cent.	4½ per Cent.	10 per Cent.		
The Gaslight and Coke Company's Act, 1868.	£162,500	Debentures. Debenture stock. Bonds for capitalized profits.	£67,000 751,310	£50,000 50,000	£329,850 263,350 £130,000	£1,643,510	£17,990
The City of London Gas Company's Act, 1859	60,000							
The Great Central Gas Consumers Act, 1851	66,000							
The Victoria Docks Gas Act, 1857	25,000							
The Companies Act, 1862, as applied to the Western Gaslight Company, Limited	200,000							
The Imperial Gas Act, 1854	173,000							
The Imperial Gas Act, 1866	81,250	900,000
The Imperial Gas Act, 1869	243,750							
The Gaslight and Coke Company's Act, 1872	250,000							
The Gaslight and Coke Company Act, 1876	100,000							
	900,000							
	£2,561,500		£818,310	£100,000	£395,200	£130,000	£1,643,510	£917,990

Dr		No. 3.—CAPITAL ACCOUNT.						Cr.			
		Expended this Half Year.		Total Expenditure to Dec. 31, 1879.		Receipts to June 30, 1879.		Received since that date.		Total Receipts to Dec. 31, 1879.	
		£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.
To Expenditure to June 30, 1879				8,566,633	12 11	By A Ordinary stock		4,100,640	0 0	4,208,535 0 0	
Expenditure during half year to Dec. 31, 1879—						A 5 per cent. preference convertible stock		*1,870	0 0	1,760 0 0	
viz.:						A 5 per cent. preference convertible stock, 2nd issue		1,800	0 0	1,800 0 0	
Lands acquired, including law charges		16,838	3 4			A 5 per cent. preference shares, 3rd issue		*5,690	0 0	5,650 0 0	
Buildings and machinery in extension of works		137,498	13 7			A 5 per cent. preference shares, 4th issue		500,000	0 0	500,000 0 0	
New and additional mains and service-pipes		19,145	17 1			A 5 per cent. preference shares, 5th issue		500,000	0 0	500,000 0 0	
New and additional meters		5,274	3 5			B 4 per cent. maximum stock		100,000	0 0	100,000 0 0	
Further expenses of issues of new capital		607	5 0			C 10 per cent. preference stock		200,000	0 0	200,000 0 0	
Cr.				179,364	2 5	D 10 " " " "		300,000	0 0	300,000 0 0	
By Sale of surplus land £828 9 7						E 10 " " " "		165,000	0 0	165,000 0 0	
Premium capital for expenses of issues of new capital 681 9 2				1,509	18 9	F 5 " " " "		30,000	0 0	30,000 0 0	
						G 7½ " " " "		60,000	0 0	60,000 0 0	
				177,854	3 8	H 7 per cent. maximum stock		1,300,000	0 0	1,300,000 0 0	
						Debentures		466,850	0 0	446,850 0 0	
						Debenture stock, 4½ per cent.		263,350	0 0	263,350 0 0	
						" " 4½ " "		50,000	0 0	50,000 0 0	
						" " 4 " "		617,000	0 0	751,310 0 0	
						Bonds for capitalized profits		130,000	0 0	130,000 0 0	
				8,744,487	16 7	Premium capital		8,794,200	0 0	9,016,255 0 0	
				352,283	4 9					80,516 1 4	
To Balance of capital account								8,794,200	0 0	302,571 1 4	
				9,096,771	1 4					9,096,771 1 4	

No. 4.—REVENUE ACCOUNT.

To Manufacture of gas—		£ s. d.	£ s. d.	By Sale of gas—	£ s. d.	£ s. d.
Coals, including dues, carriage, unloading, and trimming (see Account No. 9)		454,956 19 8		Common gas, per meter, at 3s. 6d. and 3s. 4d. per 1000 cubic feet		891,534 12 8
Salaries of Engineers and other Officers at works		7,635 5 6		Cannel gas, per meter, at 4s. 4d. and 4s. 2d. per 1000 cubic feet		52,537 4 4
Wages (carbonizing)		82,466 19 9		Public lighting and under contracts—		
Purification, including £14,035 3s. 11d. for labour		28,359 9 9		Common gas		62,061 18 8
Repair and maintenance of works and plant, materials and labour; less received for old materials, £2835 13s. 9d.		153,330 3 3		Cannel gas		3,207 7 3
			726,748 17 11	(See Statement No. 11)		
Distribution of gas—				Rental of meters		1,009,341 2 11
Salaries and wages of Officers (including Rental Clerks)		18,616 6 8		Residual products—		18,369 13 8
Repair, maintenance, and renewal of mains and service-pipes		36,019 11 6		Coke, less £22,592 15s. 4d. for labour, &c.		119,849 19 4
Repairs and renewals of meters		18,644 2 2		Breeze, less £2151 18s. 3d. for ditto		1,587 3 6
			73,280 0 4	Tar, less £407 8s. 7d. for ditto		54,980 15 6
Public lamps—				Tar products		34,615 6 1
Lighting and repairing		11,577 15 3		Ammoniacal liquor, less £348 15s. 11d. for labour, &c.		54,733 16 2
Experimental street lighting		329 3 6		Sulphate of ammonia		4,964 17 4
			11,906 18 9			270,731 17 11
Rents, rates, and taxes—				Rents receivable		2,168 1 0
Rents payable		4,939 13 2		Transfer fees		209 10 0
Rates and taxes		35,672 13 7		Canteen account		223 17
			40,612 6 9			
Management—						
Directors allowance		3,750 0 0				
Company's Auditors		250 0 0				
Salaries of Secretary, Accountant, and Clerks		6,040 13 6				
Collectors commission		11,939 19 3				
Stationery and printing		3,181 1 8				
General charges		1,760 3 9				
			26,921 18 2			
Parliamentary charges			1,116 7 4			
Law charges			628 15 2			
Bad debts			5,543 16 6			
Depreciation-fund, for works on leasehold lands			750 0 0			
Superannuation allowances under amalgamation schemes, and annuities			8,337 1 10			
Public officers—						
Gas Referees and Official Auditor		963 7 5				
Public testing-stations		408 16 1				
			1,372 3 6			
			896,618 6 3			
Balance carried to net revenue account (No. 5)			404,420 16 9			
			1,301,049 3 0			1,301,049 3 0

No. 5.—NET REVENUE ACCOUNT.

	£	s.	d.	£	s.	d.		£	s.	d.	£	s.	d.
To Interest on debentures, debenture stocks, and bonds, accrued to Dec. 31, 1879				37,079	11	0	By Balance from last account	327,210	8	2			
Dividend on A 5 per cent. pref. shares and stock	25,230	5	0				Less dividend on ordinary capital for the half year to June 30, 1879	215,283	12	0			
Dividend on B stock, at 4 per cent.											111,926	16	2
" C " 10 "	10,000	0	0										
" D " 10 "													
" E " 10 "	8,250	0	0										
" F " 5 "							Revenue account (No. 4)				404,430	16	9
" G " 7½ "	2,250	0	0										
" H " 7 "	45,500	0	0										
				108,980	5	0							
Interest on temporary loans				1,104	1	0							
Balance applicable to dividend on the ordinary stock				369,193	15	11							
				516,357	12	11					516,357	12	11

No. 6.—RESERVE-FUND ACCOUNT.

Balance, Dec. 31, 1879 . . .	£152,420 8 10	Balance, June 30, 1879 . . .	£150,079 5 10
		Interest on amount invested . . .	2,341 8 0
	£152,420 8 10		£152,420 8 10

No. 7.—INSURANCE-FUND ACCOUNT.

Balance, Dec. 31, 1879 . . .	£76,588 7 4	Balance, June 30, 1879 . . .	£75,423 18 5
		Interest on amount invested . . .	1,164 8 11
	£76,588 7 4		£76,588 7 4

No. 8.—DEPRECIATION-FUND ACCOUNT (FOR WORKS ON LEASEHOLD LANDS).

Balance, Dec. 31, 1879 . . .	£13,392 7 6	Balance, June 30, 1879 . . .	£12,449 11 4
		Amount brought from revenue account for the half year . . .	750 0 0
		Interest on amount invested . . .	192 16 2
	£13,392 7 6		£13,392 7 6

No. 9.—STATEMENT OF COALS USED, ETC.

Description of Coal.	In Store, June 30, 1879.	Received during Half Year.	Carbonized during Half Year.	Used during Half Year.	In Store, Dec. 31, 1879.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common Cannel	66,641 15,572	612,696 50,000	552,045 46,432	563 48	126,729 19,092

No. 10.—STATEMENT OF RESIDUAL PRODUCTS.

Description of Residual.	In Store, June 30, 1879.	Made during Half Year.	Used in Manufacture during Half Year.	Sold during Half Year.	In Store, Dec. 31, 1879.
Coke—chaldrons*	98,971	706,546	200,813	570,529	34,175
Breeze—chaldrons*	9,632	59,643	..	61,107	5,168
Tar—gallons	451,031	6,542,529	..	6,398,662	594,896
Ammoniacal liquor—batts of 108 gallons	15,575	178,898	..	173,371	21,102

* Under "Weights and Measures Act, 1878."

No. 11.—STATEMENT OF GAS MADE, SOLD, ETC.

Description of Gas.	Quantity Made (part measured).	QUANTITY SOLD.			Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lamps.
		Public Lights and under Contracts (estimated).	Private Lights (per Meter).	Total Quantity Sold.				
Common	Thousands. 5,799,357	Thousands. 300,236	Thousands. 5,117,388	Thousands. 5,417,624	Thousands. 68,201	Thousands. 5,485,825	Thousands. 313,532	33,385
Cannel	281,866	11,791	243,305	255,096	1,934	257,030	24,836	2,230

Dr. GENERAL BALANCE-SHEET.

	£	s.	d.
To Capital—			
Balance at credit thereof (Account No. 3)	352,283	4	9
Net revenue—			
Balance at credit thereof (Account No. 5)	369,193	15	11
Reserve-fund account—			
Balance at credit thereof (Account No. 6)	152,420	8	10
Insurance-fund account—			
Balance at credit thereof (Account No. 7)	76,588	7	4
Depreciation-fund account—			
Balance at credit thereof (Account No. 8)	13,392	7	6
Debiture interest for amount due to Dec. 31, 1879	29,026	2	6
Bond interest for amount due to ditto	6,500	0	0
Preference dividends for amount due to ditto	108,980	5	0
Unclaimed dividends	5,754	18	7
Sundry tradesmen and others, for amount due for coals, stores, and sundries	233,868	17	11
Benevolent-fund	1,606	18	5
Call account	54,734	17	0
Temporary loan	120,000	0	0
	1,524,290	3	9

Cr.

	£	s.	d.
By Cash at Bankers	120,002	17	3
Amount invested—			
Reduced Three per Cent. Consols	152,420	8	10
Three per Cent. Consols	76,588	7	4
New Three per Cent. Consols	13,392	7	6
Stores on hand, viz.—			
Coals	119,339	19	2
Coke	6,710	15	0
Tar and ammoniacal liquor and products	124,978	4	1
Sundry stores	123,631	3	10
	374,000	2	1
Accounts due to the Company, viz.—			
Gas and meter rental—			
Quarter ending Dec. 31, 1879	719,999	1	2
Arrears outstanding	14,339	14	11
	734,338	16	1
Coke and other residual products	43,111	3	0
Sundry accounts	662	1	2
	43,773	4	8
Retiring allowances	5,734	0	0
	1,524,290	3	9

The GOVERNOR: Ladies and gentlemen, I rise to propose the reception and adoption of the report, which you have been kind enough to take as read, together with the statement of accounts, which I hope you will agree with the Directors in thinking as of a very satisfactory nature. The increase in the rental from gas may appear to be rather small in comparison with what it has been of late years; but it must be taken into consideration that this increase, which is 3·67 per cent. upon the rental of the Company for the previous half year, is an increase upon a half year in which we enjoyed the benefit of 14 per cent. increase under very exceptional circumstances. It must, therefore, be considered as extremely satisfactory that we have not only been able to maintain so very large an increase in our rental, but that we are also enabled to add to it an increase of 3·67 per cent. The coal which we carbonized during the last half year was a very large quantity indeed—598,000 tons, and the increased quantity is, of course, accounted for, and most satisfactorily accounted for by the increase in gas we have sold during the period under review, and the profit is fully up to that which we have always calculated upon. Now, gentlemen, as to the condition of the Company. Speaking generally, the Court of Directors are enabled to state that it was never in a higher state of efficiency than it is at the present moment in all the branches of the manufacture, even in those new branches of manufacture we have so lately undertaken at Beckton. The utmost satisfaction is experienced every time we go round to visit our various stations. It is the practice for a certain number of the Directors periodically to visit every one of our stations, and to view for themselves, and to report upon the condition of each station. We find this is a most admirable system, and one which works extremely well. They go once or twice a month to each station, and the Chairman of the Committee makes a formal report to the Court, and the report is recorded among the archives of the Company. There is one unsatisfactory point to which I must refer, and that is the loss we have sustained in the sales of our coke. We always calculated that at Beckton we should lose a certain profit on the coke sales, and I think we reckoned on a loss of £3000 or £4000 a year; but there have been exceptional circumstances in the coke trade of the last year or two, which have worked very adversely to the interests of gas companies generally. In the first place, we have had some very wet seasons. Building has been almost at a standstill during the winter, in the frost, and this will account for a very large diminution in the sale of our coke. We are, however, I am happy to say, now in possession of contracts to an amount of something like 50,000 tons a year for export. Coke is an article which is very much appreciated in Holland and in some parts of France, and we are doing our utmost to send as much coke out of England as we can, so as to enhance the price of what remains. Gentlemen, since we last met we have raised £100,000 of capital by a new process. The first £100,000, you will remember, was raised under the auction clauses of our last Act of Parliament. It was offered to the public, and I believe if it had been a little better managed we might perhaps have realized a larger sum for the stock offered. At all events, we were not satisfied with the result of the sale, and we consequently determined upon trying the alternative method of raising capital by tender—to the public in the first instance, and afterwards to the Proprietors—at a certain minimum price. The result of our application to the public and to the Proprietors was small in the first instance, not amounting to anything like what we anticipated at the minimum price we put on the stock, but upon application to the Proprietors of the Company afterwards, I am happy to say that they had such confidence in their property

as to induce them to apply for nearly twice as much capital as we had to dispose of. I think it is a most satisfactory point, that although the public, whom we take as not very friendly to us in a general point of view, did not appreciate the value of gas property, the Proprietors themselves put a just value on it, and took every shilling at the price we mentioned. Possibly it may be asked what capital we shall require in the future. I do not think we shall require more than £100,000 during the present year, and that not until the autumn—till July or August. We shall have sufficient capital in hand, what with the premium the stock realized, and which appears in the accounts for the first time this half year, and with the further amount of £100,000 I have just mentioned that we shall require this year, to enable us to carry on our extensive works, which are continually extending, and which must in a great concern like this be continually extending. With this amount of capital we shall have sufficient funds to carry us over the year. Gentlemen, since we last met there have been certain amalgamations on the southern side of the river. I cannot conceal my opinion that those Companies who have so amalgamated have taken a step in the right direction. They have consolidated their strength, and "union is strength;" and I dare say that when the whole amalgamations are carried out it will tend very much to the prosperity of the Companies concerned. They have my very best wishes that it should be so. There has been a Bill brought into Parliament, which stands for second reading next Monday, I believe; it has been brought in by the Corporation of London, and it is of a very oppressive and inquisitorial nature, as to this Company and two other Companies—the South Metropolitan and the Commercial Companies—who are under the same Acts as ourselves. Well, the Board of Directors have maturely considered the provisions of the Bill, and, acting in concord with the other Companies, have determined to oppose it as much as possible. Gentlemen, I should not object to the Corporation of London, or any other public body, finding fault with Gas Companies, or any other Companies who persistently and continuously defrauded the public, but in this case they have no cause whatever of complaint against us. In ninety-nine cases out of a hundred where they test, they find our gas perfectly up to the standard, both as to purity and illuminating power; and, therefore, it is a gratuitous onslaught on the funds of a public Company to compel us to go into Parliament, as we shall now be obliged to do, and oppose the Bill to the very utmost. The only good clause in the whole of the Bill—and I have read it very attentively once or twice—is the last clause, in which it is stated that "all costs, charges, and expenses preliminary to, and of and incidental to the preparing of, obtaining, and passing of this Act shall be paid by the Corporation out of their corporate funds." Now, gentlemen, I will give you a few figures to show how our manufacture has gone on. You see by the accounts the increase in our gas-rental and in our sales of products. I think that the last time I saw you the whole of the return from gas sold was about £1,000,000, and I congratulated you on that point as being the first time so large an amount had ever appeared in the accounts. Now, however, we come before you with receipts, reckoning them from all sources, amounting to £1,801,000, which I think must be very satisfactory; and in alluding to this I would just refer to one question, at which perhaps some disappointment may be experienced by some of the Proprietors. I may at previous meetings have given some indication that the accounts of the manufacture of residuals should be kept somewhat separate from the other accounts of the Company. We do so in a small degree—that is, as far as the products for this half year go; but I must beg of the Proprietors not to take the figures

appearing here as any indication whatever as to the ultimate result we expect from the manufactures. They are going on in the most satisfactory manner in every respect. We have an ample sale for everything we manufacture and have to dispose of. Our goods are all reckoned as "A 1," and command, in some instances, a higher price than any other stuff of a like nature that is sold in the market; but the Board consider it would be prejudicial to the interests of the Company, manufacturing, as we are, against other parties, to let those outside people too much into the secrets of our manufacture and the figures which come out. I hope, however, that the Proprietors have sufficient confidence in the Court to take it for granted as our opinion that everything in this way is going on not only most satisfactorily, but also most productively in the interests of the Company. The amount realized for coke per ton of coal is very bad—4s., against 4s. 9d. this time last year. The gross cost of the coal at all the stations is 15s. 2d., against 15s. 4d.—a small reduction; while the net cost of the coal per ton, deducting the proceeds from residuals, is 6s. 1d., as against 7s. 3d. Gentlemen, that will let you a little into the secret as to our manufacture of residual products, showing the increase in the receipts from those products when deducted from the net cost of the coal. Our bad debts amount to the very small sum of 0.54 per cent., which is really and truly nothing when compared with the magnitude of our operations, and must be taken as very satisfactory. The increase in the gas sold has been 3.67 per cent., and the price obtained for coke per measure of 48 bushels is 6s. 4d., as against 7s. 6d. The price of coke has been going down; but, as I said before, we hope very soon to recoup ourselves in a great measure from our export trade, which makes us a better return than we have been receiving in this country. A letter has been addressed to me by a Shareholder, who I am sorry is not able to ask his own questions. He refers to the necessity for gas companies finding some process by which to ventilate houses—not only houses which are built, but houses which are in course of building—from the products of the combustion of impure gas, and he asks us to offer a sum of money for a prize to any one who will invent such an apparatus. As far as the purification of gas goes, one of our cleverest and one of the most indefatigable men—Mr. Sugg—is at present occupied on that very subject; but as to our offering a prize for such a thing, I am afraid our Official Auditor (Mr. Parkes) would not countenance the charge of the sum against our accounts. Gentlemen, I do not think that I have anything further to trouble you with, and I will therefore only express a hope that you will consider our statement of affairs as satisfactory as your Court of Directors do, and I hope that we shall go on prospering to the end. I now beg to move—"That this meeting do agree with and confirm the report of the Directors, and the Auditors report, and the statement of accounts of the Company."

The DEPUTY-GOVERNOR (Mr. Edward Vaughan Richards, Q.C.) said he had much pleasure in seconding the motion. As the Governor had alluded to a Bill before Parliament, and as some of those present might perhaps be aware that this was somewhat in his special line, he might tell them that the Bill was promoted only by the Corporation of London, and that the Metropolitan Board of Works had declined to take any part in it. Nevertheless the Bill professed to affect not only the Chartered Company, but the South Metropolitan and the Commercial Companies, with which the City of London had not the slightest connection. Assuming, however, that all allusion to the South Metropolitan and Commercial Companies were struck out of the Bill, then it remained a fact that the City of London were seeking to re-introduce as to that portion of the Company's district with which they alone were concerned—about one-fifth of the whole district—those very discrepancies and anomalies as to gas legislation, which it had been the special effort of Parliament in the last ten years to rectify. Therefore he could not believe that the Corporation of London seriously contemplated proceeding with the Bill. If they did, the Directors would be fully prepared to fight them, and he thought they would fight them with success. However, he could not conceive that they would proceed with a Bill which was ridiculous in its proposed enactments, and perfectly unheard of, when it sought to regulate territory with which the Corporation of London had no sort of connection.

Mr. DARVILL said he should like to make one or two remarks as to the electric light. He thought they ought to discuss the question, and give confidence to the Proprietors. When he saw that their shares were reduced 20 per cent. in consequence of false and unfounded statements originating in America, and which reached this country, purporting to come from "our own correspondents," and had the effect of depreciating gas property, he thought the Directors ought to try to give confidence to the Shareholders by assuring them that the gas companies stood as firmly as ever they did, and that the reports about the perfection of the electric light, although apparently endorsed by "our own correspondents," were intended to "bear" gas shares. Subsequently reports came that the previous reports were untrue, when the shares rose, and the people who were mixed up in the reports netted £40,000 or £50,000. It was simply a "ring." He only wished to draw attention to this fact, so that confidence might be imparted to the Proprietors, and that they might be warned against selling when in future they saw any such mendacious reports.

Sir MORDAUNT L. WELLS thought the best answer that could be given to the honourable Proprietor's remarks was this—that when the additional capital was required by the Company, the Shareholders themselves took it up; and he considered that this was a sufficient answer to the scare which had been caused with respect to gas property in England. If those who were most intimately acquainted with the working of the great Gas Companies of the Metropolis were willing to embark their capital in this Company and in other Companies, it showed that those who were best qualified to form an opinion with regard to gas property did not take any fright, or feeling of that kind, in respect to the agitation which had been going on in America and elsewhere. He was perfectly persuaded of this—that it would not be becoming on their part, or on the part of the Directors, to enter into any controversy whatever with respect to the question of the electric light. They had had enough of it for the present, and the best thing they could do was to turn their attention to the working of their own Company, and see how far they could, consistently with that which was due to the Shareholders of the Company, give to the public a pure and cheap light. This brought him to a point in the report which he should ask his brother Shareholders seriously to consider, as regarded the policy of the Directors in the course they had taken; he referred to the question of lowering the price of gas, and the dividend remaining in the same position as it did the previous half year. Most of them were aware that the lowering of the price had taken place under what was known as the sliding scale, which was introduced into their Act of Parliament some three or four years ago; and the principle of the sliding scale was that the public and the Shareholders were to share between them any additional profit which might be made beyond 10 per cent. The maximum price of the Company being 3s. 9d. per 1000 feet, they reduced the price of gas to 3s. 6d., and but for that the Directors would not have been empowered to pay the increased dividend, from 10 to 10½ per cent. But last half year they divided 10½ per cent., and there was a general rumour—such rumours did arise, as they all knew, in the City—that the Shareholders of the Company were to receive this half year 11 per cent. He

heard this from one of the leading men in the City, who was formerly himself a gas director.

The GOVERNOR: We could not do so.

Sir MORDAUNT WELLS said he did not state that the remark was made with any authority on the part of the Directors, but he was sure that some of the Directors would bear him out when he said that such a rumour—most improperly, perhaps—was circulated. He did not for a single moment find fault with the Directors for the course they had taken as to the dividend, because he thought it would have been most prejudicial to the interests of the Company if they declared one farthing more than 10½ per cent. He, however, required an explanation of the motive of the Directors in lowering the price of gas, there being no corresponding benefit to the Shareholders, for in lowering the price they decreased to a certain extent the paying powers of the Company in reference to the dividend. No doubt the rumour he had referred to arose entirely from the circumstance of the Directors having lowered the price of gas. The Shareholders might have thought that under the sliding scale, when the price was lowered, it was with the object of giving them more dividend than they had received under the former price. [A VOICE: The price was not to be lowered till the 1st of January.] He repeated that, according to the accounts, the price of their gas had been lowered.

The GOVERNOR: But the reduction does not affect these accounts at all.

Sir MORDAUNT WELLS begged to say that he was perfectly correct. If they referred to the revenue account they would see under "Sale of gas" the words "common gas, per meter, at 3s. 6d. and 3s. 4d. per 1000 feet," and this showed that in the sum received a portion was represented by the figure of 3s. 4d. He was, therefore, quite right.

The DEPUTY-GOVERNOR remarked that the speaker had found a mare's nest.

Sir MORDAUNT WELLS again referred to the entry he had drawn attention to in the revenue account.

The GOVERNOR: That figure only applies to a very small extent—the last ten days or so of the half year.

Sir MORDAUNT WELLS said that what he desired to point out was that the Governor had not stated any reason why they had lowered the price from 3s. 6d. to 3s. 4d., and he thought the Shareholders expected to hear from the Directors their reason for doing so. He held that it was of the utmost importance that they should know the motives of the Directors for lowering the price of gas, for unless they knew the reason for it, it was impossible for them to come to a conclusion whether it was right or wrong that the charge should be 3s. 4d. instead of 3s. 6d. He, however, would not dwell further on this point; but there was another subject as to which he wished to say a few words. He had a considerable amount of money invested in the Company, and he had the utmost confidence in the honour and integrity of the Directors. In their presence he spoke with the utmost respect, but at the same time with a feeling of independence in regard to his own position, when he said that he considered that the Company was one of the most expensively managed of the joint-stock companies in the Metropolis. He happened to be a shareholder in other companies, and he knew exactly how the directors were paid, and how the officials were paid in those companies. If there were any City gentlemen present he was sure they would do him the honour to pay some little attention to what he was about to state. The North-Eastern Railway Company was one of the largest concerns in the kingdom, their relations extending over the whole of the North of England. They had 19 Directors, men of eminence, public men, who, he knew, devoted a very considerable portion of their time to the affairs of the Company. The capital of the Company was enormous; and as to the whole working of the North-Eastern Railway system, every City man would bear him out in saying it involved, beyond all question, ten or even twenty times more work than any that the Directors of this Company could be called upon to do. ["No, no," from several Shareholders.] It was all very well for some gentlemen to say "No, no," but he had been personally mixed up for the last 25 years with joint-stock companies, though not as a director, and he maintained that the Directors of the North-Eastern Railway Company, with the enormous work they had to do, only divided the same amount as the Directors of this Company did; and although they might not now agree with him in what he said with respect to the expenses of the Company, the time would come when they would seriously take the question into their consideration. He was speaking without the slightest reflection on any of the Directors. He would not have invested his money in the concern if he had had any doubt on that subject; but he maintained the accuracy of what he had stated. Some directors of large companies received £2000, in other cases they had £3000; but these were nothing to compare with what the Directors of this Company received. The Directors only had the same interest in the undertaking which the other Shareholders had; and the only difference between them was, that the Directors were elected to that position by the other Shareholders, and yet they received £7000 a year. The question would have to be investigated either by the Shareholders or the Government. There were other charges in the accounts, with which, however, he would not trouble them, except as to the charge for printing, &c. (over £3000), which, as compared with other companies, was enormous. Then, again, they could not mention any other company where the auditors were paid at such a high rate as in this one, considering, too, the amount they paid to the Official Auditor. He had looked carefully into the matter, and he held that if there were to be an increase in their dividend, it must be by a more economical management. The Directors themselves ought to introduce into Parliament a Bill empowering them to lessen the number of the Board, and in that way diminish the amount paid to them. He was not in favour of interfering with any existing arrangement, but the Board in future should be fewer in number, and the amount paid to them would be consequently lower.

Mr. H. WIGGIN thought they had every reason to congratulate themselves on the continued prosperity of the Company, and he for one held that their thanks were due to the Board for the very able manner in which the Company had been carried on. He thought the Directors were deserving of the warmest thanks of the Shareholders for managing the concern in such a manner as to pay 10½ per cent.; but he held that if they gave too high a dividend they would have competition right and left of them. The reserve-fund, he saw, stood at about £150,000. He had had no opportunity of referring to their Acts; but some gas companies with which he was connected had the power to put by a reserve of 10 per cent. on the amount of their capital, so that they should have something to fall back upon in hard times to equalize the dividends. He did not know if this Company possessed such a power, but, if they did, he was sure the Shareholders would be delighted if the Directors would limit the dividend to 10 per cent., and put by an amount which would ensure the continuance of such a dividend. He was confident that this would increase the value of their property. He noticed in the report that they complained of the difficulty of disposing of their coke; but any one connected with gas companies knew the great difficulty there was in the matter. A company which he was in had recommended householders to adopt it for domestic purposes, especially in suburban and rural places, and for use in conservatories, and by this means they had largely increased its consumption, and so had disposed of 50,000 tons of coke at very much higher prices than had been mentioned as having been received by this Company. The mode in

which the Company he had referred to proceeded, was to make a statement at the back of every account, mentioning the price at which coke would be supplied at such and such a place. They were inundated with orders, and he threw out the suggestion for this Company to adopt it, if they found that it would be advantageous to do so. He then asked what falling off must take place in the present rate of dividend on the ordinary stock before the 7 per cent. H shares would be affected.

The DEPUTY-GOVERNOR: $\frac{3}{4}$ per cent. It would amount to a falling off of £160,000 a year.

Mr. WIGGIN expressed his satisfaction at the statement that the result of the working of the residuals had so far proved satisfactory; but he would warn the Directors that there were "rocks ahead" in this quarter, not especially as regarded this Company, but as regarded all who were connected with the manufacture of gas residuals. The present price of sulphate of ammonia was higher than ever, chiefly owing to the war between Chili and Peru, and in consequence of the inability to obtain nitrate of soda. However, if they had a better market for the sale of their coke, they would be able to stand a considerable reduction in the price of sulphate of ammonia without materially affecting the interests of the Company. He would take this opportunity of thanking the Directors, and as long as they paid him 10 per cent. he would not complain of the amount of their fees. The labourer was worthy of his hire, and if the management of their affairs by the Board enabled them to pay 10 and $10\frac{1}{2}$ per cent. dividends, he should feel it rather mean on the part of the Shareholders if they begrudged the remuneration paid to the Directors.

Mr. H. J. BADDELEY thought they ought to be very much indebted to those Proprietors who attended the meeting and showed their interest in the Company's affairs by ventilating details as to the management, but he thought that those who spoke ought to make themselves thoroughly acquainted with the facts which they laid before the meeting. As to the sliding scale, he had had some experience. The initial price of this Company for gas of a certain standard of illuminating power was 3s. 9d. per 1000, and for every 1d. they reduced the price to the consumer they were entitled to advance their dividend by 5s. per cent. The standard or initial price simply gave them a 10 per cent. dividend. The sliding scale would therefore enable them on this occasion to pay not $10\frac{1}{2}$ but $10\frac{3}{4}$ per cent. to the Shareholders, because they had been supplying gas at 3s. 6d. per 1000 feet during the year over which the dividend was earned. With regard to the reduction of price, he made no question, because it was the duty of the executive to take into account everything which affected the interests of the Company, and to form their own judgment and act on it. In the announcement made in the report, the Directors stated that they had reduced the price, from the 1st of January, to 3s. 4d. per 1000 feet, the practical effect of which would be that if this price continued during 1880, they would be enabled, if they made sufficient profits, to pay not only $10\frac{1}{2}$ per cent., but the $\frac{1}{2}$ per cent. which the price of last year would enable them to declare, and an extra $\frac{1}{2}$ per cent. for the present year, in consequence of their reducing the price to 3s. 4d. The reduction of the price must be antecedent to any increase of the dividend. It was an experiment, and the experiment must be made by the Board before there could be any increase of dividend. By reducing the price, by another 2d., to 3s. 4d., they would be enabled to give an extra $\frac{1}{2}$ per cent. if they could make sufficient profit to do so. As to the question of the emolument of the Board, that question had been fully discussed before Parliament, and by the Board of Trade acting for Parliament. They had determined that the amalgamations which had taken place had been for the interests of the public (if not for the Shareholders), and the existing condition of things must remain, as to the remuneration fixed for the Directors, till some parliamentary action was taken on it. He hardly thought that such action should be initiated by the Board of Directors or by the Proprietors. As to the electric light, he regretted exceedingly that the matter had been mentioned at all at this meeting. He had become thoroughly habituated to the electric light scare. It reminded him of the old story of the negro who had a drunken master. One day a gentleman called to see the master, but the negro said he could not be seen. "Why?" asked the visitor; "is he drunk again?" "Oh, no, sa," replied the negro; "not drunk again—the same old drunk." So with the electric light scare—it was always the same old scare again.

Mr. S. JACKSON wished to know on what ground the Directors had this year added such a small amount to the reserve-fund. Coals, he said, must rise in price, and then their profits must necessarily diminish, and the dividends decrease. He thought the matter should be reconsidered. He should like to see the reserve-fund stand at £500,000, as he thought this would enable them to look forward and meet the future, whatever might arise. He hoped that before the meeting closed they would receive some assurance that, if it was not judicious to add more than £10,000 last year to the reserve-fund, more would be transferred to it on a future occasion. He considered this was a most important matter. As to the remuneration of the Directors, he thought it would be one of the falsest economies they could adopt, to proceed in the way mentioned by one of the speakers. There was no comparison whatever between the North-Eastern Railway Company and this Company, for in the first-mentioned Company the dividend constantly fluctuated, and was altogether uncertain.

Mr. GRAHAM asked whether the item of "Experimental street lighting," £329, did not mean the improved lighting of Regent Street and Waterloo Place.

The DEPUTY-GOVERNOR: Yes, and Queen Victoria Street.

Mr. GRAHAM said his object in asking the question was to thank the Directors for having carried out such an experiment. A friend of his, who was connected with the electric light, said, when he saw the improved gas light, "that it would be their settler;" and so he (the speaker) thought, for nothing could be more beautiful. It was true that the Chartered Company were not the first to show the improvement, but the Phoenix Company; yet he thought the trouble and energy the Directors had displayed in introducing the improved lights called for the greatest praise on the part of the Shareholders, showing, as it did at once, what could be done with gas. He thought there was no comparison whatever between such a light and the electric light; and he thought the Directors deserved a separate vote of thanks for the energy they had displayed in the matter.

Mr. W. J. SMITH expressed some surprise that Argand burners were not more extensively used in the streets of London, and said that there was no comparison between the gas light in Queen Victoria Street and the electric light on the Thames Embankment. He, however, thought that if the burners were placed 10 or 15 feet higher, the light would show with much more effect.

Mr. J. N. SHOOLBRED said that, as his name was somewhat connected with the electric light, he might mention that it was the opinion of his scientific friends, as well as his own, that all the reports as to recent discoveries in America were considerably exaggerated.

The GOVERNOR: I will reply *seriatim* to the different questions put. As to the electric light, it was not my purpose, or the purpose of the Board, to have referred to it in any way whatever. I think the more it is left, the better. As Shareholders in this Company we have suffered to a considerable extent. We say nothing about it, and I should have said nothing about it but for the nefarious purposes for which this electric light agita-

tion has been raised. I may state that in this Company during a very short time, and during lately, our shares were down to 160 and up to 180 $\frac{1}{2}$. Therefore, that shows the terror which must have been infused into people to have induced them to part with their property at such an absurd price. I should not have made any mention of the subject but for that. I really think it is highly reprehensible that any class of people should combine or conspire on both sides of the Atlantic, by fraudulent and wicked statements, to depreciate our property, so that they are enabled to purchase at very low prices. Sir Mordaunt Wells very truly said that it does show very great confidence, as I stated in my opening address, that the Proprietors of the Company absorbed the whole capital we were recently enabled to allot. As to the reduction of the price of gas, that subject came under the earnest consideration of the Board before we adopted it. We reviewed our present position financially, and we reviewed our future position as we hope it will turn out; and we felt ourselves fully justified in making the Act which enables us to adopt the sliding scale, a reality both in the interests of the public and of the Proprietors. The honourable gentleman seemed to forget that the late reduction would not affect dividends till the end of this half year. We shall not be able to increase our dividend on the last reduction till next half year's meeting. The Proprietors must consider this—that it is no light matter making a reduction, even of the very small amount of 2d. per 1000 feet. It may appear to the consumers as nothing for a gas company to reduce their price by 1d. or 2d., or even more per 1000 feet; but I can show you, from the effect it has on our accounts, that it is a reduction which ought to be very highly appreciated and received most thankfully by the public, for every 1d. per 1000 feet we, in the past, reduced the price of gas has been a dead loss to the Company of £40,000 a year. Therefore on the last reduction we made our loss has been £40,000, and now from our increased operations, 1d. per 1000 feet reduction amounts to £50,000, which is a very large sum taken off our balance-sheet; and it would have been madness on the part of the Directors if they had not looked into this subject with the greatest care, so as to see if they were not justified in doing it, and fully justified in the expectation that they would be able to pay a dividend in excess of what we now pay. As regards the expenses of the Company, I wonder the honourable Proprietor did not attend some other meetings; for, as it proves to be the fact, this Company (the Chartered Gas Company) is the most cheaply managed Gas Company in London. I will read to you an extract from Mr. Field's last published Analysis of the Accounts of the Metropolitan Gas Companies, for the sake of your information, and acting up to what Mr. Baddeley says—that gentlemen ought not to come here and make statements they cannot well bear out. The general expenses of this Company, per ton of coal carbonized, is 1'22s.; the next company (I will not mention names) is 1'67s., and others are 1'91s., 1'85s., 1'71s., and 2'58s.; thus showing that this Company is the most cheaply managed Gas Company in London. As to comparing this Company, and the work the Directors do here, with the work of a railway board, it is absurd. They do not do one-tenth part of the work we do here, and they also have, what we have not—the privilege of travelling free all over the country. The Directors are fully satisfied with the dividend that we are now paying, according to our present condition. We could have paid an extra 5s. per cent., but we preferred putting the money to the reserve-fund, in accordance with the generally expressed wish of every meeting of the Proprietors I have had the honour and pleasure of attending. As to the lighting of Queen Victoria Street and Regent Street, that was done at the Company's expense, and I believe truly it has been an expense which has been fully justified, and bears the good fruit that one honourable Proprietor mentioned.

The motion for the adoption of the report was then put, and carried unanimously.

The SECRETARY next read the resolution declaring the various dividends on the different stocks, which also was carried unanimously.

The GOVERNOR then left the chair, which was taken by

The DEPUTY-GOVERNOR, who said that the reason why the Governor had vacated the chair was that he retired from the Court by rotation, but he offered himself for re-election. The Proprietors knew the way in which the Governor had conducted the affairs of the Company, and the amount of time he devoted to their interests, despite the observations of Sir Mordaunt Wells. He believed that, in the proper form, the motion for the re-election should come from the Shareholders, and he was quite sure that the Governor had friends enough to move such a resolution.

Sir MORDAUNT WELLS expressed his pleasure at moving the re-election of the Governor, and observed that the remarks he had made were in perfect good faith, and not in any way reflecting on the Directors.

Sir THOMAS DAKIN, in seconding the motion, thought it came very well from Sir Mordaunt Wells, who was, no doubt, independent, and liked free discussion.

The DEPUTY-GOVERNOR put the motion, and it was carried unanimously.

The GOVERNOR, who resumed the chair amidst cheers, said: Gentlemen, I have had on so many occasions the pleasure and honour of addressing you, in returning thanks to you for the compliment you have so frequently paid me, that I can scarcely find words now to give effect to my feelings on this occasion. It is a most gratifying fact to me, after having been so many years in your service, and devoting my time and abilities, as far as they go, in advancing the interests of the Company, that I have lived to see it the first gas company in the world.

Sir T. DAKIN then moved the re-election of the other retiring Directors—Mr. H. E. Adair, Mr. J. Brickwell, Mr. U. J. Burke, Mr. R. T. Frere, Col. W. T. Makins, M.P., Mr. T. Paine, and Mr. B. L. Smith. He said he thought with such an excellent report, and the importance of the services rendered by the gentlemen mentioned, that it was unnecessary for him to say anything as to the desirability of re-electing them. He had had some experience as to the duties of the Directors on the other side of the table, and he knew the amount of labour and ability they gave to the work before them.

Mr. BADDELEY seconded the motion with pleasure, observing that if he said anything on the subject he should only depreciate the motion in their eyes.

The GOVERNOR put the resolution, and declared it carried unanimously.

Sir T. DAKIN next moved, and Mr. BADDELEY seconded, the re-election of the Auditors—Mr. J. S. Barker, Mr. H. W. Chisholm, and Mr. F. Farnan.

Sir MORDAUNT WELLS asked whether the Official Auditor was appointed by the Directors.

The GOVERNOR: No, by the Board of Trade; but he is, nevertheless, paid by the Company.

Sir MORDAUNT WELLS asked the amount that was paid to him.

The DEPUTY-GOVERNOR: The officials are paid for together in a lump sum, and we cannot tell what the Auditor receives.

The motion was carried unanimously.

Sir T. DAKIN then moved a cordial vote of thanks to the Directors for their valuable services, and the motion was seconded and carried unanimously.

The GOVERNOR: On behalf of my colleagues and myself, I beg to thank you most heartily for the confidence you place in us.

The proceedings then terminated.

BIRMINGHAM CORPORATION GAS SUPPLY.

The Annual Report of the Birmingham Corporation Gas Committee, which will be presented at a special meeting of the Town Council to be held to-day, is as follows:—

Your Committee report that they have given instructions for the disposal of the plant at the Fazeley Street works, and that they have invited offers for the purchase, or rent, of the site and buildings.

They have, as authorized by the Council, accepted the following tenders for the new gasholder and tank at Swan Village:—Aird and Sons, tank, £18,190; C. and W. Walker, holder, £14,371.

Your Committee report that the siding from the Windsor Street branch of the London and North-Western Railway is now completed, and that they have authorized the expenditure of £1400 on the construction of a 2-feet tramway from the siding into the present retort-houses, and in the provision of waggons for the delivery of the coal alongside the retorts. They have also authorized the expenditure of £750 in the purchase of a second locomotive for use at the Saltley works.

Your Committee report that, in pursuance of the policy recommended in their report to the Council in December, 1878, they have refused, whenever possible, to make extensions or additions to the mains in the purchasing districts without the consent of the Local Boards. They have recently, however, been compelled, by the action of consumers in Langley, to make additions to the mains in the Oldbury district, without the consent of the Oldbury Local Board. Their attention having been directed to statements made at a subsequent meeting of the Local Board, they instructed the Secretary to address the following communication to the Clerk to the Board:—

Corporation of Birmingham, Gas Department, Jan. 17, 1880.

A. Wright, Esq., Clerk to the Oldbury Local Board.

Dear Sir,—At a meeting of the Gas Committee, held on Monday last, the attention of the Committee was directed to statements reported to have been made at the last meeting of your Board, with regard to the action of the Gas Committee in relaying mains at Oldbury. As the motives and wishes of the Committee appear to have been much misunderstood, I was then instructed to ask you to lay before your Board the following statement:—

It appears that it is alleged, chiefly, that the pressure at Langley having been sufficient last winter, there is no necessity for the work now; that the Gas Committee must, therefore, be actuated by some unworthy motive; and that the work has been undertaken without notice to your Board.

With regard to these allegations, I am instructed to remind you that the Gas Committee, being anxious to avoid, as far as possible, disputes with your Board, have refused, in every instance when they could do so under their Act of Parliament, to make extensions or alterations of mains in the Oldbury district, pending the transfer. All applicants for such extensions, including the Chairman of your Board, have been informed that they must either obtain the consent of your Board to the extension, or must themselves pay the cost of it. The Committee have, indeed, carried this principle so far, that on one occasion, when it became necessary to incur a small outlay in lowering a main, and relaying the services from it, they obtained the consent of your Board before proceeding with the work.

On reference to the minutes and correspondence of the Gas Committee, I find that, in November, 1876, Mr. Showell complained of the deficient supply at Langley, and that our Engineer then reported that a satisfactory supply could only be given by the relaying of the mains in Oldbury. On this, the Committee informed Mr. Showell that they were anxious, under existing circumstances, to avoid the expenditure of the large sum that would be necessary. In May, 1877, a similar complaint was received from the Arden Brewery Company, who were told that the Committee were unwilling to move in the matter.

In November, 1877, numerous complaints were received from consumers in Langley, and the Committee, aware that they were running considerable risk of proceedings against them for the penalties provided in cases of insufficient supply, but, nevertheless, still anxious to avoid a large expenditure, made some improvements and alterations in the mains supplying Langley, which they hoped would relieve them from the difficulty of their position. The supply was improved to a small extent by these alterations, but in the following month Mr. Showell again complained, and the Committee informed him of what had been done, and of their unwillingness to do more unless the Oldbury Local Board would not raise difficulties.

Complaints from other consumers in Langley have been continually made until the present date, and, so late as the 30th of October, 1879, Mr. William Smith, of Langley, was informed that the Committee were not willing to undertake the required work.

On Dec. 10, Mr. Showell wrote to me that he had been obliged to use petroleum lamps in his office, and asking whether we could not improve the gas supply. On the 12th of December, in answer to my reply, he wrote that he had long forborne to put any undue pressure on the Gas Committee, but that he could not have his business stopped, and he gave me notice in this letter of his intention to claim compensation. In the meantime, Mr. France had written to me, informing me that he should make a claim in respect of the deficient supply to his house and to the Temperance Hall, and Mr. William Smith had given me notice of his intention to obtain, with others, legal assistance. These complaints were substantiated by an official complaint from your Surveyor and Inspector of Nuisances, of a deficiency in the supply to Langley.

On this I wrote to you, on the 15th of December, informing you that the Gas Committee would meet on the 22nd, when they would have to consider whether the work should be done, under section 8 of the Oldbury Gas Act.

In the meantime, an application was made for a supply of gas to Mr. D. M. Sadler's new brewery at Langley; and, as the Committee could not, under their Act, refuse this supply, they had seriously to consider their position. Their Engineer informed them that any further supply to the district would undoubtedly reduce the pressure to a lower standard than that prescribed in the Act of Parliament, and in that case the Committee would become liable to all the consumers in the district for penalties. It therefore appeared to them that they had no further choice in the matter, and, not having received any reply to my letter to you of the 15th of December, and having, therefore, no reason to suppose that objections would be made by your Board, they gave instructions for the work to be done, and you were informed of their decision in my letter of the 23rd of December.

It appears to be assumed by your Board that increased pressure at the works would meet the difficulty. The Gas Committee have not, however, undertaken the work without first making careful experiments on this subject. It has been ascertained that with a pressure of 3½ inches at the works, the pressure on the 4-inch main at Langley is insufficient to comply with the requirements of the Act; that an increase of the pressure at the works to 4 inches only affected in a very slight degree the pressure at Langley; and, if this increased pressure had been sufficient, I need not point out to you that no competent Gas Engineer would recommend that such a pressure should be maintained at the works.

With regard to the illuminating power, I may remind you that, in my letter of Dec. 15, I stated that the illuminating power had been well maintained. I may now add that our works have been open for some time past to an officer appointed by the Wednesbury Local Board, with full liberty to make independent tests, and that he has reported to his Board that the illuminating power is considerably in excess of the parliamentary standard.

The cost of the work will not exceed £700, and the Committee will endeavour to carry it out in the most economical manner possible.

The Committee regret to notice some of the statements which are reported to have been made at your Board, but they do not feel that they should do more now than ask you to lay before it this statement of the facts of the case.

(Signed) EDWIN SMITH, Secretary.

In their reports to the Town Council in February and May, 1879, your Committee stated that it would be necessary, before the winter of 1880, to provide additional manufacturing power, and that, as the greatest manufacturing capacity had been reached at the other works, these additions could be best provided at the Windsor Street works. Your Committee have also reported to the Council that the additions to purifying and other plant at Windsor Street, authorized during the past year, have been planned with a view to the ultimate increase of the carbonizing plant. They are of opinion that it is now necessary to proceed with these further extensions, and they recommend that they be authorized to obtain tenders and to make contracts for a new retort-house, new exhauster, engine, and boiler houses, and exhauster at Windsor Street. They estimate the cost of these works at about £75,000, and the addition to the maximum daily

make at 6,750,000 cubic feet. They propose to spread the expenditure over two or three years.

Your Committee report that the amount unexpended of the capital authorized under the provisions of the Corporation Gas Act is £121,488 6s. 11d., which the Committee do not think sufficient for the requirements of the undertaking. The Council have authorized additional works now in progress at Windsor Street and West Bromwich works, which are estimated to cost £52,000. Having regard to this expenditure, and to the extensions at Windsor Street now proposed, your Committee recommend that they should be authorized to apply, when necessary, to the Local Government Board, for power to borrow, from time to time, a further sum of £125,000.

Your Committee report that, on the advice of counsel, and of the solicitors engaged in the case, they have consented, on the withdrawal of the action commenced against them by the liquidator of R. R. Kelly's estate, to pay a sum sufficient to cover the plaintiff's costs, it being a condition of this arrangement that, if there has been any informality in the liquidation of the chemical company, a formal liquidation shall now be effected, and the previous acts of the Corporation confirmed. They report that, on the part hearing of the cause, *Hipkins v. Corporation*, they consented, on the advice of their counsel, to pay a sum of £200 and the plaintiff's costs.

Your Committee report that the Arbitrators and Umpire fixed the hearing of the arbitrations in the Smethwick, Oldbury, and Tipton cases for the 19th of December last. Your Committee being anxious that no further awards should be made until the principle of the award in the West Bromwich case is definitely settled, arranged with the Local Boards of these districts that, in consideration of their consent to the postponement of the awards until the appeal has been finally disposed of, a formal agreement should be executed, providing for the transfer of their portions of the undertaking on July 1, 1882; and also providing that, if the final awards have not then been given, a proportion of the profits derived from the undertaking shall be paid to the Local Boards from that date until the completion of the purchase on the final awards being made, the Local Boards paying interest on the amount of the purchase-money, and bearing their proportion of any loss on the undertaking. Your Committee report that, in pursuance of an arrangement made by their agents during the arbitration, they have agreed that, subject to the appeal in the West Bromwich case having been decided before the 1st of July next, the transfer of the West Bromwich portion of the undertaking shall be made to the West Bromwich Commissioners on that date.

The total quantity of coke in stock at the various works on the 31st of December, 1879, was 6060 tons, as against 34,203 tons at the corresponding period of 1878. Your Committee report that the sale of coke in the town was 49,286 tons in 1879, as against 38,388 tons in 1878.

The sale of gas for the year has been 2,645,396,200 cubic feet, as against 2,494,495,900 cubic feet in the previous year, being an increase of 150,900,300 cubic feet, or at the rate of 6 per cent.

The number of new services laid during the year was 2557, as against 2912 in 1878.

169 official tests of the illuminating power of the gas were made during the past year, the highest being 18·04, the lowest 16·55, and the average 17·22 candles, being about 2½ candles in excess of the parliamentary standard.

The number of cooking and heating stoves and gas fires supplied by the department during the year has been—

Gas fires	289
Cooking stoves on hire	138
Cooking and heating stoves sold	371
Total	798

Your Committee have much pleasure in submitting herewith the annual balance-sheet and statement of accounts. The net profit for the year amounts to £51,165 18s. 4d., and your Committee recommend that the balance of the profit and loss account be appropriated as follows, viz.:—£25,000 to the borough improvement rate, and £26,165 18s. 4d. to the sinking-fund for the redemption of loans and annuities. Your Committee report that they have informed the Finance Committee of the Council that they hope to place £25,000 to the credit of the borough improvement rate in the present year.

STATEMENT OF ACCOUNTS FOR THE YEAR ENDED DEC. 31, 1879.

Loan Capital.

Description of Loan.	Rate per Cent. of Interest.	Total Amounts Borrowed Dec. 31, 1879.	Remaining to be Borrowed.	Total Amount Authorized.
Mortgages	4½ 4 3½ 3½	£2,500 0 0 713,782 16 4 86,600 0 0 37,500 0 0	£11,668 3 8	{ £2,000,000 (calculating the annuities at 20 years purchase. At 25 years purchase, amount would be £2,274,824 15s.)
Debenture stock	4	48,650 0 0		
Annuities (capitalized at 25 years purchase)		1,374,123 15 0		

Dr.—Capital Account.

	Expenditure to Dec. 31, 1878.	Expended this Year.	Total to Dec. 31, 1879.
To Expenditure to Dec. 31, 1878	£2,131,442 8 0	—	£2,131,442 8 0
Since that date—			
Extension of buildings, manufacturing plant, machines, storage works, and other structures connected with manufacture	24,794 3 11	—	—
Less plant abandoned	5,000 0 0	—	—
		£19,794 3 11	—
New mains, and other works connected with distribution	—	1,085 17 8	—
New meters (not in place of old ones)	—	1,013 19 6	—
			21,894 1 1
Total expenditure			£2,153,336 9 1
Balance of capital account			109,820 2 3
			£2,263,156 11 4

Cr.—Capital Account.

	Certified Receipts to Dec. 31, 1878.	Received during Year.	Total Receipts to Dec. 31, 1879.
By Debenture stock	£48,650 0 0	—	£48,650 0 0
Mortgages and bonds	840,293 19 5	£86 16 11	840,382 16 4
Annuities (capitalized at 25 years purchase)	1,374,123 15 0	—	1,374,123 15 0
* After deducting capitalized value of the annuity payable by the Corporation of Walsall.			£2,263,156 11 4

Dr.—Revenue Account.

To Manufacture of gas—

Coals, including carriage, unloading, and all other expense of depositing same on works . . .	£157,629 10 0
Purifying materials and wages . . .	3,952 0 2
Salaries of Engineers, Superintendents, and Officers at works . . .	2,771 17 4
Wages at works . . .	38,489 14 10
Repairs and maintenance of works and plant (including renewal of retorts), machines, apparatus, tools, materials, and labour; less old materials sold . . .	52,869 2 9
	£255,712 5 1
Distribution of gas—	
Salaries of Chief Inspector, Inspectors, Assistant Inspectors, and Clerks in Light Office . . .	£9,712 0 10
Repairs, maintenance, and renewal of mains and of service-pipes, including materials, laying and paving, and labour . . .	16,015 19 9
Repairing, renewing, and refixing meters . . .	9,534 18 3
	35,262 18 10
Public lamps—	
Lighting and repairing . . .	4,075 14 1
Rents, rates, and taxes—	
Rents . . .	£809 5 9
Rates and taxes . . .	14,196 16 5
	15,006 2 2
Management—	
Salaries of Secretary, Accountant, and Clerks . . .	£1,866 13 1
Collectors commissions and salaries . . .	1,410 4 9
Stationery and printing . . .	890 14 5
General establishment charges and incidentals . . .	2,952 4 1
Auditor . . .	52 10 0
	7,173 6 4
Law and parliamentary charges . . .	1,639 18 4
Bad debts . . .	2,251 4 9
Expenses on loans . . .	201 15 0
Bank charges . . .	100 0 0
Cost of maintaining recreation grounds at Nechells . . .	£380 7 1
	7,173 6 4
Total expenditure . . .	£321,803 11 8
Balance carried to profit and loss account . . .	142,261 4 0
	£164,064 15 8

Cr.—Revenue Account.

By Sale of gas—

	Cubic Feet.	Per 1000 Cubic Feet.	
Common gas, 5,871,700 at 4s. 0d. & 4s. 3d. . .			£1,175 2 10
Ditto 4,272,200 " 3s. 10d. & 4s. 1d. . .			818 19 10
Ditto 4,430,700 " 3s. 8d. & 3s. 11d. . .			812 6 0
Ditto 3,619,500 " 3s. 6d. . .			633 8 2
Ditto 592,385,600 " 3s. 0d. & 3s. 3d. . .			88,896 15 4
Ditto 451,056,800 " 2s. 10d. & 3s. 1d. . .			63,921 4 6
Ditto 612,201,400 " 2s. 8d. & 2s. 11d. . .			81,656 16 2
Ditto 819,222,500 " 2s. 6d. & 2s. 9d. . .			102,456 16 11
Public lighting and under contracts . . .			22,083 14 2
			£362,455 3 11
Deduct adjustment for stock, &c. . .			48 14 2
			£362,406 9 9
Less discounts and adjustments . . .			15,696 17 7
			£346,709 12 2
Residual products—			
Coke, less labour and cartage . . .			£41,368 10 8
Breeze, do. do. . .			33,196 1 7
Tar . . .			38,199 3 11
Ammoniacal liquor . . .			129 6 0
Sundry residual products . . .			112,893 2 2
			1,537 1 4
Rents . . .			1,954 18 6
Fittings . . .			960 6 6
Discounts on purchases . . .			9 15 0
Transfer fees . . .			
			£164,064 15 8

Dr.—Profit and Loss Account.

To Amount carried to reserve-fund account from profits of 1878 . . .	£7,152 2 0
Amount carried to sinking-fund from profits of 1878 . . .	22,679 15 8
	£29,831 17 8
Interest on mortgages and bonds, accrued to Dec. 31, 1879 . . .	32,191 1 8
Interest on debenture stock to Dec. 31, 1879 . . .	1,946 0 0
Annuities . . .	54,964 19 0
Sinking-fund, for redemption of loans and annuities . . .	4,104 14 7
Balance, being net profit for the year . . .	51,165 18 4
	£174,204 11 3

Cr.—Profit and Loss Account.

By Balance of net profit brought from last account . . .	£54,831 17 8
Less amount paid to borough improvement fund . . .	25,000 0 0
	£29,831 17 8
Balance brought from revenue account being profit for the year to Dec. 31, 1879 . . .	142,261 4 0
Interest on amount invested on account of reserve-fund . . .	2,000 0 0
Interest allowed by bank . . .	111 9 7
	£174,204 11 3

Statement of Coals.

Description of Coal.	In Store, Dec. 31, 1878.	Received during Year.	Carbonized or Used during Year.	In Store, Dec. 31, 1879.
	Tons. Cwt.	Tons. Cwt.	Tons. Cwt.	Tons. Cwt.
Common . . .	20,906 17	316,231 8	312,147 7	24,990 18
Cannel . . .	1,108 1	4,712 15	4,764 1	1,056 15

Statement of Residual Products.

Description of Residual.	In Store, Dec. 31, 1878 (estimated).	Made during Year (estimated).	Used in Manufacture during Year (estimated).	Sold during Year.	In Store, Dec. 31, 1879 (estimated).
	Tons.	Tons.	Tons.	Tons.	Tons.
Coke—common, chaldrons of 36 bushels . . .	76,006	384,477	111,406	335,467	13,610
Breeze—ditto . . .	5,946	19,146	5,254	16,030	3,808
Tar—gallons . . .	83,599	3,726,274	—	3,735,473	74,400
Ammoniacal liquor—bushes of 108 gallons . . .	3,366	91,804	—	93,859	1,311

THE JARROW WORKS OF THE SOUTH SHIELDS GAS COMPANY.

Last Tuesday, at the invitation of the Directors of the South Shields Gas Company, the Jarrow works of the Company, which are now fast approaching completion, were visited by a considerable number of the Shareholders, and much interest was manifested in the inspection of the works and plant.

Since the new works were commenced they have assumed considerably greater magnitude than at the time was thought possible. The original works stood upon a portion of the present site—an exceedingly advantageous one from its central position and its proximity to the landing-stage of the Tyne General Ferry Company and the Corporation Quay. It was, however, felt to be desirable that direct communication with the river should be obtained, and as an opportunity for this occurred during the progress of the work, the Directors of the Company readily availed themselves of it by acquiring some adjacent chemical works. The advantages of this extension cannot be over-estimated, as the two sites will be connected by a bridge across Ferry Street, and the whole work brought into direct communication with the river. Not only will the work be thus facilitated, but there will be economy in the manufacture, and the Company have also room to make future extensions.

The works, which are considerably advanced, will have a productive power equal to a million cubic feet of gas per day. They have been in operation now about six months, and have given satisfaction in their general working. The plan of the works is an exceedingly simple one, the structures and apparatus being arranged in three parallel blocks—the first, the gasholders; the second, the retort-house; and the third, the purifying plant.

With reference to the first, the tanks for the holders were constructed a few years ago, and one of the holders was erected. The contract for the other was made some little time since, and the work will be completed during the coming summer.

In the second block—the retort-house—a change in the usual structures is at once apparent, openings being arranged along the side of the house, and girders running parallel through them, with buckets of coke travelling along them, and depositing the coke upon the heap forming under the girders. In the interior of the house there is a still greater change—a portion of the flooring being removed the whole length of the house in the front of the retort arches, and rails being laid along for a carriage to travel on; the girders from the yard extending over the tops of the retort arches, from which are suspended long trough-shaped buckets; and, further, there is a whirr of machinery to be heard, which, to those accustomed to an ordinary retort-house, will be a greater novelty than anything else.

Though in the matter of detail there are in the house some novelties that may be worthy of notice, yet the great object of attention is the machinery for doing the work. This is constructed according to the patent of Mr. W. J. Warner, the Engineer of the works; and it is the outcome of long years of patient toil to perfect apparatus that should be efficient for the performance of the various operations in the retort-house. The motive power for the machine is that of a steam-engine of 10-horse power, which is communicated to a travelling machine by an endless rope running at a very high speed—about 6000 feet per minute. The engine also drives two shafts running the whole length of the house—one for communicating motion to the hoists or cranes, of which the parallel girders of the coke and coal buckets form a portion; the other for the purposes of driving revolving diggers for feeding the coal buckets from bunkers or coal stores in front of the retorts. The machine for charging and drawing the retorts, being driven by the endless rope, moves to and fro along the house in front of the retorts, and is supported by a carriage running on the rails. The carriage also carries a platform, upon which the men stand to attend to the retorts and actuate the machinery. The drawing and charging tools are supported and adjusted by a screw ram. The work of the house consists of three operations—getting the charge of coal ready for feeding the machine, the charging and drawing, and the removal of the coke from the house as it is drawn from the retorts.

For the feeding operation the coal bucket is lowered, and the two compartments, into which it is divided for the two charges for each bed of retorts, are filled by the revolving diggers from the bunkers. The bucket is then raised by the hoist and left, the whole of the buckets thus being filled and kept suspended till the time of charging. The next portion of the work is to actuate the machine drawing the charge and re-charging the retorts. This is done, after adjusting the tools, by causing the machine to travel into position in front of the first retort. The coke falls into a bucket under the machine, which then moves on to the next retort. As the retorts are at equal distances apart, the moving of the machine to the second retort brings the scoop into position to charge the first. The charge in the buckets is delivered into the scoop by releasing the hinged bottom of the bucket; and the scoop is then thrust into the retort, the charge of coal delivered, and the scoop withdrawn and put into position to receive the other charge; the machine moving on to the next retort, and so on along the whole of the house. The third part of the operation is that of removing the coke. This is done after lowering the empty coal bucket, by lifting the coke buckets by the hoist, and propelling them along the girders into the coke yards, where they deliver their loads, and are then returned to the house. Fresh charges of coal are thereupon raised, and the work proceeds with but little labour beyond that of actuating the machinery. This is but slight, there being great control over the whole apparatus, the men working it being able to adjust the tools vertically and longitudinally by just a pull of a handle.

In the purifying-house there is the same indication of a desire to lessen, as far as possible, the amount of manual labour employed. There is a travelling crane, a joint arrangement of Mr. Warner and Mr. Hopkinson, of Manchester, to be driven in the same way as the machinery in the retort-house, by an endless rope; and it is not only used for the purposes for which cranes in such places generally are, but is also adapted for raising and distributing the purifying material. It is so easy of manipulation that the youngest son of Mr. Warner, a child nine years old, last Tuesday set it in operation and stopped it. At the end of the purifying-house are the boilers, the engines, and the exhausters; and this machinery is of first-class finish, and very effective.

The buildings themselves are of a composite character in construction, being erected partly of concrete and partly of fire-brick. The roofs of the whole have an exceedingly light appearance, and have in connection with them some novelties worthy the attention of those interested in such structures. The Company have not yet erected offices, but we understand that this is contemplated when the works are further advanced. Of course, the leading feature of the works is the machinery, which has undergone a severe test during the six months it has been in operation; and altogether the work reflects great credit on the enterprise of the Directors in thus meeting the requirements of the district.

It is but due to Mr. Warner, the Engineer to the Company, to again say that to him must credit be given for all the improvements to which we have referred. The makers of the machine, for which Mr. Warner has several patents, are Messrs. Higginbottom and Mannock, of Manchester. Messrs. C. and W. Walker, of Donnington, were the Contractors for the

gasholders, roofs, and purifying plant; Messrs. Wren and Hopkinson, of Manchester, for the travelling crane; Messrs. Hanna, Donald, and Wilson, of Paisley, for the engines and exhausters; the Birtley Iron Company, for the connections, hydraulic mains, ascension-pipes, &c.; Messrs. John Abbot and Co., Limited, for the boilers and fittings; and Messrs. J. Cowen and Co., for the retorts, which are used with Morton's patent lids. Mr. W. Whyte has been Resident Engineer, and has rendered good service to Mr. Warner in his arduous work. It is due also to the late Assistant Engineer of the works (Mr. W. Belton, now Engineer and Secretary of the Shrewsbury Gas Company) to say that he was engaged with Mr. Warner for a considerable time upon these works in their earlier stages.

After the inspection of the works,

Mr. J. H. PENNEY (the Secretary of the Company) gave the following statement of the work already done by the machinery:—The machine has drawn and charged the retorts about 20,600 times; and in doing this work has travelled, backwards and forwards, a distance equal to 197 miles—142 miles in the first three months, about 55 miles in the next eleven weeks. This difference in the rate of working was owing to the incomplete state of the coal cranes, &c., in the first three months. Since the latter have neared completion, the work has been reduced to about one-sixth. Formerly, when working with only one bucket, the machine had to travel 728 feet each time; but this is now reduced to 121 feet. In travelling this extra distance, the machine has been subjected to a trial fully equal to $2\frac{1}{2}$ years working.

VISIT OF THE RAMSGATE LOCAL BOARD TO THEIR GAS AND WATER WORKS.

On Monday, the 9th inst., the Gas and Water Committee of the Ramsgate Local Board invited the other members of the Board to join them in the annual inspection of the gas and water works.

After inspecting the offices, testing-room, and stores, the members, headed by the Rev. E. G. Banks, Chairman of the Commissioners and of the Gas Committee, were conducted by the Engineer (Mr. W. A. Valon), to the retort-house, where the method of carbonizing the coal was shown and explained, the process of manufacturing gas being traced from the retorts to the gasholder, the various apparatus employed therein being plainly but interestingly described. After the condensers, the new washer was viewed. In this a piece of glass was fixed, so that those present might see the interior construction and the action, the strength of the liquor being tested both at the inlet and outlet, as well as the quantity passed. The scrubber was next described, after which the engine-room was examined; and here every one was both pleased and surprised, the arrangements being of a most perfect kind. The purifiers were then visited, the station-meter and governor being in their turn minutely examined and explained. The new gasholder formed an interesting part of the visit, since it is the largest one of the kind in the vicinity of Ramsgate. Passing from the holder, the new sulphate of ammonia works were inspected, they being in full operation. This last addition to the works will, there can be no doubt, be the means of greatly increasing the profit made from the gas supply for the benefit of the town.

The visitors then proceeded to the Whitehall water-works, where the engines and boilers, which have recently been thoroughly overhauled and repaired, were seen. A cage was here prepared by which means any one desirous of descending the well might do so; while the temporary pumping machinery erected to keep the adits free from water while extending the tunnels formed a most interesting item in the inspection. By an ingenious device, the water already found is allowed to flow on to the ordinary pumping-station, while that in which the men are working is lifted by the temporary machinery. These new tunnels have been extended about 1100 feet, nearly doubling the original water supply. It was then proposed to proceed to the Southwood station, but, it being late and the weather rather unpropitious, the idea was abandoned, and the members returned home, evidently much gratified with the way that they had spent their afternoon.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS.

The First Quarterly Meeting of this Association for the present year was held at the Guildhall Tavern, London, on Thursday last, when the PRESIDENT (Mr. James Hunter, Engineer and Manager of the Woolwich Consumers Gas Company) read the following address:—

Gentlemen,—I thank you sincerely for the honour conferred by your election of myself as President. I highly esteem the confidence thus reposed in me, and trust I may be enabled to conduct the business of the Association to your satisfaction, being too cognizant of my deficiencies, and that there are many amongst you more fitted to hold this exalted position. I feel assured, however, of your kind forbearance to my faults, and assistance in promoting the well-being of the Association. To show that it has grown into a healthy condition, I need only mention that we now number 60 members. It has pleased the Almighty, in His all-wise providence, to preserve us during the past year, and although illness has affected one or two of the members, still no deaths have occurred. That the Association is very highly esteemed, is fully apparent by the additional number of members, some of whom are well-known, highly-respected, large-experienced, and liberal-minded members of our profession. It is to be trusted that this satisfactory condition may continue for many years, and it behoves us all to endeavour to maintain and improve our position by every means in our power.

We know and feel the great benefit derivable from thus associating together, without taking a prominent or ostentatious course; but in our quiet familiar discussions, much information has been conveyed, and now that it is proposed that a record shall be taken of what is stated, we hope it will act as a guide in our pursuit of knowledge, and as a permanent good to those coming in the future. It is not to be supposed that some of the opinions expressed will not hereafter be modified; but let such modifications be based upon a sure foundation, the result of matured thought and greater experience. It might be thought that this would tend to prevent the expression of experience by the timid. That such will not be the case, we feel assured from past practice; each freely giving or soliciting an opinion without fear, the great principle ruling all, being to convey sound knowledge upon any matter under consideration. We would strongly urge upon all to continue to propagate this good and kindly understanding, as we believe the most talented of our members is not above the acquisition of knowledge, however humble the source from which it emanates, for we all know how acceptable is the assisting thought or hint in times of difficulty.

The papers read before the Association have led to much interchange of opinion, and no doubt considerable knowledge has been acquired or confirmed. One matter especially deserves mention—namely, the highly-interesting visit made to the works of our respected President (Mr. West), at Maidstone, for I feel certain that I only express the general sentiment in saying it was an enjoyable day, and well warrants the best thanks of the Association to the Directors of the Maidstone Gas Company and to Mr. West for the kindness and hospitality accorded to us. No gas manager could have been there without adding to his former knowledge. His eye-

sight was gratified by the utmost order, cleanliness, and good design prevailing, and his thoughts, present and future, would be occupied with new ideas; and what he observed was being done to alleviate our harder-worked brethren, doubtless created a desire to strive to do likewise.

The benefit to be derived by Mr. West's system of carbonization was clearly elucidated, and the plan is well worthy of adoption by all, where facilities permit, either in new works or extensions, or with a desire to cheapen production; and it gives me great pleasure to record the high appreciation of its merits by being placed in operation in one of the most prosperous and best conducted gas-works in the kingdom—viz., the South Metropolitan, of which Mr. G. Livesey is the Engineer. The system has been in use several years, and is now being applied in the provinces.

I must not pass unnoticed the excellent paper by Mr. Hammond, of Lewes, on "Purifying Gas by, and the Treatment of Ammonia," giving a detailed description of his patented process, and throwing some light upon an important and interesting subject. I trust that further success has attended his labours, and that it will be convenient to him to give us another paper on the subject on a future occasion.

An admirable paper was read at our last meeting by Mr. Townsend, of Waltham, "On the Use of Tallow for Jointing Gas-Mains." It was followed by an interesting discussion, and I hope to hear that the system of jointing therein recommended is applicable to the heavier Metropolitan traffic and street disturbance.

The Weights and Measures Act, and its relative effect on the sale of coke, has been under consideration, but has not resulted in any definite uniform system being adopted. I would urge a decision being arrived at at an early period.

During the past year the electric light has ebbed and flowed in its brilliancy before the public, so far as it affected gas stock; at the same time, some progress has been made in the adoption of lighting by the numerous systems. If, however, under the high pressure with which it has been urged forward, so small a result has been attained, and that with difficulty, gas companies have little to fear. Mr. Edison, if we are to believe newspaper reports, has something exceedingly brilliant to bring forth shortly; but this has been stated so repeatedly that confidence is much shaken in his being able to advance farther than his present position, and until more information is forthcoming it will be useless to speculate on the matter.

The period through which we have just passed has been marked by depression of general trade, but I trust that a revival has now set in. It is gratifying to find that the larger proportion of gas companies have not suffered in this respect, circumstances, so far as cost of material and sale of residuals are concerned, having greatly assisted them. This continued prosperity has not been without its effect, as may be observed by the reductions made in the price of gas. It is to be remarked that those companies who work under the sliding scale continue to advance in public favour. The success attending these cases of legalized co-operation is but a proof that much satisfaction and benefit are to be derived from serving the consumer liberally. After the repeated instances during past years of the advantages of the sliding scale to the parties solely or the most interested—consumer and company—it is clear that if the companies are only permitted to remain undisturbed for a year or two, its benefit will be much more exemplified. It is therefore to be deplored that numerous gas companies have been, and are in prospect of being absorbed by public authorities, who are to some extent irresponsible bodies—here, to-day and gone to-morrow, at the caprice of the ratepayers, the bulk of whom may never be affected by the price of gas. The means whereby this is effected are such as few, if any, gas companies have been able to avail themselves of, and may be considered seriously detrimental to the commercial enterprise and welfare of the country at large; being, as they are, the deprivation of one of the few secure and remunerative means of investing the savings of the provident.

Instances of the beneficial results of amalgamation are not wanting, and those at present upon the *tapis* will, no doubt, result to the advantage of all concerned, if they are permitted to remain unembarrassed. This is a step highly to be commended.

There is a matter of more importance to gas companies than Edison's scares, and, I think, requires attention—viz., the use of petroleum or similar oils, which now enters, and will continue to enter into competition with gas lighting among a numerous class of the population. The improvements made in its combustion will no doubt have an effect in other spheres of gas consumption. The light is brilliant, convenient, and the cost agreeably small, while the periodical outlay for the oil is more suited to the financial position of smaller consumers than the quarterly charge of the gas company, which is frequently accompanied by the addition of what is by many considered to be an objectionable meter-rent. Cheaper gas is needed, and there is great risk in delaying its production. Are the facilities for gas manufacture to be derived from this oil? Being so rich in character, it may be capable of becoming an important aid even in the present system of gas-making, and worthy of trial, if only with a view of a reduction in the use and cost of coal. It is true the present supply of coal is abundant; and as new mines are being opened on the Continent, it may be considered inexhaustible. The Americans are stepping in advance in this respect; therefore do not let us lag behind. Depend upon it, there is the germ of greatness in it. Look well to it.

Purification, sulphur compounds, naphthalene, exposure of gas to tar, the hydraulic main, the dip-pipe, the seal, extraction of tar, settings of retorts, the regenerative furnace, and numerous other matters appertaining to gas production, have, no doubt, had your attention, and need not be mentioned now. The able articles recently published by Mr. R. H. Patterson in the JOURNAL OF GAS LIGHTING well deserve your perusal and study. That benefit has been derived from the much advocated system of exposing gas to the tar flowing from the hydraulic main is undeniable; at the same time, it may be capable of evil from its too long duration. I must, however, be permitted to leave the question an open one for the present.

Purification by lime, although efficient in the removal of sulphur compounds, requires further investigation, with a view of better results being obtained in point of economy. Most gas managers knew something of the chemical changes of material combinations, and were able to assign a reason for them; but few gas men or even chemists were acquainted with the manipulations of gaseous chemical or mechanical combinations as affecting coal gas, or the difficulties attending it, as illustrated by the erratic results of practical working. The affinity, if I may use the term, adhesion, or combination of one gas with another, even in the presence of a body known to be capable of the extraction or dispersion of one of them, though under favourable circumstances, has failed in producing the result desired—a result at variance with expectation or past knowledge. It is pleasing to know that some of these difficulties are being remedied by more perfect apparatus, such as Mr. Livesey's washer, which is giving great satisfaction. Mr. Anderson's brush-scrubber is also producing good results; and Messrs. Kirkham, Hulett, and Chandler's washer-scrubber is doing well.

The yearly increasing quantities of spent lime, the growing risk of complaints of nuisance from its use, and the difficulty of its disposal, are being much felt by gas companies, and when considering the cost and bulk of

the mass of purifying material, whether lime or oxide, daily being handled in London alone, to say nothing of the entire country, we must admit that it is enormous. A natural question arises—Cannot this be avoided? The various schemes, however, brought forth are not yet in the condition that would warrant the entire abandonment of the present system. Under these circumstances, Mr. Hislop's process for the revivification of lime well deserves our consideration. The capability of ammonia to purify gas is being pushed forward with commendable zeal, and the fact is fairly prominent that the residual products from the carbonization of a ton of coals will purify the gas obtained therefrom, and it is in my humble opinion by pursuing this course that we may expect to be independent of external aid, and obtain a perfect process unattended with present evils.

The heating of retorts by the regenerative or similar furnaces, is receiving attention; but at present I must leave these expensive luxuries to the larger companies, trusting to hear of their success.

I desire not to trespass too much on your time, or I should wish to have alluded to the gas-meter, public lighting, &c.; but there is a matter which cannot be passed unnoticed—viz., Sunday working. I will not enter much into the question, but confine myself to one or two remarks. The result of its discontinuance is very satisfactory, and greater attention should be devoted to this subject. It is not only a duty, for the welfare of the men and their families, but desirable on other grounds. Among others: The improved class of workmen, superior in every respect to what it was customary to see in gas-works; greater sobriety, better conduct and health, more attention to duties, and better time kept; less trouble and anxiety to those in charge—all these are advantages which, as practical gas managers, you can appreciate, and, therefore, it is not necessary for me to allude to them. Lastly, and not the least important, is the resulting general improvement and advancement of the companies' affairs.

With many thanks for your kind attention, I will conclude by expressing my pleasure at seeing so large an attendance of members, and my regret that our Secretary is too unwell to be present among us.

In the evening the members dined together, a very pleasant gathering taking place. The chair was occupied by Mr. HUNTER, and the vice-chair by Mr. JAMES ELDRIDGE, of Richmond. In the unavoidable absence of the Secretary (Mr. J. L. Chapman) through sickness, Mr. D. F. GODDARD efficiently performed his duties. Dinner over, the President gave the toasts of "The Queen," and "The Prince of Wales and the rest of the Royal Family," in felicitous terms, and the toasts were heartily responded to. The toast of the evening, "Success to the Southern District Association of Gas Engineers," was ably proposed by Mr. T. R. RICHARDSON, Secretary of the Woolwich Consumers Gas Company, and replied to by the CHAIRMAN, who afterwards proposed "The British Association of Gas Managers," expressing regret at the absence of the Secretary of that Association (Mr. W. H. Bennett) through ill-health. This toast was responded to by Mr. CORBET WOODALL. The remaining toasts included the "Committee of the Southern District Association," humorously proposed by Mr. JOHN CHAPMAN, of HAYROW, and replied to by Mr. C. GANDON, of the Crystal Palace Gas Company; the "Visitors;" the "Press;" &c.

THE OPPOSITION TO THE LIVERPOOL CORPORATION (VYRNWY) WATER SCHEME.

DEPUTATION TO THE LOCAL GOVERNMENT BOARD.

A deputation, representing certain public bodies of towns in Shropshire, Worcestershire, and Gloucestershire, which are receiving their supply of water from the source of the Severn, waited upon Mr. Sclater-Booth, the President of the Local Government Board, last Tuesday, in opposition to the Bill in Parliament now being promoted by the Liverpool Corporation, for obtaining water from the River Vyrnwy and other tributary streams of the Severn.

Earl BEAUCHAMP, who, in the absence of the Duke of Beaufort, introduced the deputation, said that the subject of the proposed new water supply to Liverpool was one of considerable importance. It was important first of all as regarded the trade of the Severn, next as regarded the fisheries, and also as regarded sanitary questions, which were involved in an adequate supply of water to the populations living on the banks of the river. With respect to the trade of the Severn, it was felt by those interested that it was a matter of great hardship that the trade should be interfered with; as they believed it would be, if the Bill now proposed by the Liverpool Corporation were allowed to pass into law. As regarded the fishery question, it would be idle on his part to contend that it should be placed in the scales as against the interest and commerce of a great town like Liverpool; but it was a very important question to consider in connection with the matter, and ought not to be overlooked, especially as there was reasonable ground for hoping that the supply of fish in the Severn would not always remain at the point at which it now stood, and that legislation would have the beneficial effect of developing this class of food. The really important question, however, was the sanitary one. Many of the towns situated on the banks of the Severn drew their water supply from it, and evidence could be produced that the Vyrnwy, which it was proposed to divert, contained the finest kind of water that was supplied through the medium of the Severn. The Severn watershed did not lie on the side of Liverpool, and the deputation felt that it was not right that the Corporation of that town should endeavour to avail themselves of the source of supply which was not within their own watershed, and that they should seek to tap another which was outside their area. The question of a National Water Supply to the people of this country was an important one, and he thought that before Liverpool was allowed to step in and appropriate one of the large watersheds of the country, this question ought to be well and carefully considered by Government. If Liverpool required so large a supply of water for sanitary purposes mainly, perhaps there could not be so great an objection to the scheme; but they would derive a large revenue from water sold for trade purposes, and which the deputation contended was a revenue derived from what was practically their own water. Liverpool, he maintained, ought not to come to the Severn for her water supply, as she was so placed that a supply could be obtained from the Cumberland district. There was an unanimous feeling in the districts represented by the deputation that it would be a great grievance that the water supply of Liverpool should be drawn from the sources named in the Bill, and they also thought it was a great hardship that they should be called upon to enter into conflict with a large and powerful Corporation like that of Liverpool in order to maintain their interests. He asked Mr. Sclater-Booth, having regard to the important questions involved, and also in view of a National Water Supply, to do what he could to induce the Government to resist the Bill proposed, and to spare the opponents of the scheme an enormous expense—an expense which must be borne in great part by the ratepayers.

The TOWN CLERK OF WORCESTER observed that, as far as that city was concerned, the traffic on the river would be injured by the Bill becoming law. If the pure water of the Vyrnwy should be taken by Liverpool, the inhabitants of Worcester would be compelled to have a less pure supply than they had at present, and would probably have to bear the expense of procuring a fresh supply from another source. The supply of water for Liverpool should be taken from a source which would not interfere with

trade interests of any magnitude, and which would not affect any large population. Besides, he considered that if Liverpool required more water it could be obtained from Thirlmere, as there was a clause in the Manchester Corporation Water Act of last session providing that Liverpool could get 25 million gallons a day from Thirlmere.

Mr. SCLATER-BOOTH asked whether the clause referred to was a special reservation in regard to Liverpool, or a power generally reserved.

The TOWN CLERK OF WORCESTER said it was a general reservation made on behalf of the people of Lancashire.

The MAYOR OF WORCESTER urged that by the scheme of the Liverpool Corporation the water supply of Worcester would be greatly diminished and depreciated. It ought, he said, to be remembered that Worcester had spent £70,000 in sewerage and water works, and it would therefore be very hard if the inhabitants of the city were driven to find out a fresh source, which probably would be the case if Liverpool were permitted to take the waters of the Vyrnwy. The Liverpool Corporation had no right to go for water to a watershed which did not belong to them, and he hoped that the scheme would not be tolerated by the Government until a Commission had carefully inquired into the question of a National Water Supply.

Mr. ROBERTSON, M.P. for Shrewsbury, stated that the Corporation of that town were unanimous in their opposition to the Bill, as they were of opinion that it was calculated to injure the interests of Shrewsbury and neighbourhood, especially from a sanitary point of view. Liverpool could get a supply of water from the Dee, which would be more convenient and less costly than obtaining it from the Severn. He submitted, on behalf of the Corporation of Shrewsbury, that Liverpool ought not to be permitted to appropriate to itself so very large a portion of the best waters of the Severn.

Mr. SCLATER-BOOTH asked if any calculation had been made as to the quantity of water to be extracted from the Vyrnwy.

Mr. ROBERTSON replied that it was proposed to take the waters from the Vyrnwy, Marchant, and Afon Cowny, and to give 8 million gallons a day compensation.

Sir BALDWIN LEIGHTON considered that it was scarcely fair for Liverpool and Manchester, which were practically one district, to monopolize nearly the whole of the gathering-ground of England and Wales.

Mr. WILLIS-BUND, of the Severn Conservancy Board; Mr. WYNN, M.P. for Montgomeryshire; and the TOWN CLERK OF CHELTENHAM, also spoke in opposition to the scheme.

Mr. WALTER PIERCE, President of the Liverpool Land and House Owners Association, stated that a large number of property owners in Liverpool were quite in sympathy with the objects of the deputation. He also said that the poll taken in Liverpool, under the Municipal Corporations (Borough Funds) Act did not fairly represent the feelings of the people of the town on the question.

Mr. SCLATER-BOOTH, in reply, said that the subject the deputation had brought before him was, of course, very interesting and most important, and when the project for supplying Liverpool with water from some portions of the sources of the Severn was made known, it was natural that it should excite attention, and perhaps apprehension in some localities. Therefore, he could not wonder that common action should be taken by those represented, with the view of considering whether their interests did not require some united course to be pursued. It was nevertheless true that the needs of a population like Liverpool were very great, and were growing in regard to the first necessary of life. It was thus a duty incumbent upon the Town Council of Liverpool, if they were, as he was informed they were, in urgent need of an additional supply of water, to look in different directions, and it was no new intention to turn southward instead of northward. Still, they were, to a certain extent, in the dark as to the real amount of mischief, if mischief there would be, that would be entailed upon the inhabitants of the Severn Valley. That was one of the difficulties with which they had to contend at present in dealing with this matter. He could not tell what the calculations of the Water Engineers were, and what they proposed to do by the construction of reservoirs on an enormous scale for the purpose of concentrating the supplies. All these matters were very difficult to appraise until the subject had been sifted, and the promoters had the advantage of going into the committee-room with their case more easily proved than perhaps the case of their opponents might be. On the other hand, when he spoke of the wealth and power of the Corporation of Liverpool, he could not help looking round him on those assembled, and they showed ample power to watch and guard the interests of those whom they represented in the different counties through which the Severn, the second great water basin of the country, flowed. The conditions which they had submitted to him as to the use of these waters were of very great weight indeed, and he could not say he thought they would do wisely to assert a right of monopoly to the water of the Severn. No doubt the Liverpool plan differed from the Thirlmere scheme of the Manchester Corporation—a fact which had been unobserved by the Government, and it was one respecting which he need not be reminded. On the other hand, if the Water Engineers could so arrange a plan of this kind as that it would inflict no injury on the persons who were naturally entitled to the use of the waters, and whose needs must certainly have the first claim upon the sources of the Severn, it was hard to say that a place like Liverpool might not be served in respect to the most pressing need of its population. The plan of going to the sources of the Dee was one of very old date, therefore it could not be said the Corporation of Liverpool had sprung a mine upon the country generally in going out of their own district for a supply of water. At the same time it was a question for Parliament and the country whether a plan of this kind should receive sanction or not. He could only promise that the representations which the deputation had made should be submitted to the Government, with a view to consider whether it would be their duty to take any specific action. The natural course was to leave these technical questions to be reported upon by a Committee, and the opponents of a plan like this would have ample means to make their views heard in both Houses of Parliament. He could not doubt that their case would be listened to and attended to, and at all events care would be taken that no injury should be done to the inhabitants of the important towns and districts which they represented. He could not enter further into the matter on this occasion, and he would conclude by saying he should be sorry if it was supposed that the promoters of the plan would not have to submit to a most searching investigation, and be prepared to make clear that if their scheme were sanctioned no injury would follow to the inhabitants of the Severn Valley.

The deputation then withdrew.

ACKWORTH, FEATHERSTONE, PURSTON, AND SHARLSTON GAS COMPANY.—A special meeting of this Company was held on Tuesday, the 3rd inst., for the purpose of confirming a resolution submitted to the Shareholders at a meeting held on the 13th ult., viz.—"That the Bill for incorporating and conferring powers on the Company be approved, subject to such conditions, alterations, and variations as Parliament may think fit to make therein." Mr. A. Wardman was in the chair; and the Secretary (Mr. J. Watson) having read the notice convening the meeting, the necessary confirmatory resolution was, after some discussion, agreed to.

PAINTER'S PATENT HYDROSTATIC PIPE-JOINT.

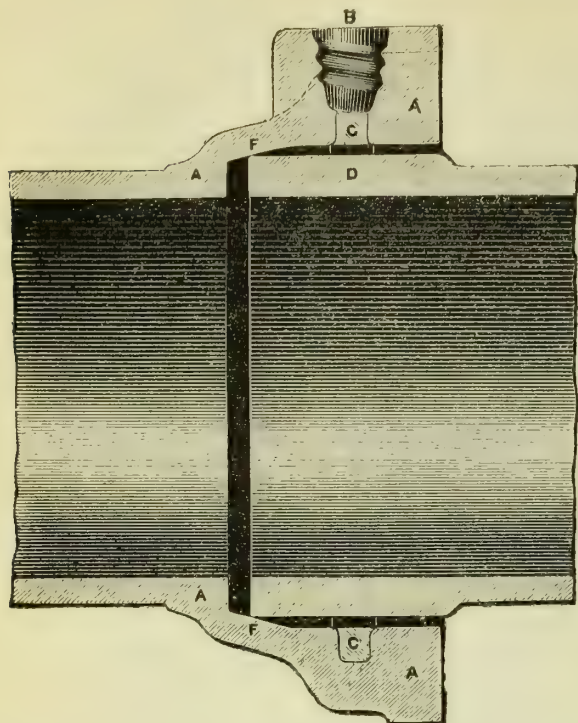


Fig. 1.—SECTION OF PIPES IN POSITION FOR MAKING JOINT.

We desire to call the attention of those in charge of gas and water works to the novel and scientific invention illustrated above, and which promises to be of great service in general practice.

The improved joint is made by caulking a lead ring between the spigot and socket of the pipe, by means of hydrostatic pressure so applied that the ring is subjected to a uniform pressure at all points of the circumference, thus leaving no room for imperfect work. When we add that the operation is performed without heat, that any unskilled labourer can make the joints faster than the pipes can be laid in position, that the joints can be made under water with equal certainty, and that less than one-third of the usual amount of lead is sufficient, we have, we think, said sufficient to call the critical attention of the profession to the invention.

Fig. 1 is a vertical section of pipes laid in position, and fig. 2 is the same after the joint has been made. A is the socket end of a pipe; and B a screw-hole in the centre of a boss, cast on the part of the pipe laid upwards. This screw-hole is cast upon a chill, and communicates with a groove cast around the inside of the socket. The groove is filled with lead, C, run into place, at the foundry before the pipes are sent out. D is the spigot end of a pipe, and being without the usual bead is preferably cast a little thicker for strength. E is a cast-iron plug, also cast in a chill to avoid fitting; and F is a taper shoulder, which guides the spigot into a concentric position. G is the forcing material—a semi-fluid compound of pitch, whiting, and sand, which conveys the pressure to the back of the lead ring from a forcing-jack.

The pipes being laid in position, the labourer screws a small forcing-jack into the hole, B, having previously inserted within the jack enough of the forcing compound, G, to make several joints. By turning the handles of the jack, the semi-fluid forced downwards deflects the lead ring beneath B, and flowing each way around and behind the lead, squeezes it in upon the spigot, and spreading laterally, as it impinges upon the spigot, the lead is caulked so as to prevent any return, or leakage past it. As soon as the lead is firmly seated (which for a 12-inch pipe requires about six or eight minutes), the labourer takes out the jack, puts a little clay in the hole, B, and screws in the cast-iron plug, E, to retain the forcing material, and he is then ready for another joint. The lead ring is simply cast in place by slipping an expanding ring, covered with felt, within the socket, and pouring the molten lead through the hole, B.

It will be seen that the invention is based upon the law of the flow of solids, as in the case of drawing lead pipes, and squirting bullet-rods.

The joint has, it is stated, been tested under a pressure of 1000 lbs. per square inch, and afterwards the pipe was deflected to a considerable angle by a sledge hammer, without causing leakage. In fact, settlement of the ground after the pipes have been laid makes the joint tighter by the lead ring forming a slight ellipse upon the pipe.

We have seen copies of several testimonials in favour of the joint from engineers of repute in the United States, where it appears to be giving satisfaction. The invention is in the hands of Mr. J. S. Fairfax, of 1, Queen Victoria Street, E.C.

A NEW METAL COMPOUND SUITABLE FOR PIPE-JOINTS.

At the Meeting of the Society of Arts last Wednesday, a paper on "A New Metallic Compound, and its Application to Industrial and Artistic Purposes," was read by Mr. GRANVILLE COLE, Ph.D. Omitting those parts which had special reference to the uses of the new compound for artistic purposes, the paper was as follows:—

The subject of my paper is the discovery of what I shall prove to you is a new metallic compound, and I shall endeavour to set forth a few facts, attested by experiments, in respect to its nature. In the first place it will be right to give a brief account of the discovery of the metal.

Nearly a year ago, Mr. J. Berger Spence discovered that the sulphides of metals combined with molten sulphur form a liquid. This liquid, on cooling, becomes a solid, homogeneous mass, possessing great tenacity, and having a peculiar dark grey, almost black colour. Nearly every metallic sulphide which is known combines, as experiments have proved, with an excess of sulphur, and, curiously, nearly all these combinations have the same properties.

Examining the metal from a chemical point of view, I may state, briefly, that it is a chemical compound belonging to that class known as thiates or sulphur sulphides.

Dr. Hodgkinson, Chemical Demonstrator at the Science Schools, South

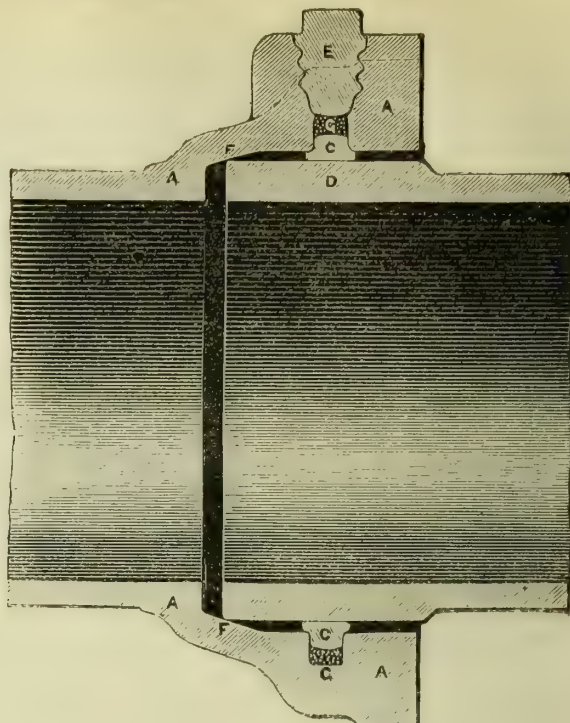


Fig. 2.—SECTION OF JOINT COMPLETED.

Kensington, has kindly sent me the following facts. I cannot do better than quote his letter on the subject:—

It appears to be the easiest thing in the world to obtain a homogeneous casting with it. Specific gravities of portion sent gave 3.3743 to 3.7036 (reduced to 0° C.)

When finely powdered, it is acted upon slowly by concentrated HCl. and NO₂HO in the cold. In large lumps, little or no action takes place. As yet I have not been able to determine the expansion equivalent accurately; it would appear, however, to be small. The fracture is not conchoidal, as might perhaps have been expected, but somewhat like that of cast iron.

I have not had time to try many "utilization experiments" on the substance, but I have no doubt it would be exceedingly useful in the laboratory even; for instance, for making the air-tight connections between glass tubes by means of choutchouc, and a water or mercury jacket, where rigidity is no disadvantage. The fusing point is so convenient, about 340°, that it may be run into the outer tube on to the choutchouc, which it grips, on cooling, like a vice, and makes perfectly tight.

I do not know what you may call the material, but should think, as it seems to be more than a mere mixture, "ferrie thiate" would not be a bad or inappropriate name.

I will now give a short summary of the metal's peculiarities, and advantages over those of other metals or metallic compounds.

1. It has a comparatively low melting point—viz., 320° Fahr., or rather more than 100° above the temperature of boiling water. Here, then, we have in its favour the small amount of fuel needful to supply the necessary heat for reducing the metal to a condition for use.

2. It expands on cooling—a property not shared by the majority of other metals or metallic compounds. I believe that type metal and bismuth are two exceptions. Later on, I think I shall convince you that for an operation like the joining of gas and water pipes this expanding property is one of great importance.

3. It claims to resist atmospheric or climatic influences.

4. As compared with other metals or metallic compounds, its resistance of acids, used commercially, of alkalies, and water, is certainly superior.

5. As compared with lead, which is one of the cheapest of metals, it is one-third the weight; and whereas the average cost of lead for the last ten years has been nearly £18 a ton, Spence's metal only costs £15. A ton of Spence's metal being three times the amount in bulk of that of a ton of lead, it is available for three times the amount of work. It may, therefore, be considered to be nearly a quarter of the price of lead.

As to the uses to which this metal may be applied for industrial purposes, I propose to divide these purposes under three heads:—1. Gas and water works. 2. Chemical works. 3. Miscellaneous.

As practice is better than theory, I will simply relate, as best I can, those experiments which have been tried at the South Metropolitan Gas-Works. Experiments, under the direction of Mr. Livesey, were made some weeks back; and two pipes were joined by the metal in much less time than would have been taken had lead been employed. The pipes, after having been joined, were tested under pressure, but no leakage was found.

In order to show the especial advantages the metal has over lead, it would be as well here if I endeavour to tell you how gas or water pipes are joined when lead is used. The pipes having been laid together, the joint is packed with yarn; and clay is then laid round the exterior of the joint, and the molten lead is run in. Unfortunately, lead possesses the property of contracting on cooling. The leaden joint has, therefore, to be caulked, or, as it is called in the North, staved. This caulking, or staving, means wedging the lead in, so as to obtain a perfectly tight joint; and it naturally occupies considerable time, and necessitates excavation, in order to allow the men to work all round the pipes.

Excavation and caulking are both rendered unnecessary by the use of Spence's metal. The pipes have only to be laid together, and after the yarn has been forced into the joint and the clay placed, the liquid metal is run in, the clay is removed, and the joint is finished. The metal does not splash in running into the mould, thus avoiding a great source of waste of material and danger to workmen.

Experiments were also tried to test the metal joints in the event of subsidence of the ground. Four lengths of 9-foot piping, 6 inches diameter, were joined with the metal, and supported on trestles. After the metal had set, which it did in a few minutes, the centre supports were knocked away, leaving only the two end ones. The 36-foot length of piping sank 7 inches, without showing a leakage, even after pressure.

These experiments were so satisfactory, that the South Metropolitan Gas Company have adopted the metal, and are now laying their pipes with it. Mr. Livesey, the Chief Engineer, in writing on the subject to Mr. Spence, says: "We have now only the test of time, and that, I think, we may take the risk of." Others of the London gas-works, and a very large number of provincial gas-works, are adopting it.

In the same way it will be useful for water-works. Mr. Hope, who undertook some experiments in Scotland, reports that at the Edinburgh Water-Works two pipes were joined, and subjected to a pressure of 400 feet of water, which was as much as they could get on, without the joint showing any leakage. This is the greatest pressure which we have as yet been able to put it to, so what it will actually bear I am not at present in a position to say.

From a sanitary point of view, as water has no action on the metal, it would be extremely valuable for cisterns, instead of iron or lead. Being almost a non-conductor of cold, pipes might be lined with it to prevent the water from freezing.

To chemical manufacturers, the metal being less acted upon by acids than any other metals, it may also be of service. I refer especially to sulphuric acid, which is the most extensively used of all acids in commerce. Lead has, up to the present, been used for sulphuric acid tanks. I have myself tested the metal with sulphuric acid, and its action is almost imperceptible. The one objection to the use of the metal in this case is its low fusing point, but when acids have only to be used up to a certain temperature, say 200° Fahr., I venture to predict a large field for its use.

Besides the uses I have thus briefly set before you, there are many others to which the metal may be applied; for instance, joining iron to stone or wood, the tensile strain of the metal being from 650 lbs. to the square inch five minutes after setting. For joining railings to stone it would answer equally as well as lead, and be very much less in cost; also for coating the holds of ships. I have been told that an Act of Parliament has been passed by which builders are compelled, if the district surveyors desire, to cover the walls of houses, after they are built, two feet out of the ground with some material to prevent the damp from rising. It seems to me that Spence's metal is peculiarly adapted for this purpose; and I may state that experiments on a large scale are still being carried on at Mr. Spence's works, Belvedere, Kent.

I feel sure we have not yet come to the end of all the uses this Spence's metal may be put to, but I trust that I have shown you sufficient to induce you and others who may be interested in this discovery to make further investigations. If my paper is somewhat shorter than is usual, it is to some extent owing to my hesitation to make any statement which either Mr. Spence or I have not verified by actual experiment ourselves. In conclusion, I express a hope that I have established the proposition with which I started, and I trust you are satisfied that this Spence's metal is a discovery which has a prospect of much utility to the fine and industrial arts, and that I have been justified in bringing it before the attention of the members of the Society.

In the course of the discussion which followed,

The CHAIRMAN said Dr. Cole had certainly proved that there was in one way or other a very large field for the employment of this new metal. It was very curious to see how an invention, first made with a particular object, sometimes took afterwards an entirely different direction. This material was first brought forward as affording admirable reproductions of works of art, and now they were informed that it was already in profitable use for joining gas and water pipes, and that for this purpose it possessed considerable advantages, not merely because lead required wedging in, in order to make a tight joint, but very often, from the difficulty of getting at the under side of the joint, it was imperfectly accomplished; whereas this new metal, from its fluidity, penetrated all round, and so made a good piece of work of it.

The SECRETARY narrated the tests to which he had subjected the specimens sent him by Dr. Cole. He said that at anything under about 320° Fahr. it was pasty, and if the temperature went much beyond that it became pasty again, but between 320° and 350° it was perfectly liquid. He thought it rather a pity that a better name had not been devised for the material, as it was certainly not a metal.

Mr. GEORGE LIVESY said he had had some experience in regard to joining gas-pipes, and he would state the result. Lead, though it was almost universally used, was most unsuitable for this purpose in some respects. It was expensive; it required caulking or setting up to make it tight, because it contracted in cooling; and, if it was necessary to remove the pipes—which constantly happened, except in the very largest mains—from the increased consumption requiring larger pipes, the use of lead prevented the pipes being lifted without cutting them, and this occasioned considerable loss. Various means had been tried for drawing pipes, but all had failed, and they always had to be cut. Another drawback was that lead, being valuable and easily disposed of, was constantly being stolen. This new metal, however, was free from all these disadvantages; and it had many advantages for main-laying purposes, not the least of which was its perfect soundness. The account given by Dr. Cole was quite accurate. The four pipes joined at his (Mr. Livesey's) works in the Old Kent Road, as described, and supported at the two ends, were exposed to the most severe test, and when he purposely broke one of the joints at the conclusion of the experiment to see what the effect was, he found the metal had taken a perfect impression of the cast iron. The South Metropolitan Gas Company were now using it instead of lead; the men had no difficulty in applying it; and the only test required was that of time, of which he had no fear. The only possible difficulty was that the workmen, being accustomed to use a fierce fire to melt lead when used, might make the metal too hot, and so burn the sulphur in it; but this could easily be guarded against. If required, the metal compound could be easily cut out with a chisel in order to remove the pipes; and another advantage was, that if from any cause it did not run quite round a large pipe and make a perfect joint, the part which had not been filled could be cleaned out, a fresh piece of clay put there, and the place filled up with a little more metal, and thus the joint was made quite sound.

Mr. CRESSWELL wished to know, in the first place, if this material, when used for joining pipes, possessed any elasticity, because he was told that it was absolutely essential to the permanence of gas-pipes under the London streets, with heavy traffic continually passing over them, that there should be a certain give and take, or elasticity in the joints. If, when heavy pressure was brought to bear on the pipes, they gave way at the joints, the value of the joints was reduced to *nil*. In the ordinary way, the pipes were first caulked, then the joint was filled with lead, and the lead caulked, and thus an elastic joint was produced which would yield to such an extent that the pipe might be bent without destroying the continuity of the joint. If, on the other hand, this metal was so brittle that under any sudden pressure it gave way, it would be a formidable difficulty. The next question was this. He understood there was a project for bringing water to London from the sea, and one of the greatest difficulties, as he was informed, which the promoters would have to deal with, was to discover a joint for the pipes which would not be affected by salt water. If any means could be devised for cementing pipes which would allow of salt water being conveyed from Worthing to London, and remaining in the pipes for 48 hours or more, or even permanently, it would relieve the promoters of the enterprise of a great difficulty, and perhaps confer a great boon on the inhabitants of the Metropolis.

Mr. WALLER asked if the compound would expand and contract in the same proportion as water-pipes, if used for joints for hot water.

Mr. SPENCE said the joints would be considerably affected by hot water if the temperature were very high. Ordinary boiling water would not

affect the compound; but, as it melted at about 300°, if there were a steam pressure of about 40 lbs. there would be such an increase of temperature that the joints would not stand. It did possess a certain degree of elasticity. In one case, 30 feet of pipes were connected with this metal at the joints, and deflected to the extent of 8 inches, and, when the weight was removed, the pipes recovered their original position, showing that it was elastic to some extent. With regard to expansion and contraction he was hardly yet in a position to speak. He would take this opportunity of stating that if ever the metal compound, as it was called, did take a place in art or industry, much of its success would be due to Dr. Cole, who had greatly assisted him in his experiments, and in elucidating the facts; and also to Mr. Livesey, who was the first to take it up in a practical way.

Mr. LIVESY said lead was certainly not elastic. If four lengths of 9-feet pipes were joined together with it, caulking it up in the ordinary way, and the central supports were knocked out, the upper part of the joints would squeeze into a narrower compass, and the lower would be left open, and when the pipes were again brought to a straight line, the lead would not return to its original shape. Lead was not elastic in any sense whatever, and it was, therefore, a very bad thing for pipe-joints, where there was any settlement or change of position. This new metal seemed to have the effect of making the four lengths into one continuous, perfect pipe, which had just the same strength in the joints as anywhere else. This was shown by the fact that when supported at the two ends it sagged evenly throughout, making a continuous curve; whereas if the joints had been made with lead, there would have been a number of straight lines, with angles at the joints.

Dr. COLE, in answer to Mr. Cresswell, said he believed that salt water would have no action on the metal whatever.

A vote of thanks to Dr. Cole terminated the proceedings.

TECHNOLOGICAL EXAMINATIONS.

The City and Guilds of London Institute for the Advancement of Technical Education have just issued a revised edition of the programme for their technological examinations, which are to be held in May next, at different local centres throughout the country, as notified in the JOURNAL for Sept. 30 last year, p. 511. Among the additions, which appear for the first time in the second edition, is a notification that an examination on "Fuel" will be held. The examiner will be Professor Edmund J. Mills, D.Sc., F.R.S.; and the examination will include questions founded on such subjects as the following, but will not necessarily be confined to those subjects:—

1. Nature and mode of propagation of flame.
2. Conditions of perfect and economical combustion. Forms of burners, stoves, and furnaces.
3. Calorimetry. Calorific value and calorific intensity of any combustible or mixture of combustibles.
4. Properties and treatment of wood, "charbon roux," and charcoal. Comparison of the "oven" and "stack" processes.
5. General consideration of the transition from cellulose (and its allies) to carbon.
6. Preparation and properties of peat. Various methods of drying peat, and apparatus therefor. Economics of peat. Peat charcoal.
7. Lignites and their uses.
8. The different varieties of coal. Coke, as prepared both by the "oven" and "stack" methods.
9. Coal gas as a fuel. The regenerative furnace.
10. Anthracite.
11. Cereals, petroleum, patent fuel, and other minor fuels.

For the full Technological Certificate, the candidate will be required to have passed at least in the elementary stage of one of the following science subjects:—Machine Construction and Drawing; Applied Mechanics; Acoustics, Light, and Heat; Organic Chemistry; Geology; Metallurgy; Steam.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of this district continues in a depressed condition, and there is no improvement since last week. The better classes of round coal are becoming more difficult to move, and owners in many cases are not able to keep their best coal collieries going full time. I have heard of one or two inquiries coming into the market for gas coal, and it would certainly seem prudent on the part of consumers who have requirements to cover to take advantage of the present state of the market. As I pointed out last week, there is a probability of the better classes of round coal being very plentiful during the summer, and low in price; but, although the quantity of the lower classes of round coal going into consumption for manufacturing purposes is still considerably below the means of production, there is everywhere in the iron trade—which, of course, is the principal consumer—a feeling of confidence with regard to the future; and, should the demand from this branch of industry increase to any large extent, it would naturally tend to harden the market generally. At the present time there is a weakness in round coals, as well as an abundance of supplies in the market, which might induce the holders in some cases to sell forward for the purpose of securing orders, and I have heard of a few instances where this is being done, although generally some advance upon present rates is asked for anything like extended deliveries. The prices now ruling for round coal at the pit mouth are about as under:—Good qualities of Wigan Arley, 8s. to 8s. 6d. per ton; inferior sorts, 6s. 6d. to 7s.; Pemberton four-feet about the same price; common round coals, suitable for house-fire purposes, are fetching about 6s., whilst steam and forge coal can be bought at from 5s. 3d. to 5s. 9d. per ton. With regard to slack, there seems to be generally rather a better feeling in the market. The requirements of consumers of this class of fuel are decidedly on the increase, and there is every probability of a much larger demand, which is bringing a good many inquiries into the market for forward contracts. This is causing colliery proprietors to hold more firmly than they have been doing, although the prices at present obtainable are no higher; good slack at the pit mouth ranging from 2s. 9d. to 3s. 3d., and common sorts from 2s. 3d. to 2s. 6d. per ton.

In the iron trade there has been, if anything, a rather better tone, and although there is still underselling on the part of merchants, second-hand lots of outside iron have scarcely been offered at such low figures as last week. A fair demand for shipment is maintained, and a good deal of activity is being looked forward to when the spring shipping season opens. For Lancashire pig iron delivered into the Manchester district quotations remain at about 70s. per ton, less 2½ per cent. Makers of finished iron are very firm, and very little iron can at present be obtained except through merchants. Lancashire bars delivered into the Manchester district are quoted at about £9 to £9 10s., and hoops at about £10 10s. per ton.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The best Durham gas collieries are kept fully employed. Some more contracting was done last week. Prices continue at the same rate. We

are within a fortnight of the reopening of the Baltic trade, when very numerous cargoes of gas coals will be shipped for various parts of the world. The demand for steam tonnage to carry coals, especially gas, over sea is increasing. A lot of a good sort of second-class gas coals has been sold under contract, and will be sent abroad during the ensuing season. The shipments of gas coal coastwise were again very much held in check last week through the continued prevalence of fogs in the North Sea, in the lower reaches of the Thames, and upon the south-eastern coast.

Large contracts have been made for the shipment of best steam coals. But the advance in prices has not been so great as the coalowners anticipated. Small and manufacturing coals keep their position in the market. The demand for coke is fully upheld. Large quantities, sold under contract, are sent away to the blast furnaces, not only in the Tyne, Tees, and Durham district, but to the north-west of the island. The price of Morley Hill Durham coke, a quality much used for shipment to Spain, is 19s. a ton, f.o.b. The coasting trade is dull; 6s. per ton being paid a steamer to load gas coals for Cork on Friday. Low rates were paid all last week to sailing ships to load coals for the English Channel ports and the North of France. There has been rather an excess of sailing tonnage. Captains have been anxious to make another coasting voyage before the Baltic opens, and they have put too many ships into the market. Rates have been lower by about 6d. per ton. Several sailing ships and steamers were chartered last week to load gas coals for the Baltic.

The markets in the Cleveland iron district were rather flat last week. The price of crude iron could hardly be upheld. There is a great demand for manufactured iron. The foundries are very busy making large castings, and gas and water pipe-making is kept back.

The chemical market is quiet.

The demand for all the better qualities of fire-bricks is very fully maintained.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At a meeting of the Directors of the Inverurie Gas Company, held a few days ago, it was resolved to reduce the price of gas from 8s. 4d. to 7s. 11d. per 1000 cubic feet.

Chief Magistrate M'Farlane, presiding at a meeting of the Police Commissioners of Coupar Angus, on Monday, the 9th inst., gave notice of a motion to the effect that the Commissioners should take the gas supply undertaking of the burgh into their own hands.

In connection with the proposed improvement and extension of the gas-works at Broughty, the Gas Committee held a meeting on Monday of last week, when they inspected the works and plans proposed by Mr. Henderson, Gas Engineer, of Leven, and considered certain suggestions made by the Manager and Convener; and they subsequently agreed to proceed to Kirkcaldy and Forfar in order to ascertain the general state of the works at those places, and more especially the working of the scrubbers, as also the general condition in which those works were kept in comparison with the works at Broughty Ferry.

The question of bad debts by gas consumers was up for consideration at the last monthly meeting of the Gas Corporation of Dumbarton. But according to a statement from the Manager, Mr. J. M'Gilchrist, there were really none to report, not even a single penny of bad debts for the six months ending November, 1879. That fact speaks volumes in favour of the deposit system advocated by Mr. M'Gilchrist in the paper he read before the West of Scotland Association of Gas Managers, at the meeting held at Kilmarnock in the autumn of 1878. The bad debts in connection with the gas undertaking in Dumbarton are perhaps less than those of any other town in the United Kingdom. For the past two years they have been less than 1s. 4d. per £100 collected.

The Cleaning and Lighting Committee of the Town Council of Edinburgh had under consideration at a recent meeting a proposal to introduce larger lights into the lamps in Princes Street, with the view of improving the lighting of that important thoroughfare. After full consideration of the subject, however, the Committee arrived at the conclusion that an experiment should be made in the city with the electric light, and for this purpose it was resolved to recommend the Council, at its next meeting, to authorize the Committee to make the necessary arrangements for testing the electric light in Princes Street, on Waverley Bridge, and on North Bridge.

A visit was recently made by the members of the Town Council of Port Glasgow and a number of the leading town officials to the new water reservoir at Auchendoors, now nearly completed, which will give an additional storage of 90 million gallons, being more than double the present supply, without taking into consideration the new works recently completed at Douglichill. The water was turned into the new reservoir on the day of the inspection.

A long discussion took place on the water question at the last meeting of the Hawick Town Council, and a motion to enlarge the present reservoir and re-arrange the town main-pipes was lost by 10 votes to 4. Provost Watson spoke strongly in favour of the new scheme reported on by Messrs. Leslie, Edinburgh, to cost about £15,000, and give an additional supply of some 600,000 gallons a day. The present supply is upwards of 300,000 gallons for about 15,000 of population. The Provost gave notice of motion accordingly.

Mr. J. M. Gale, C.E., Glasgow, has been requested by the Water Commissioners of Dumfries to visit that town, for the purpose of examining the whole water supply system with a view to a better distribution and the prevention of waste. Plans by the same gentleman for obtaining a supply of water for the burgh of Annan from Middlebie Burn, about nine miles from the town, have just been submitted to the Police Commissioners of the burgh.

The Glasgow pig iron warrant market was much more regular last week than in the two preceding weeks, and a large amount of business was done daily. As high as 70s. 13d. cash was paid on Friday afternoon.

The coal market was dull during the past week, and the coalmasters had difficulty in keeping their pits going full time. Prices are a shade easier all round.

PENISTONE LOCAL BOARD WATER SUPPLY.—The Penistone Local Board have commenced their water supply operations by making a reservoir at Cross Royd Head. The first sod of the new reservoir was cut on Tuesday last.

THE PURCHASE OF THE CONWAY GAS-WORKS BY THE TOWN COUNCIL.—Last Tuesday, Major Tulloch, R.E., on behalf of the Local Government Board, held an inquiry, at Conway, as to the application of the Town Council for a Provisional Order empowering them to purchase the local gas-works. There was no opposition to the proposal.

DORCHESTER GAS COMPANY.—The half-yearly meeting of this Company was held last week—Mr. Henry Lock in the chair—when permission was asked of the Shareholders to borrow £5000 extra capital. A dividend of 10 per cent. was recommended, and the report of the Directors was unanimously adopted.

WINCHESTER GAS AND WATER COMPANY.—We hear that the Directors of this Company resolved at a recent meeting to recommend to the Share-

holders that a further reduction of 3d. per 1000 feet should be made in the price of gas at and from Midsummer next. This will be the third reduction during the last five years.

AIRDALE GAS COMPANY.—The ordinary half-yearly meeting of this Company was held on Monday, the 9th inst.—Mr. Robert Sutcliffe in the chair. The works were declared to be in a satisfactory condition, and a dividend at the rate of 10 per cent. per annum was declared. Mr. Sutcliffe was re-elected Chairman of the Company, and Mr. Bland Vice-Chairman.

SALE OF SHARES IN THE OSSETT AND MIRFIELD GAS COMPANIES.—At a recent sale by auction at Wakefield, 12 £5 original shares (fully paid) in the Ossett Gas Company were sold for £12 12s. 6d. each; a second lot, consisting of 16 similar shares, selling at the same price. Twelve £5 shares (7 per cent.) in the same Company realized £8 10s. each, and 86 £5 shares (fully paid) in the Mirfield Gas Company, £10 15s. each.

SALE OF FOLKESTONE GAS AND WATER COMPANIES SHARES.—Last Wednesday there were sold by auction some shares in the above-named Companies, with the following result:—£10 paid-up original shares in the Folkestone Gas and Coke Company sold at an average price of £21—a few fetched £21 2s. 6d.; new shares, £15 each. Shares in the Folkestone Water-Works Company, £10 paid up, sold the majority for £20 per share, whilst some others fetched £20 7s. 6d. and £20 10s. per share.

THE GAS SUPPLY OF TRING.—An agitation has been started against the quality and price of gas at Tring, and two public meetings on the subject have been held. The first was on Thursday, the 22nd of January, when a Committee of five was appointed to draw up a protest and memorial for signature and presentation to the Company. These were submitted at the adjourned meeting the following Thursday, and unanimously approved of. The memorial—which, among other things, asks for a reduction in the price of gas from 5s. 10d. to 4s. 6d. per 1000 feet—was directed to be sent to the Directors of the Company. We have not yet heard their decision in the matter.

SALE OF SHARES IN THE BARNSELEY GAS COMPANY.—On Wednesday last a number of shares in the Barnsley Gaslight Company were submitted to auction by Messrs. Lancaster and Sons. Lots 1 and 2, consisting of £100 and £200 original stock, were sold for £201 15s. per £100. Four E shares, paying 7 per cent., and four F shares, paying 10 per cent., were sold for £108. Lot 4, £100 original stock, paying 10 per cent., were sold for £202 10s., and £200 original stock was sold for £202 10s. £354 of original stock realized £202 per £100. Lots 7 and 8, £100 and £166 4s. 6d., were purchased for £201 per £100. The four following lots—viz., 17 C shares, 13 D shares, 20 D shares, and 17 E shares—realized similar prices.

BUCHAREST GAS COMPANY.—This Company has been recently started for working the concession granted by the Municipality of Bucharest for lighting the city. It is for 40 years, and was granted on March 26, 1868, on certain conditions which were modified in May, 1870. The Company propose to work any additional concessions they may acquire for the lighting of other places, and their operations are to include the sale of coal, coke, and the residuals of gas-making, or the manufacture of chemical products therefrom. The capital of the Company is to be 6,000,000 frs. (£240,000), divided into 12,000 shares of 500 frs. each. The business of the Company is to be managed by a Board, consisting of not less than five nor more than nine Directors, who are to be appointed in general meeting. The offices of the Company are in Paris.

GENERAL GAS ASSOCIATION FOR FRANCE AND ABROAD.—A limited liability company has just been started with the above title, for the purpose of obtaining, in France and elsewhere, concessions and undertakings relative to public or private lighting and heating by gas, or any other method, and of conducting all financial, commercial, and industrial operations in connection therewith. The Association also propose to undertake the supply of water in such places as they may light with gas. The capital of the Association is to be 20,000,000 frs. (£800,000), in 40,000 shares of 500 frs. (£20), and the business will be conducted by a Board of not less than five nor more than fifteen Directors, who are, as usual, to be appointed at a general meeting of the Shareholders. The offices of the Association are in Paris.

RATHMINES WATER SUPPLY.—On Thursday, the 5th inst., a special meeting of the Commissioners of the township of Rathmines and Rathgar was held to consider a letter from the Water-Works Committee of the Dublin Corporation, renewing the offer of a supply from the Varty source of one million gallons per day delivered at high pressure within the township, with a head of pressure sufficient to carry the water considerably above the highest house in the township, at a rental of £3000 per annum, the Corporation to take the necessary steps for the introduction of the supply. An additional supply of half a million gallons, if the Commissioners should require it, was offered at 1½d. per 1000 gallons. After a long discussion a division was taken, which resulted in the loss, by 11 votes to 5, of the resolution authorizing the reopening of negotiations with the Corporation on the subject.

THE ELECTRIC LIGHT IN PARIS.—It will be remembered that early last year the Municipal Council of Paris authorized a preliminary trial of the electric light for the public illumination of the city. The places selected for the trial were the Avenue de l'Opéra, the Place du Théâtre Français, the Place de la Bastille, and one of the pavilions of the Halles Centrales. The experiment was to extend over one year, from the 15th of January, 1879. Authority was at the same time given to the Paris Gas Company to light by an improved system, for a similar period, the Rue du Quatre Septembre, the Place du Château d'Eau, and one of the pavilions of the Halles Centrales. The term authorized expired on the 15th ult., but the Council have resolved to continue the electric light in the Avenue de l'Opéra and the Halles Centrales until the 1st prox. In the Place de la Bastille, however, gas lighting will be again adopted as soon as the necessary arrangements can be made for its re-establishment.

ADOPTION OF THE AVERAGE METER SYSTEM FOR THE PUBLIC LAMPS AT MORECAMBE.—At the monthly meeting of the Morecambe Local Board last Tuesday, the following report from the Lighting Committee was agreed to:—

The Lighting Committee appointed by the Local Board on Aug. 12, 1879, to make arrangements for the better lighting of the town, considered it advisable that the Board should become owners of the public lamps, pillars, and brackets, and that the gas to the same be supplied on the average meter system; and with that view, the Committee have been in correspondence with the Directors of the Gas Company, with whom they have made a provisional purchase of the pillar lamps and bracket lamps at £4 and £2 5s. each respectively, and that the gas be supplied on the average meter system, one meter to every twelve lamps, and at 5s. per 1000 cubic feet. The Committee consider the above terms satisfactory, and recommend the same to the Board for their approval. A resolution to apply to the Local Government Board for their sanction to the borrowing of the necessary money to carry out the proposal was also passed.

CHICHESTER WATER COMPANY.—The half-yearly meeting of this Company was held last Thursday—Mr. W. Smith in the chair. The report which was presented by the Directors congratulated the Shareholders on the progress which continued to be made in the business done by the Company. The receipts from water-rents during the last three half years had

been as follows:—December, 1878, £504 4s. 11d.; June, 1879, £488 12s. 8d.; December, 1879, £558 6s. 3d. The profits for last half year amounted to £427 9s. 7d., which, together with the sum of £345 10s. 6d., the balance of profits carried over from the previous half year, amounted to £773 0s. 1d., out of which a dividend of 4s. 6d. per share was declared on the 21st day of August last. This had been paid, and absorbed £332 2s., leaving a balance of £440 18s. 1d., out of which the Directors recommended that a dividend of 5s. 6d. per share, free of income-tax, on the fully paid-up shares, be declared, making 5 per cent. for the year. Services have been laid on to 28 additional houses. The residue of the shares in the Company have been issued and allotted, in pursuance of the resolution passed at the extraordinary meeting which was held on Oct. 9 last. A call of £2 per share on such shares has been made and paid. This has enabled the Directors to clear off the item of £221 6s. 10d., being the excess of expenditure over the amount of shares issued, as shown in the capital account for last half year, and to purchase a large stock of pipes for the purpose of laying the mains down St. Pancras, as well as for further extensions, including the pipes which will be required for the intended additional main from West-gate to the reservoir. The Directors consider that the Company have been fortunate in having been placed in a position, by the issue of the remainder of the shares, to purchase the pipes while iron was at a very low price. The report was agreed to, the proposed dividend declared, and the retiring Directors were re-elected.

Register of Patents.

APPLICATIONS FOR LETTERS PATENT.

- 521.—HULETT, D., High Holborn, London, "Improvements in or applicable to apparatus for condensing, washing, and purifying gas and other vapours." Feb. 6, 1880.
 538.—THOMPSON, W. P., High Holborn, London, "Improvements in and appertaining to gas-engines or engines actuated by the explosion or combustion of mixed gas or vapour and air." A communication. Feb. 7, 1880.
 545.—WALKER, C. C., Lilleshall, Salop, and WALKER, W. T., Highgate, London, "Improvements in or connected with the purification of coal gas, and in the apparatus employed therein." Feb. 7, 1880.
 561.—BROUGHAM, F. J., Westminster, "Improvements in the method of

- or arrangements for distributing, igniting, and extinguishing gas for street and other lighting." A communication. Feb. 9, 1880.
 569.—ATTRILL, H. Y., and FARMER, W., New York, U.S.A., "Improvements in the manufacture of gas for heating and illuminating purposes, and in the means and apparatus connected therewith." Feb. 10, 1880.
 573.—HADDAN, H. J., Westminster, "Improvements in apparatus for closing or emptying water-pipes or other fluid conduits, part of which improvements are applicable generally for shunting electric currents." A communication. Feb. 10, 1880.
 591.—POCOCK, A. W., Wandsworth, London, "Improvements in meters for measuring liquids." Feb. 10, 1880.
 594.—HOPKINSON, W. W., Brunswick Square, London, "Improvements in the means or apparatus for controlling the flow of liquids, specially applicable to controlling the supply of combustible liquids for lighting or heating purposes." Feb. 11, 1880.
 601.—ADAMS, J., Glasgow, "Improvements in gas-stoves." Feb. 11, 1880.
 619.—KROMSCHRODER, J. F. G., Prince of Wales Road, London, "Improvements in the manufacture of coal gas for lighting purposes." Feb. 12, 1880.
 622.—BRIGHT, H., Leamington, Warwick, "Improvements in apparatus for enabling the process of softening hard water to be effected automatically." Feb. 12, 1880.

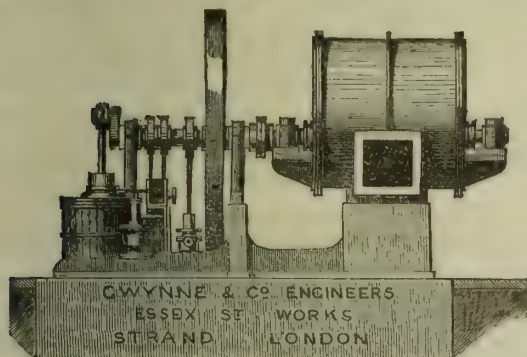
PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 3808.—BAMFORD, G., Bradwell, Derby, "Improvements in valves." Aug. 16, 1879.
 3694.—LAKE, H. H., Southampton Buildings, London, "Improvements in and relating to apparatus for the manufacture of illuminating gas." A communication. Sept. 15, 1879.

PATENTS WHICH HAVE BECOME VOID

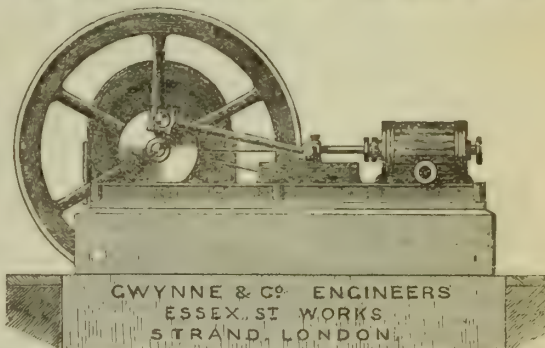
- BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.
 315.—DUFRENÉ, H. A., "Improvements in burners for mineral and other oil, vapour, and gas." Jan. 25, 1877.
 341.—COTTERELL, F. J., "An improvement or improvements in sliding gaseliers or gas chandeliers." Jan. 26, 1877.
 413.—HUNT, B., "Improvements in pipe-joints." Jan. 31, 1877.
 431.—POPE, J., "Improvements in taps or cocks, which improvements are also applicable to regulating the flow of water to water-closets and other like receptacles." Feb. 1, 1877.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS. **GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.**



The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship."

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce machinery of the very highest quality, and most approved design and workmanship. The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, **GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.**

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address

BEALE'S IMPROVED PATENT GAS EXHAUSTERS,

WITH

Wrought-Iron Spindles and ENGINES COMBINED.

SOLE MAKERS,

GEORGE WALLER & CO.

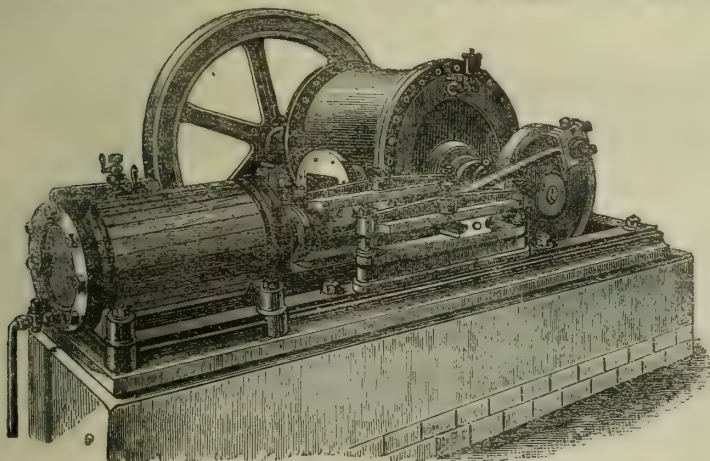
MAKERS OF ENGINES, EXHAUSTERS, INDEX AND DISC GAS-VALVES, HYDRAULIC MAIN VALVES, BYE-PASS VALVES, TAR, LIQUOR, AND OTHER PUMPS, SCRUBBERS AND PURIFIERS, CONDENSERS, BOILERS, &c.

G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

[SEE ALSO ADVERTISEMENT, PAGE 262.]

Phoenix Engineering Works:

HOLLAND STREET, SOUTHWARK, S.E.



WANTED, Readers of the NEW Edition,
"Cooking & Heating by Gas;" on Burners, &c.
Copies, by post, Threepence, direct from the Author,
MAGNUS OHREN, Assoc. M.I.C.E., Gas-Works, SYDENHAM.

TO GAS MANAGERS.

WANTED, by a Young Man, aged 25,
a Situation as GAS-FITTER, Meter Fixer, Main
and Service Layer.
Apply to W. HUCKLE, Gas-Works, Wolverton, Bucks.

AGENCY.

WANTED, an Agent in Gas Engineer-
ing work for the Northern and Midland Counties.
Address, with full particulars, to No. 629, care of Mr.
King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a small Gas-Works in
the Country, a MANAGER to Make Gas, Lay
Mains and Services, Fix Meters, and take states of same.
Wages 25s. a week, with good house and garden, also coals
and gas.

Applications, with two recent testimonials, to be made
to Mr. BARRATT, Engineer and Manager, Gas-Works,
Grantham, on or before the 26th of February.
None but strictly steady and sober men need apply.

TRURO GAS COMPANY.

WANTED, by the above Company, a
thoroughly practical Man as a GAS-FITTER.
One who understands bronzing and lacquering would be
preferred. To a steady and competent man, the situation
would be a permanent one.

Applications, enclosing testimonials, with references,
and stating wages expected, to be addressed to the Secretary,
Mr. J. HAMILTON.
Truro, Feb. 6, 1880.

THE NORTHWICH GASLIGHT AND COKE COMPANY, LIMITED.

WANTED, a Gas Manager. Make
20 millions, Salary £100 per year, with house,
coal, gas, water, rates, and taxes free.

Applications, stating age, &c., to be sent in not later
than Saturday, March 6, 1880, addressed to the Chairman,
sealed and endorsed "Gas Manager."
HENRY PICKERING, Secretary.

Northwich, Feb. 14, 1880.

WANTED, a Man about 30 years of
age, accustomed to the Outdoor work of a Gas
Company, under the direction of the Engineer. The person
appointed must devote his whole time to the duties,
and be able to command men. He will be required to act
as Foreman over at least 15 lamplighters. He must
thoroughly understand Taking the Index of Gas-Meters,
at which he will be required to assist. He will also be
expected to make himself generally useful. The wages will
be 30s. per week.

Address No. 623, care of Mr. King, 11, Bolt Court,
FLEET STREET, E.C.

ARUNDEL GAS COMPANY.

WANTED, by the above Company Four
Good PURIFIERS (second hand), not to exceed
8 ft. square, with Dry Centre-Valve, Grids, Covers, and
Lifting Gear complete.

In consequence of enlargement of Works, the Company
have for DISPOSAL Two Double Purifiers, 8 ft. by 4 ft.,
with Two 6-in. Four-way Valves and Connections; Wood
Sieves, Covers, and Lifting Gear, nearly new. Also a
STATION-METER 2000 ft. per hour; 4-inch Connections;
Clock and Tell-tale arrangements.

Particulars, including price, and where to be seen, to be
sent to W. C. Dawson, Manager, Gas-Works, Arundel.

By order,

RICHARD HOLMES, Secretary.

Arundel, Feb. 6, 1880.

Assistant Draughtsman required, well
up in Working Drawings, and who can take out
quantities.

State age, previous engagements, references, and re-
muneration expected, to D. O., Messrs. Cutler and Sons,
Girder and Bridge Works, Millwall, LONDON, E.

OLD SWINDON GAS COMPANY.

NOTICE is hereby given that the ser-
vices of William Barrett Swaine, late Secretary and
Manager of this Company, terminated on the 31st of January
last, and the said William Barrett Swaine holds no authority
to receive any money due to the Company, or to give any
orders or directions for or on behalf of such Company.

W. J. CANNING, Secretary and Manager.

Gas-Works, Feb. 11, 1880.

FOR SALE—One Vertical Condenser,
consisting of Bottom Box 21 ft. long by 20 in. by
16 in., Fourteen 10-in. Pipes, and Seven 10-in. Bends.
Apply to Mr. S. STUDEOLME, WHITEHAVEN.

GAS COKE.

A LARGE QUANTITY required for
delivery over a period of nine months.

Address, with price per ton into trucks at railway station,
to G. J. EVESON, Gas, Coal, and Cannel Contractor,
BIRMINGHAM.

FOR SALE—A Set of Four Purifiers,
each 18 ft. long by 8½ ft. wide, and 6 ft. deep, with
Centre-Valve and 12-in. Connections complete.

Parted with as being too small.
Offers to be addressed to the MANAGER, Edinburgh and
Leith Gas Company, Baltic Street, LEITH.

GAS AND WATER SHARES.

FOR SALE—A few Ordinary £10 Shares,
fully paid, in the Chesterfield Water-Works and
Gaslight Company. The Shares are entitled to a maximum
dividend of 7 per cent. per annum, and the selling price
includes the half year's dividend at that rate which will
be declared at the general meeting to be held this month.
Price £13 per share.

Address, the Executors of J. G., deceased, 5, Knifesmith
Gate, CHESTERFIELD.

NOTICE TO MANAGERS OF GAS COMPANIES.

THE LAW UNION FIRE AND LIFE INSURANCE
COMPANY, of No. 126, Chancery Lane, London, grants
Policies of Insurance on Gas-Works, and Buildings con-
nected therewith, which cover risk of explosion and spon-
taneous ignition of Coal, on very advantageous terms.
Full particulars will be sent post free on application to
FRANK M'GEDY, Secretary.

126, Chancery Lane, London.

GASHOLDER FOR SALE.

THE Forfar Gas Corporation have for
SALE a Single-Lift GASHOLDER, 60 ft. diameter
by 18 ft. deep, with six tripod Columns and wrought-iron
Girders, now in working, but must be removed between
the 1st and 31st of May next.

Further particulars on application to the Manager at the
Works.

Tenders received by Mr. WILLIAM GORDON, Solicitor,
Clerk to the Commissioners, on or before March 31, 1880.
Forfar, Feb. 11, 1880.

TENDERS WANTED.

THE Forfar Gas Corporation is prepared

to receive TENDERS for the following Works:—
First, The Furnishing and Erection at the Gas-Works,
Forfar, of a Telescopic Gasholder, in Two Lifts, each
18 ft. deep—Outer Lift, 60 ft., and Inner Lift, 58 ft. 3 in.
in diameter.

Second, The Converting of the present 60 ft. Single-Lift
Gasholder into a Telescopic Gasholder of Two Lifts, the
Inner Lift being 58 ft. 3 in. in diameter and 18 ft. deep.

The plans and specifications will be seen in the hands of
the Manager at the Works, and sealed tenders, marked
"Tender for Gasholders," must be lodged with Mr.
WILLIAM GORDON, Solicitor, FORFAR, Clerk to the said
Corporation, on or before the 21st day of February, 1880.

The lowest or any tender may not be accepted.
Corporation Gas-Works, Forfar, Jan. 28, 1880.

TO TAR DISTILLERS.

THE Directors of the Wakefield Gas-
light Company are prepared to receive TENDERS
for the Purchase of the Surplus TAR made at their Works,
for the period of Fifteen months expiring the 30th of June
1881. Approximate quantity, 900 tons.

Sealed Tenders, endorsed "Tar Tender," to be sent in
not later than the 21st of February next.

By order,

JOHN W. WHITAKER, Manager and Secretary.
Gas Office, Feb. 2, 1880.

RAMSGATE IMPROVEMENT COMMISSIONERS— GAS AND WATER DEPARTMENT.

THE Gas and Water Committee invite
TENDERS for about 60 Tons of SULPHURIC
ACID, delivery to extend over Twelve months.

The Committee do not bind themselves to accept the
lowest or any tender, which should be sent in not later
than 2 p.m. on the 26th of February, addressed to the
Chairman.

Particulars on application to

WILLIAM A. VALON, Engineer.

RAMSGATE IMPROVEMENT COMMISSIONERS— GAS AND WATER DEPARTMENT.

THE Gas and Water Committee invite
TENDERS for about 490 ft. of Machine-made CLAY
RETORTS, particulars of which may be obtained on
application.

The Committee do not bind themselves to accept the
lowest or any tender, which should be sent in not later
than 2 p.m. on the 26th of February, addressed to the
Chairman.

WILLIAM A. VALON, Engineer.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had
considerable experience in matters connected with
Gas, Water, and Sanitary Improvement, begs to say that
he continues to assist Inventors in the perfection of their
designs, and to obtain for them PROVISIONAL PRO-
TECTION, whereby their invention may be secured for
Six Months; or LETTERS PATENT, which are granted for
Fourteen Years.

Patents completed, or proceeded with at any stage,
thereby rendering it unnecessary for persons resident in
the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon
application to the Advertiser, 22, Great George Street,
WESTMINSTER.

GASHOLDER.

THE Directors of the Isle of Thanet Gas

Company are prepared to receive TENDERS for the
Construction of a GASHOLDER, 108 ft. in diameter, at
their works at Margate.

The plans and specification can be seen on application to
Mr. H. E. JONES, Gas-Works, Stepney, E.

Tenders, endorsed "Gasholder," and addressed to the
Chairman, are to be sent in to the Company's Office, at
Margate, not later than Thursday, the 26th of Feb. inst.

The Directors do not bind themselves to accept the
lowest or any tender.

THOS. C. FULLER, Secretary.

GASHOLDER TANK.

THE Directors of the Isle of Thanet Gas

Company are prepared to receive TENDERS for the
Construction of a GASHOLDER TANK, 112 ft. in dia-
meter, at their works at Margate.

The plans and specifications can be seen on application
to the Engineer, Mr. H. E. JONES, Gas-Works, Stepney,
London, and copies of same at the Thanet Gas Office at
Margate.

Tenders, endorsed "Gasholder Tank," to be sent in to
the Office of the Company, at Margate, addressed to the
Chairman of the Gas Company, not later than Thursday,
February 26, 1880.

The Directors do not bind themselves to accept the
lowest or any tender.

THOS. C. FULLER, Secretary.

STAFFORD CORPORATION GAS-WORKS.

TO IRONFOUNDERS.

THE Gas Committee are prepared to
receive TENDERS for and Fix a Wrought-Iron
LATTICE GIRDER, 58 ft. 6 in. long and 4 ft. 6 in. deep,
and also a HYDRAULIC MAIN.

Plans and specifications may be seen at the Gas-Works.
Sealed tenders, addressed as under, and endorsed "Ten-
der for Ironwork," to be delivered on or before the 21st inst.

The Committee do not bind themselves to accept the
lowest or any tender.

JNO. STORER, Manager.

Gas-Works, Stafford, Feb. 11, 1880.

GLASGOW CORPORATION GAS.

THE Committee of the Town Council

on Gas Supply are prepared to receive TENDERS
for the FIRE-CLAY RETORTS, FIRE-BRICKS, and
FIRE-CLAY that may be required in their Works for
Twelve months from May 1, 1880.

Specifications may be seen and forms of tender obtained
on application to the Manager, at 42, Virginia Street,
Glasgow.

Sealed offers, marked "Tender for Retorts," or "Fire-
Bricks, &c.," to be addressed to the Committee of the
Town Council on Gas Supply, and lodged at the Gas
Office, 42, Virginia Street, on or before Tuesday, the 24th
inst.

The Committee do not bind themselves to accept the
lowest or any tender.

J. D. MARWICK, Town Clerk,

Clerk to the Committee.

City Chambers, Glasgow, Feb. 7, 1880.

SALE OF OLD MATERIALS.

THE Directors of the Rochester, Chat-
ham, and Strood Gaslight Company are prepared to
receive TENDERS for the Purchase of about 50 Tons of
OLD IRON now lying at their Works, part at Rochester
and part at Gillingham; also for Two 6-horse ENGINES,
one Vertical or Table, the other Horizontal; and Two
STEAM BOILERS, cylindrical with Egg-ends, now lying
at the Rochester Works.

Further particulars may be known on application at the
Office, 56, High Street, Rochester, and the materials may
be seen by applying to the Foreman at the Works.

Tenders may be for the whole or for any part of the
materials, and must be delivered, sealed and marked
"Tender for Old Materials," at the Office as above, before
noon of Thursday, March 4 next.

The Directors do not bind themselves to accept the
highest or any tender.

By order,

W. SYMS, Secretary.

Feb. 12, 1880.

CORPORATION OF BIRMINGHAM—GAS DEPARTMENT.

THE Gas Committee of the Corporation

of Birmingham are prepared to receive TENDERS
for the TAK to be produced at their various Works for a
period of One, Three, or Seven years, from the 30th of June
next.

The quantities produced in 1879 were as follows:—

Saltley Works	8,500 Tons.
Windsor Street Works	5,000 "
Adderley Street Works	2,500 "
Swan Village Works	3,000 "

Total 19,000 Tons.

The Committee will receive tenders, either at a fixed
price per ton, or at a price to be calculated on a sliding
scale, varying with the selling price of products.

The Corporation are prepared to let on lease a portion of
their surplus land, on which Tar Works could be erected.

Forms of tender may be obtained on application to me.

EDWIN SMITH, Secretary.

Old Square, Birmingham.

Now Ready, Price One Guinea,

PRECEDENTS IN PRIVATE BILL LEGISLATION AFFECTING GAS AND WATER UNDERTAKINGS.

COMPILED BY MR. G. W. STEVENSON, C.E., F.G.S.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, FEBRUARY 24, 1880.

Circular to Gas Companies.

THE Bill in Parliament promoted this session by the Corporation of the City of London, which passes under the somewhat complex title of "The Gaslight and Coke, Commercial Gas, and South Metropolitan Gaslight and Coke Companies Bill," was read a second time last week, in spite of the mild opposition offered to it by Colonel Makins. We have already given an abstract of the measure in question, and are bound to say that the case made out by Colonel Makins was a lame one. Although provisions have been inserted, in recent Metropolitan Gas Acts, for testing the pressure of gas, they seem to have remained in abeyance, and it is only now that it is sought to bring them into active operation. We may say at once that these provisions must prove vexatious to the Companies concerned, and are likely to lead to some loss. The day pressure at six-tenths need not be objected to; but the pressure of one inch required from sunset to midnight, and which must be kept at some excess, may possibly

increase the amount of unaccounted-for gas. Perhaps, too, it is hardly fair to saddle the Companies with the cost of the self-registering pressure-gauges that will be required. The tests are made in the interests of the consumers, and as a self-registering pressure-gauge is a somewhat expensive instrument, the cost might very well have been divided between the Corporation and the Companies. But as the latter have been required to furnish all other apparatus for the testing-stations, we suppose that this fresh imposition must not be objected to. We feel somewhat sorry for the Gas Examiners, whose duties will be considerably added to under the operation of such an Act as is now proposed. Their daily attendance at the several testing-stations will be requisite—not necessarily at any fixed hour, although it would be most convenient to change the registering papers daily at the same time. It will be seen, too, that the Examiners will have to diligently study an almanac, inasmuch as they will have to report on the maximum and minimum pressures between sunset and midnight and midnight and sunset. The duty that is proposed, requiring the pressures to be taken twice a week at the public lamps, is altogether new, and must cause some trouble. We therefore recommend the Examiners to ask at once for these additional duties to be considered in their salaries. In some respects the Bill as it lies before us is, as we have previously pointed out, favourable to the Chartered Company, inasmuch as it repeals the clause in the Act of 1876, which requires the Company to keep a register of the quantity of gas made at each of their stations, and fines them for deficiencies in illuminating power according to the amount of gas manufactured. Under the new Bill it is provided that a Company—say the Chartered—having a deficiency of illuminating power recorded at one station, shall only forfeit a specific sum, according to the amount of the deficit; and it is further provided that the same Company shall not be fined for defects at more than one station on one day. Considering how the gas from the several manufacturing stations of one Company is now mixed up, this is only a fair provision. The testings for purity are to remain as under the Acts of 1875-6, the average of three days being taken to represent the purity of one day.

Perhaps, however, it is superfluous to go on pointing out the provisions of this measure, as, from the opinion expressed by the Parliamentary Secretary of the Board of Trade, it seems clear that the Board will not allow the Bill to pass in its present form. It has been sent to the Metropolitan Gas Referees, with a request that they will give their opinion upon its provisions, and send a report, on receipt of which the Board will consider what shall be done. We can hardly too much admire the grandmotherly attentions of the Board of Trade to the interests of Gas Companies. The naughty boys of the controlling Authorities and the Companies might have had, in a committee-room of the House of Commons, a stand-up fight, which would have proved very expensive to all but the Metropolitan Board of Works, who, by obtaining a modification of the 21st section of the Bill, have left the Corporation to pay all expenses attending its promotion. The Board of Trade, however, propose to induce the parties to forego this fight, by calling them together to listen to a little lecture, and bidding them to shake hands and be friends. The proposal is that Companies and controlling Authorities shall consent to a measure to be called an "agreed Bill," which the Board of Trade promise to push through. Perhaps this will, after all, be the best course that could be pursued. If we might raise an objection, it would be that it virtually makes two of the Gas Referees the arbiters of the fate of the Gas Companies. There is no fear that the powers conferred on the Referees will be injudiciously exercised; but we must confess that we shall look with some curiosity for the report they may present on the Bill.

People have long complained of the lighting of Blackfriars Bridge, and their complaints have at last been brought to the notice of the Common Council. The Committee of the Bridge House Estates presented, at the meeting of the Council last Thursday, a report in which they proposed an alteration in the shape of the lamps, noticing the fact that the lamps at present in use are often broken, and more often extinguished, especially in gusty weather. The lighting of the bridge, as a member remarked, has been a disgrace to the Corporation. Advocates of the electric light naturally proposed that this mode of illumination should be tried on the bridge, the power being obtained from the electric station of the Metropolitan Board of Works at Charing Cross railway bridge. We fancy that the suggestion may be carried out, notwithstanding the past experience of the Corporation with the light upon the Holborn Viaduct. We cannot agree, however, that the electric light is superior to gas in the case of a fog. A friend

of ours, who compared the penetrating power of the two lights during the recent dense fogs, gives it—and he is an unprejudiced judge of the matter—as his opinion that gas light has much greater advantages in a fog. However, we shall soon hear more of the matter, for the report has been referred back to the Committee for consideration.

It may here be mentioned that a new electric lamp, which promises some advantages over those at present in use, has been devised by M. André, and is now being exhibited in Liverpool. In this case, the carbon pencils are enclosed in a hermetically-sealed globe, as in the case of Mr. Edison's lamp. Of course, if the vacuum can be maintained, the carbon points will last a long time; but probably the inventor of the lamp will find the same difficulty as Mr. Edison has with his.

The Wharnccliffe meeting of the Shareholders of the London Gaslight Company, called to approve of the promotion of the Company's Bill now before the House of Commons, was held last Wednesday. We need hardly say that the Proprietors gave their unanimous sanction to the steps taken by the Directors, and we do not anticipate that the Bill will have to encounter any opposition in either House of Parliament. The Bill when passed will undoubtedly conduce to the prosperity of the Company, but its provisions should be carried out in no niggardly spirit. The Company must have an abundance of apparatus to show, to let on hire, and to sell; the charges for hiring must be small, and the selling price, such as with reasonable interest will cover cost. It should be well understood that the profit is to be made by the increased sale of gas. This may be great or small, according to the liberality displayed by the Company in the disposal and hiring of the apparatus.

Alderman Chamberlain, M.P., occupied the time of the Birmingham Town Council, at their last meeting, by delivering speeches which occupy more than four columns of the JOURNAL, in moving the adoption of the report of the Gas Committee, to which we have alluded in a previous issue. Everybody knows that the purchase of the Birmingham Gas Companies undertakings has proved most advantageous to the Corporation, and every one also knows that the purchase was effected by the personal energy of Alderman Chamberlain. He might have been egotistical, but few expressions fell from his lips to remind the Council that the gas purchases were due to his foresight and judgment. It is not necessary again to mention the figures we have already given, but we may just state that Alderman Chamberlain speaks of a reduction of threepence per thousand feet having been made in four years, since the purchase of the undertakings by the Corporation. There is, however, no necessity to bestow praise upon a reduction which must have been made. The Corporation were, so to speak, gorged with profits, and there was no other course for them than to lower the price to the consumers. The fact is, that another reduction ought to be made about the present time, and this the Corporation can well afford if they will only give up their practice of applying profits in aid of rates. It may be said this is no business of ours; but the matter involves a principle. Alderman Chamberlain considers that as the ratepayers are responsible for the gas undertaking, they, *quoad* ratepayers, have the best right to the profits made. We, however, who do not consider that the ratepayers have any responsibility at all in the matter, think that the consumers should be first considered. Of course, seeing that the ratepayer and consumer are generally one, it follows that any benefit conferred by a low price for gas would be equally shared in. Alderman Chamberlain tells us, truly, that if twopence be taken off the price of gas for the benefit of the consumer, fivepence must be added to the improvement rate; and he sees very clearly that many consumers would pay the increased rate willingly if they could get a reduction in the price of gas. These would, of course, be the large consumers; but there must be in Birmingham a numerous class of persons occupying tenements of low rateable value, to whom low-priced gas would be a greater boon than a low improvement rate. But it is of no use to argue this question. A majority of the Birmingham Town Council have made up their minds that a large proportion of the gas profits shall be devoted to the improvement rate, while a very considerable balance is carried to the sinking-fund, which is calculated, at its present rate of increase, to pay off the purchase-money in twenty-eight years—a debt which Parliament has allowed them eighty years to wipe out. It is well, however, to make hay while the sun shines. The consumption of gas in Birmingham has relatively diminished, and the profits have, to a slight extent, decreased. There is also a prospect of their being smaller at no distant date, for coals are rapidly rising in price, and it is estimated that they will cost the Corporation £20,000 more for the

current than for the past year. Much of this additional cost will, no doubt, be compensated for by the increased value of coke. The Corporation have suffered a good deal from the low price obtained for this residual during the past year or two; but everything now looks highly promising for the current year, and next February we shall probably hear of another £25,000 being carried to the improvement rate, and a still larger balance transferred to the sinking-fund. Alderman Chamberlain only expressed his disappointment at one matter. When studying the probable results of the purchase, he estimated that the consumption of gas would in four years increase twenty-six per cent.; whereas, as a matter of fact, the increase has only amounted to sixteen per cent. This is, so far, satisfactory; but the additional consumption would no doubt have been greater if the price had been lower.

The half-yearly meeting of the Liverpool United Gas Company was held on Tuesday last, when the maximum dividends were declared. The Company are in a very flourishing condition, and the Corporation seem to have ceased to indulge in dreams of buying up the undertaking. The consumption of gas increases very rapidly within the Company's limits, and it has become urgently necessary to make large additions to their Linares works. We recently alluded to this fact when noticing the Bill promoted by the Company, and also referred to the circumstance that the Company proposed to raise some new capital by borrowing instead of by the issue of shares. After the ordinary meeting, a Wharnccliffe meeting was held, to obtain the Shareholders sanction to the promotion of the Bill; and at this meeting it was announced that the Directors had resolved to strike out of the Bill all reference to the raising of fresh capital. They will thus only apply for powers to erect new works.

The annual meeting of the Newcastle and Gateshead Gas Company was held last Wednesday, when the usual dividend of 7 per cent. was declared, and a reduction of threepence per thousand feet in the price of gas was announced. This reduction, from 2s. 9d. to 2s. 6d. per thousand feet, with the usual discount of ten per cent., will practically bring the price to 2s. 3d. per thousand feet to ordinary consumers. The Chairman supposed this to be the lowest price charged for gas in any town in the United Kingdom. We may remind him that at Walsall the charge is 2s. 2d. per thousand feet; but this latter is a Corporation undertaking. The gas supplied to Newcastle and Gateshead is of excellent quality, and at the present price is remarkably cheap. What would the consumers of Birmingham say if the Corporation brought down their price to 2s. 3d. per thousand feet?

The annual meeting of the Ipswich Gaslight Company was held last week. The balance of revenue account admitted of the payment of maximum dividends—namely, ten per cent. upon the A shares and seven and a half per cent. upon the B and C shares—and to carry forward a balance of £268 to the next account. In past times great complaints were made both of the illuminating power and of the sulphur impurities in the gas furnished by the Company, and the Directors seem now to have set vigorously to work to prevent any such complaints occurring in the future. They have made extensive improvements in their retort-house, and are about to have erected new purifying plant of the most improved kind. For the time the Corporation and the Company appear to be at peace; but from what passed at the meeting it seems likely that the question of purchase may soon crop up again. The Company are about to issue new capital, which the Directors wished to put up to auction, but to this course the Shareholders objected, and it was eventually decided to allot the shares *pro rata* among existing Proprietors, and it was further decided to borrow an additional sum of £4700 on mortgage.

The Bury St. Edmund's Gas Company held their half-yearly meeting on the 13th inst. The Company have been so far successful under the sliding scale that they are able to pay an additional one per cent. dividend. This is something, but the Chairman does not hold out any hope of being able for the present to make another reduction in price, so there is no prospect of further increased dividends. Nothing unusual occurred at the meeting except a dispute as to the duties of a Company's Auditor. The Solicitor to the Company sent in a bill claiming a lump sum of £250 for his services in obtaining the Company's last Act of Parliament. The account stated shortly that the amount charged was for "innumerable attendances and correspondence relative to the 'new Bill,' and other duties in connection therewith; and, without specifying each item, really gave a summary of all the work done. The account had, of course, been passed by the Directors, and was placed before the Auditor with a receipt as usual. This officer objected that details should

have been furnished, which was perfectly unnecessary if the Directors had been satisfied with the reasonableness of the Solicitor's charge. We do not know that any other Company's Auditor would follow the same course, but we just mention it to express an opinion that the officer went rather beyond his duty.

Another pleasant gathering of gas managers, engineers, and others interested in the manufacture of gas, took place last Thursday, at the Jarrow works of the South Shields Gas Company, to view the new machinery invented by, and erected under the direction of Mr. W. J. Warner. Apart from the great interest which attaches to machinery in many respects so novel, and in all respects so useful, the gathering had a social aspect. After a luncheon had been discussed, Mr. Warner gave at some length a description of his apparatus, which had been seen in action by the assembled guests. It is not necessary here to enter into an account of the machinery, of which we shall presently give drawings and a full description. It is sufficient to say that the company which met on this occasion separated highly gratified with all they had seen and heard.

Under the auspices of Sir John Lubbock, an entirely new principle is about to be introduced into the management of joint-stock companies. Hitherto the paying off of capital has been strongly objected to; but by the present Bill, which has already passed the House of Commons, it is provided that when a Company have an accumulation of undivided profits, they may, under special resolution, return the whole or any part of it to the Shareholders in reduction of the paid-up capital. An option is given to the Shareholders to refuse the money which may be so offered to them, and to compel the Company to retain it, subject to interest of not less than three nor more than four per cent. The amount of capital so paid off, of course, reduces the paid-up capital by a similar amount; but the Directors will have power to increase the capital to the original amount. This may be a very wise piece of legislation; but its success will depend on one or two things. How are the Shareholders to be selected who are to be paid off? And what is to prevent the operation of this law, under the manipulation of clever Directors, being eventually to place the highest paid stock of the Company in very few hands? We are here thinking only of Gas and Water Companies entitled to divide ten per cent. It is, we believe, the consideration of a possibility of this kind that has hitherto induced the Legislature to refuse power to Companies to pay off share capital.

Water and Sanitary Notes.

MR. FAWCETT appears determined to hold the Home Secretary to his word. Last night he once more asked Mr. Cross what the intentions of the Government were with respect to the purchase and future management of the Metropolitan water undertakings. This question is beginning to create considerable excitement among the Metropolitan Vestries and District Boards, who, for the most part, are longing to have a share in the management, by the election on the proposed Water Trust of members from their several bodies. Of what that Trust will be composed we have as yet no information, for Mr. Cross, in his reply to Mr. Fawcett last night, said that the arrangements are not yet complete. Until they are, we shall not, of course, have any parliamentary action on the part of the Government. What Mr. Cross means by "arrangements" we do not understand. It is said that every settlement has been made with the Water Companies, so we cannot help thinking that the "arrangements" must relate to the constitution of the Trust. In reply to a further question from Mr. Fawcett, as to whether, considering the enormous pecuniary interests involved, and the risk of speculation in shares if some parties obtained earlier information than others as to the provisions of the proposed measure, the Home Secretary said he intended to ask the Chancellor of the Exchequer to give him a day for the introduction of the Bill, and he would take care that it should be in the hands of honourable members the following morning, or as early as possible. The latter part of his answer is somewhat Jesuitical. There can be no difficulty in getting the Bill printed so as to be delivered the morning after its introduction.

The annual report of Dr. Tidy to the Metropolitan Association of Medical Officers of Health, on the quantity and quality of the water supplied to London during 1879, has just been published; but, as we print regularly the Doctor's monthly reports, we need not here enter into many details. It goes without saying that the water supply of London is admirably

maintained by the Companies. The quantity furnished now averages, we are told, 32·7 gallons daily per head of the population, which, within the limits of the Companies, now amounts to over four and a quarter millions. When it is remembered that provision for the supply of this vast population, which has never failed for a single day, with the exception of a few occasions in small isolated districts, has been provided and is maintained by private enterprise, it does seem most extraordinary that efforts should be made to abolish the Companies who have done so much for the Metropolis. Beyond the liberal supply given, we venture to assert that the general quality of the water is beyond all question. That it is occasionally turbid we do not deny; that it contains at times "organic carbon and nitrogen" is indisputable; and that even "living and moving organisms" may be occasionally found, by any one who will take sufficient trouble to discover them, we are ready to admit; but, taken on the whole, the supply of water obtained from the Thames and the Lea, and filtered by the Companies, is unquestionably equal in quality to any water supply in the kingdom. Dr. Tidy states very fairly that last year was an exceedingly trying one for the Thames Companies. The excessive rainfall caused frequent floods, and it need hardly be said that a heavy flood in the Valley of the Thames causes immense inconvenience to the Water Companies. These have been almost wholly obviated by the provision of subsiding reservoirs, which, holding sufficient water for several days consumption, relieve the filter-beds of a large portion of their work. The worst of it is that much of the good which is done by the Companies operations is undone by the filthy receptacles into which water is received on the consumers premises. We are not forgetful here of the condition of a cistern at a certain well-known club-house, at which great complaints were made of the water. Dr. Tidy concludes his report by the expression of a wish that when the water undertakings pass out of the hands of the Companies they may be as efficiently worked as they are now. We hope so too; but the works are not yet bought up.

The Water Bill of the Liverpool Corporation occupies a good deal of attention from the Corporations and others who derive their water supply either directly or indirectly from the Severn. It must be admitted that the position is not so active as it once threatened to be. Cheltenham, for example, not particularly interested in the matter, now declines to oppose. Bewdley, too, threatened opposition, but that has fallen through. The chief opposition now comes from the Severn Fishery Commissioners, who pretend to see in the execution of the designs of the Liverpool Corporation the abolition of all their rights, duties, and emoluments. They allege that the carrying out of the Vyrnwy scheme would rob the Severn of its best spawning-grounds, and would speedily lead to the extinction of all salmon in the stream. This would be a serious matter, seeing that, according to present appearances, in some of the Scottish rivers this fish is destined to destruction by disease. Severn salmon always had a high reputation, and we should greatly regret their extinction; but we really cannot place the worth of a few fish against the wants of an enormous community like that of Liverpool. We have before expressed an opinion that the principal opposition to the Bill would fall through, and the information which has reached us as to the proceedings of local bodies seems to support this conclusion.

It would appear that the Yeaton Water Company, against whom such strong complaints were made some time ago, are doing their best to remove all grounds of dissatisfaction. They have gone over their gathering-grounds, and have determined to stop out all sources of a polluted character. They are further about to bore into the new red sandstone, from which, of course, they can obtain any quantity of pure water. They further propose to construct a reservoir at a great elevation, from which the houses in the highest parts of Yeaton can be supplied. We never like to see a Company fail, so we hope the one at Yeaton will do their utmost to provide for the wants of the district they have undertaken to supply.

YESTERDAY'S PRICES OF GAS AND WATER SHARES.—Mr. A. G. Prater, Stock and Share Broker, of 23, Cornhill, gives the following as the closing prices yesterday of some of the principal gas and water shares:—

Gas Companies.		Water Companies.	
Commercial	181 —184	Chelsea	205 —208
Continental Union	19 —20	East London	207 —210
Crystal Palace District	173 —177	Grand Junction	115 —117
European	17 —18	Kent	284 —287
Gaslight and Coke "A"	183 —185	Lambeth	203 —206
Imperial Continental	177 —179	Southwark & Vauxhall	211 —213
London	175 —180	Do. "D"	172 —177
Phoenix	35½ —36½	West Middlesex	180 —183
South Metropolitan	195 —200		

URBAN WATER SUPPLY.

CONTINUING the analysis of the Parliamentary Return on this subject, we propose in the present article to consider the state of the supply to towns within the drainage area of the Trent. This great river, draining an important area in the middle of England north of that drained by the eastern tributaries of the Severn, has most of its sources in the coal measures; but the greater part of its course is in the Permian and Triassic beds, especially those known familiarly as the New Red Sandstone. Its northern tributaries and the upper part of the main stream flow in valleys over which there is a rainfall of about 29½ inches; but the southern feeders flow through a tract where the rainfall is only 26 inches. The population in the Upper Trent and the Valley of the Tame (which includes the western division of the whole area) is very large, amounting to at least two-thirds of that of the whole Trent catchment, although comprising much less than one-third of the whole number of square miles. Owing to the very favourable condition of the new red sandstone as a water-yielding formation, a large part of the supply of the district is obtained from wells in that rock, many of them sunk to great depth.

Very little information is to be found in the returns concerning the state of supply to these towns. Many of them are grouped, and are in the hands of large Companies having powers under special Acts of Parliament, and the Local Authorities appealed to for information do not seem to have thought it necessary even to inquire concerning the simplest facts connected with the supply. Of the numerous towns in the Staffordshire Potteries and the surrounding neighbourhood, from the sources of the Trent to Stafford, including the upper tributaries, no information whatever is given beyond the general statement that there is a constant supply from the deep wells of the Staffordshire Potteries Water-Works Company. The population thus supplied is not less than 160,000, and the number of towns is about fourteen. They include Stoke-upon-Trent, Newcastle-under-Lyme, Hanley, Longton and Lane End, Burslem, Tunstall, Kids Grove, and several others of smaller population. We are not informed whether the quality of the water is good, the quantity sufficient, the works costly or otherwise, or the water charges reasonable.

Stone is the first town on the Trent not supplied by the Staffordshire Potteries Company. It has only private wells. Stafford, on the Sow, is also supplied by house wells, but the Corporation are undertaking works for a regular supply. Rugeley is similarly circumstanced, but arrangements are at the present time in progress with the South Staffordshire Water-Works Company. These towns bring us to the mouth of the Tame.

The Tame rises in the South Staffordshire coal-field near Wolverhampton, of which town about half the population is situated within the drainage area of the river. Its water supply has been already considered in the Severn catchment. The Wolverhampton supply extends more or less completely to six other large towns—namely, Bilston, Willenhall, Wednesfield, Heath Town, Short Heath, and Coseley. The last-named town is partly supplied by the South Staffordshire Water-Works Company. This Company are said to supply 24 gallons of water per head per day throughout the very large district they serve, which includes, besides part of Coseley, the towns of Walsall, West Bromwich, Tipton, Wednesbury, Darlaston, Rowley Regis, Oldbury, Smethwick, and Upper Sedgeley. The population supplied by the Wolverhampton works amounts to about 130,000, and by the South Staffordshire Water-Works Company about 250,000. All the information given as to the South Staffordshire Company is that the supply is constant. Birmingham has mixed sources of supply, the water being taken partly from the small river Rea, a tributary of the Tame, and partly from artesian wells. The proportions are not stated. All the water is filtered, and the supply is constant; it amounts to nearly 25 gallons per head per day. The cost of the works exceeds £4 per head of population, and the charge to consumers, as far as can be gathered from the returns, is as much as 8d. per thousand gallons. Birmingham also supplies, apparently on the same terms, Aston, Balsall Heath, Handsworth, Harborne, and Saltley. In the towns of Nuneaton, Bulkington, Hinckley, Chilver, Coton, and Tamworth, there are no public works, and the supply is chiefly from private wells. We need not enlarge here on the risk incurred in pumping up from the sandstone, even when the depth is considerable, water from beneath a large town, especially when it has existed as an inhabited place for many years. The town of Atherton is not in the return. Lichfield is supplied with well water pumped into a reservoir. There are two wells, one of which, sunk from the top of a hill, is old,

the other is recent and in the valley. The depth is not great in either case. The supply is constant, and exceeds 35 gallons per head per day, but the waste is considerable. The cost of works for the new well and distribution has been about 35s. per head, and the charge is 3·8d. per thousand gallons. Ashby-de-la-Zouch receives an intermittent filtered supply from two streams, collected and pumped into a reservoir, but the quantity and cost are not given.

There are several towns in the sub-drainage area of the Dove, of which Leek is the principal. This town has a constant supply from springs flowing into a service reservoir, the amount obtainable being estimated at not much less than 30 gallons per head per day. This is not all used, and the surplus runs away to the River Churnet. The works cost at the rate of £2 6s. per head of population. The charge is 3·15d. per thousand gallons, not making any deduction for waste. At Ashbourne there are only local wells; and of Uttoxeter, Cheadle, and some smaller towns, there is no mention.

In the Derwent sub-drainage area we are told that Buxton has a constant supply from mountain springs to a sufficient but unmentioned extent. The works executed by the Local Authorities have cost as much as £8 per head of the resident population; but as the town depends on its visitors, which in the season quadruple the usual population, the amount is not excessive. The town of Fairfield has works in progress. Bakewell has a constant supply of 22 gallons per head per day from springs in the millstone grit. The cost of works was about £3 per head of population, and the charge about 7d. per thousand gallons. Baslow and Darley have no public works; the latter being supplied from springs. Matlock is supplied by a Company from springs, but there is no further information given. The same may be said of Matlock Bath. Wirksworth receives 20 gallons per head per day of water from the millstone grit. The cost of works is not given, and the charge as stated appears to be less than a halfpenny per thousand gallons. At Ripley, water-works are in progress. At Bonsall and Heage there are springs and wells, but no public works. Belper has a sufficient constant supply from a Company, but quantities are not given. Lastly, at Derby there is a constant supply to the extent of nearly 40 gallons per head per day, obtained from the river by filtration into adits driven at no great distance from the banks. No account is given of the charge, and the works are in the hands of the Corporation.

We now come to the sub-drainage area of the Soar, in which Leicester is the chief town, and Loughborough the next in importance. There are other towns, such as Barrow and Lutterworth, not mentioned; and Melton Mowbray, Thurmaston, and Quorndon are supplied from private wells. Leicester has a catchment area on Charnwood Forest, and large reservoirs. The water is exceptionally good, constant, and abundant, amounting to 30 gallons per head per day. The cost of the works a little exceeded £3 per head of population, and the charge is nearly 6d. per thousand gallons. Leicester supplies a part of Belgrave, but the quantity as stated is only at the rate of 2 gallons per head per day, and the charge as much as 2s. 8d. per thousand gallons. Loughborough has a constant supply of 26 gallons per head per day. The cost of works has been £2 5s. per head of population, and the charge is 2·2d. per thousand gallons.

Within the drainage of the Erewash, Heanor receives little more than 3 gallons per head, the water being raised from a shaft by pumping at a charge of 14·3d. per thousand gallons. Works are in progress which are expected to give an adequate supply at a moderate price. Ilkeston receives rather more than 8½ gallons per head per day, partly from a small catchment area, and partly from a deep well. The supply is constant, but insufficient. The works have recently been purchased by the Urban Authority, at a cost equivalent to 16s. 9d. per head of population, and the charge by the Company was at the rate of 7·4d. per thousand gallons. Additional works are required. The towns of Codner in the Erewash, Hucknall Torkard in the Lean, Bingham in the Devon, and Southwell in the Greet sub-drainage areas, are not alluded to.

In the Idle catchment are several towns, some of them populous and important, but concerning none of them do the returns give complete information. Except Warsop, where the River Meden is utilized, and Worksop, where works are in progress by a Company, the towns named are supplied by shallow wells and springs. At Mansfield, about 8 gallons per head per day are supplied from wells by a Company, and this is said to be sufficient. No particulars are given of cost or charge.

We have yet to consider the conditions of water supply in

the towns on the main stream of the Trent below the confluence of the Tame. The first town is Burton, which receives nearly 16 gallons per head per day from the South Staffordshire Water-Works Company. The next is Nottingham, which, till lately, was served by a Company, whose works have now been sold to the Corporation. The supply has been about 20 gallons per head per day, drawn chiefly from deep wells in the new red sandstone, some within the town, and others outside in the open country. The water from the town wells is inferior. No information is given as to cost or charge. Of Newark no information is given. Gainsborough is described as being supplied from the Trent with filtered water to the extent of 25 gallons per head per day. The supply is constant. The cost to the Local Board was about 27s. 6d. per head of the present population. The charge is 4-2d. per thousand gallons. Some additions to works are under consideration.

Such is the sum of the information communicated with reference to this great and important drainage area; but it is exceedingly meagre, omitting many large towns, and communicating no available information concerning most of the others. The result is that out of about 120 places, in each of which there is a population exceeding 1000, as many as 30 are not included, and must be assumed as being without Urban Sanitary Authorities; more than 20 are supplied by two large Companies, about whose arrangements no information is given; 12 by the two large Corporations of Birmingham and Wolverhampton, and 30 are supplied imperfectly by local wells within the town, and are without public works of any kind. Of less than one-fourth of the number are we enabled to give an account of quantity, cost, and charge, in any way complete. With regard to these, it is clear that the cost and charge vary exceedingly, being in some much less, but in general a good deal more than in the Thames and Severn towns.

The most important result of the inquiry with regard to these Midland and North Midland towns on the new red sandstone is, that so many of them obtain their water from wells, and that in so large a proportion the wells are private, and are therefore sunk within the limits of the town. There is no doubt that the large towns, and those places near the large towns, supplied by them are much better off than the smaller towns that are provided only with local wells. Thus Birmingham, Wolverhampton, Nottingham, Leicester, and Derby, the five largest towns, are well looked after, and really leave nothing to be desired in the way of water supply; but the same cannot be said of the towns of which the population varies from 2000 to 10,000. The returns, imperfect as they are, enable us to discover readily enough, by their silence, the places where sanitary conditions are least looked after, and therefore most required.

MR. ANDERSON'S NEW PAMPHLET.*

Mr. George Anderson is too well known among those to whom his new pamphlet appeals, to require either introduction or recommendation in these columns. His experience as a manufacturer of gas on a large scale, as well as a designer of works and an inventor of apparatus for every process involved in the production, purification, and distribution of gas, has always been freely expressed for the benefit of others, either at the meetings of the British Association of Gas Managers, or in his writings; and the pamphlet under notice may best be described as a confidential communication, to all whom it may concern, of certain facts and opinions which the writer has found useful in his own practice, and which may well be as important to others as he has found them to be in his own case.

Without pretending to be very comprehensive in its nature—a quality which is denied by the essentially personal character of the publication—it will be found to contain a good deal of information, and many valuable hints on practical details of gas management, which will be appreciated by those who do not use any of Mr. Anderson's specialities; while users of his improved appliances will be enabled to correct or verify their own experience of them by the reports from various sources which the pamphlet contains.

Mr. Anderson stoutly defends his system of combining clay and iron retorts in his so-called "triplicate" settings, and makes out a very good case for their general adoption. We own that the furnace gases leave an ordinary fire-clay retort setting with a great portion of their energy unused, which, in the usual way, is at once sent up the chimney and lost. Mr. Anderson maintains that this heat is quite sufficient to work iron retorts, and he contends that long experience of his combined settings bears him out in his belief.

Another portion of the pamphlet deals very fully with the revolving brush scrubbers which he has introduced with much success, and he explains their principle and action so clearly, and appeals so confidently to the records of their use in some of the largest gas-works of the United Kingdom, that we cannot do better than recom-

mend gas managers who are meditating the extension or improvement of their washing and scrubbing appliances to make a careful perusal of his statements.

An account by Mr. R. H. Patterson of his systems of purification by dry lime, and of his "liquid processes," forms the concluding portion of the pamphlet. The former is well known and practised, but the latter have not as yet advanced beyond the experimental stage, although their inventor is sanguine of their ultimate adoption. His remarks, though somewhat combative in general tone, are well worth consideration, and certainly form by no means the least instructive portion of the publication; and as such we leave them to the critical judgment of our readers to whom any honest attempt to solve the great sulphur question is of genuine interest.

ANALYSES OF COALS AND CANNELS.*

We have before us a work containing the verified and averaged analyses of various kinds of English, Scotch, and Welsh gas coals and cannels, made from bulk by Mr. Robert I. Tootill, Gas Chemist, of Manchester, late Coal and Cannel Analyst and Assistant Chemist at the largest of the Manchester Corporation Gas-Works.

Strictly speaking, the experiments of Mr. Tootill might be more correctly termed practical tests, rather than the chemical operations generally described by the term analysis, being confined to the determination of the yield of gas, coke, tar, and liquor of the various samples, and the commercial value of these important components. The information thus obtained is, however, generally all that a gas manager requires to know, and in a brief introductory note the Author gives clear instructions as to the proper use of these data, in connection with the selling prices, for determining the true comparative value of one sample with another. Eighty-six examinations are given, the samples having been taken from bulk as delivered at the works, and the kinds of coal and cannell appear to represent fairly well the different sources from which the greater portion of the coal carbonized in northern and north midland gas-works is drawn, and some bear names equally well known farther south. There is only one important improvement we should have liked to see in the statements, and that is in respect of the coke, which is sometimes valued by Mr. Tootill in terms of comparison with the Wigan Coal and Iron Company's cannell coke, and in other cases is merely qualified as "good" or "bad." This strikes us as being rather vague and unsatisfactory. It would have been better if a fuller description of this important residual had been given; or, at least, the proportion of ash should have been recorded.

The book, nevertheless, will, we have no doubt, be useful for reference by users of the varieties of coal and cannell comprised in the analyses given.

Communicated Article.

THE THEORY OF DISSOCIATION.

By Mr. H. B. DIXON, M.A.,

Millard Lecturer on Chemistry at Balliol and Trinity Colleges, Oxford.

II.

The phenomenon of partial decomposition of compound bodies at high temperatures into simpler constituents, which reunite on cooling to reproduce the original compound, established by St. Claire Deville in the case of certain compounds, and called by him dissociation, was applied by Canizzaro and Kopp to explain particular variations from the law which connects the molecular weight of a compound with its vapour density. According to Mons. Deville's experiments, the amount of decomposition increases with the temperature, so that for a particular compound there should exist a temperature at which decomposition should be complete. At and above this temperature the decomposed substance should occupy as many times its original volume as the number of simpler bodies it split up into. If the temperature of complete dissociation into two constituents were but a few degrees above the boiling point of any given compound, then its vapour density, as given by experiment, would not be the real density of the compound, but that of a mixture of the two constituents occupying double the normal volume. Dissociation gives an easy explanation of abnormal density, and reconciles apparent contradictions with the truth of Avogadro's hypothesis, that *equal volumes of all gases contain an equal number of molecules*. To understand the importance of this question on chemical science, it will be necessary to glance at the development of the molecular theory of gases from the beginning of this century.

According to the generally received atomic theory of Dalton, matter is not infinitely divisible, but is composed of a multitude of very small indivisible particles, or atoms, having peculiar properties and a definite mass. The ultimate particles or atoms of one kind of matter are all exactly similar, but differ in properties and mass from the ultimate particles of other kinds of matter. Thus hydrogen gas is supposed to be made of an aggregation of minute indivisible hydrogen atoms, chlorine gas of an aggregation of minute indivisible chlorine atoms, each of which are $35\frac{1}{2}$ times as heavy as each hydrogen atom. When combination takes place between the two gases, each atom of hydrogen unites with one atom of chlorine to form a "molecule" of hydrogen chloride; so that, in the aggregate, one part by weight of hydrogen unites with $35\frac{1}{2}$ parts by weight of chlorine to form $36\frac{1}{2}$ parts by weight of hydrogen chloride. Since combination thus takes place atom with atom, the proportion by weight in

* "Improvements in Apparatus employed in the Manufacture of Gas." By George Anderson, Gas Engineer, London.

* "Analyses of Coals and Cannels." By Robert I. Tootill, Manchester.

which two elementary substances combine will give the relative weight of their respective atoms. But many elementary substances combine together in more than one proportion to form different kinds of matter, in which cases the different combining proportions are found to bear very simple ratios one to another. Take the substances produced by the union of the elements oxygen and nitrogen in different proportions. If the compound with the least oxygen be analyzed, it is found to contain 14 parts by weight of nitrogen for every 8 parts by weight of oxygen; the next compound is found to contain 14 parts by weight of nitrogen for every 16 of oxygen; the next, 14 of nitrogen for 24 of oxygen; the next, 14 of nitrogen for 32 of oxygen; the last, 14 of nitrogen for 40 of oxygen. In this series of compounds the amount of oxygen which unites with the same weight of nitrogen increases by regular increments; so that the quantity of oxygen present in the second member of the series is exactly twice that present in the first, the quantity of oxygen in the third is exactly three times that present in the first, and so on. The study of this and similar cases of combination in multiple proportion led Dalton to enunciate his atomic theory. The reason of the regular increase in the weight of oxygen, as we pass from the lower to the higher oxides of nitrogen, lies in the fact that each atom of nitrogen can unite with one, two, or more atoms of oxygen, each weighing 8, and in no intermediate proportion. According to Dalton's theory, the lowest oxide contains only one atom of oxygen in its molecule; the second, two atoms; the last, five atoms. When an element is thus capable of combining in several proportions, the lowest proportion was that taken by Dalton as its "atomic weight."

It is usual to express the atomic weights of all the elements by the ratios which they bear to the weight of hydrogen. We assume the atom of hydrogen to weigh 1; this weight is taken as the unit of the atomic scale, and the weights of the other elements are referred to it. But we have as yet no means of deciding whether the combining proportion, as given by analysis, is really the atomic weight of a particular element, or some multiple of it. In other words, the exact determination of the percentage composition of a compound gives us several numbers, between which a choice must be made for the atomic weight of its constituents, according as we suppose one or more atom of each to be present. Dalton found that in the two compounds formed by carbon with oxygen, one contained exactly twice as much oxygen as the other, united to the same weight of carbon. In two compounds of carbon with hydrogen—namely, ethylene and marsh gas—the latter contained exactly twice as much hydrogen as did the former, combined with an equal weight of carbon. If the weight of hydrogen in ethylene be taken as unity, then the weight of carbon united with it is 6. In marsh gas, then, 2 units of hydrogen are united with 6 parts by weight of carbon. Moreover, in water there are 8 parts by weight of oxygen united with 1 of hydrogen; 6 and 8 being the weights of carbon and oxygen which can unite respectively with unit weight of hydrogen. These numbers express, therefore, the proportion by weight in which carbon and oxygen should unite to form the simplest compound, atom with atom, if ethylene and water are the simplest compounds of carbon and oxygen with hydrogen. Now, in carbonic oxide, 6 parts by weight of carbon unite with 8 parts by weight of oxygen; and, in carbonic acid, 6 parts by weight of carbon unite with twice 8, or 16 parts by weight of oxygen. Calling the atomic weight of hydrogen 1, the atomic weight of carbon was taken as 6, the atomic weight of oxygen 8. These numbers are not those generally accepted by chemists at the present day as the atomic weights of carbon and oxygen; for there are many facts tending to show that water is not the simplest compound of hydrogen and oxygen, and that ethylene is not the simplest compound of hydrogen and carbon. Of these facts, the most important are those connected with the volumes occupied by matter in the gaseous state.

In 1805, Gay-Lussac discovered, by exact experiments, that a given volume of oxygen unites with exactly twice its volume of hydrogen to form water. The simplicity of this ratio led him to examine the exact proportions by volume in which other gases unite. He established, by careful experiments, the fact that hydrogen and chlorine combine exactly, volume with volume, to form hydrochloric acid; that 2 volumes of nitrogen are united with exactly 1 volume of oxygen in nitrous oxide; and that 3 volumes of hydrogen are united with exactly 1 volume of nitrogen in ammonia. Moreover, he discovered the fact that the volume of a compound gas bears a similar simple ratio to the volume occupied by its constituent gases in the free state. Thus 1 litre of hydrogen unites with 1 litre of chlorine to form exactly 2 litres of hydrochloric acid gas. There is no contraction of the gases on combination. One litre of oxygen unites with 2 litres of hydrogen to form 2 litres of steam; 1 litre of nitrogen unites with 3 litres of hydrogen to form 2 litres of ammonia gas. The same simple relation between the volumes of the combining gases and the volume of the compound gas has been proved to exist in many other cases; in all the experiments the gaseous volumes being measured under the same conditions of temperature and pressure.

On applying Dalton's atomic theory to the chemical combination of gases, a remarkable relation is made manifest. According to the atomic theory, bodies unite in definite proportions by weight, which express the relative weights of their atoms. Gay-Lussac showed that gases unite in definite and simple proportions by volume. There exists, therefore, a simple ratio between the volumes of gases and the number of atoms contained in these volumes—in other words, there is a simple relation between the density of gases and their atomic weights.

What this simple relation is was first propounded by Avogadro. According to his hypothesis, all matter in the gaseous state consists

of free and independent molecules, removed one from another by heat-repulsion to distances, great in proportion to their size, and always equal under like conditions of temperature and pressure. A litre of hydrogen and a litre of chlorine contain the same number of molecules. These molecules are so far apart one from the other that the force of cohesion does not come into play between them, and the distances between them are governed solely by the temperature and pressure to which the gases are subjected, independently of the chemical nature of the molecules themselves. The two gases, therefore, expand or contract equally for an equal increase or decrease of temperature, and expand or contract equally for an equal decrease or increase of pressure. The hypothesis of Avogadro is in accordance with all the observed physical properties of gases, and gives a very clear and simple explanation of the laws of combination of gases by volume; if it can be shown to be true, it affords a very certain method of determining, not only the atomic weights of the elements, but the molecular weights of compound bodies from which their atomic composition may be calculated. For if equal volumes of all substances in the gaseous state contain an equal number of molecules, then the relative weights of equal volumes of two gases will bear the same relation to one another as their molecular weights. Now the density of hydrogen gas is taken as 1, and the molecular weight of hydrogen is taken as 2, for reasons which we will examine directly; accordingly, the number expressing the density of any gas, compared with hydrogen as 1, will not express its molecular weight as compared with hydrogen, but *half its molecular weight*.

A litre of hydrogen, which we assume to weigh 1, combines with a litre of chlorine, which is $35\frac{1}{2}$ times as heavy. Two litres of hydrochloric acid gas are produced, which together weigh $36\frac{1}{2}$ —the sum of the weights of the components. Each litre of hydrochloric acid weighs half this amount, or $18\frac{1}{4}$. But each litre of hydrochloric acid contains the same number of molecules as the original litre of hydrogen and as the original litre of chlorine, and each molecule of hydrochloric acid must contain at least one atom of hydrogen and one atom of chlorine; so that in the two litres of hydrochloric acid there must be at least twice as many atoms of hydrogen and chlorine as there were molecules of hydrogen and chlorine originally. Each molecule of hydrogen and chlorine must then, if Avogadro's hypothesis is correct, contain at least two atoms. Since hydrochloric acid is the simplest known compound of hydrogen and chlorine, its molecule is said to consist of one atom of hydrogen and one atom of chlorine, and the molecules of these gases in the free state are accordingly said to consist of two atoms.

It is a practical inconvenience that we have different standards for the density and molecular weight of bodies in the gaseous state; as the custom obtains, we have 1 for the unit of density, 2 for the unit of molecular weight. This mode of reference has led many chemists to adopt the expression that *the molecule of a compound gas occupies two volumes*. "Specific gravity," or "density," being defined as "the weight of a unit of volume," and the molecular weight of a compound body being double its density, this molecular weight is, therefore, the weight of two units of volume. The molecule of a gas is said to occupy twice the space occupied by one atom of hydrogen—a statement which, of course, implies that the molecule of hydrogen (H_2) occupies twice as much space as does the atom of hydrogen (H), although, as far as we know, the atom of hydrogen (H) can have no independent existence apart from other atoms. In spite of this inconsistency, the statement that a particular molecule occupies two volumes has been found a concise way of expressing the fact that the vapour density of a particular substance is found to be half its molecular weight, the density of an equal volume of hydrogen, under similar conditions of temperature and pressure, being taken as unity.

That the elementary gases, oxygen, hydrogen, chlorine, &c., are composed of molecules, each containing two atoms at least—a consequence which follows from Avogadro's hypothesis—is not inconsistent with any chemical fact. Indeed, from purely chemical considerations, it seems probable that the molecules of these gases contain two atoms. With regard to gaseous compounds, we have a vast array of facts all pointing to the truth of the hypothesis. The densities of numerous compounds, as determined experimentally, are in accordance with what we know of their constitution as revealed by their chemical reactions. To take two instances, the vapour density of ammonia as compared with hydrogen is $8\frac{1}{2}$; its molecule, therefore, should weigh twice this amount, or 17. Chemical analysis tells us that the ratio of nitrogen to hydrogen is as 14 to 3, so that its formula must be either NH_3 , or some multiple of this—*e.g.*, N_2H_4 , or N_3H_6 . But the hydrogen of ammonia is found to be replaceable by thirds only, not by sixths or by ninths. The formula NH_3 assigned to ammonia on purely chemical grounds, agrees with that deduced from its vapour density. The vapour density of ethyl alcohol is 23; its molecule should weigh, therefore, twice this amount, or 46. Chemical analysis gives for its formula either C_2H_6O , or $C_4H_{12}O_2$, &c. But the hydrogen of ethyl alcohol is only replaceable by sixths; the oxygen can only be taken out altogether or not at all. The first formula is, therefore, the correct one, which gives 46 for the weight of the molecule of alcohol, in accordance with Avogadro's hypothesis. From cumulative evidence such as this, the majority of chemists have been led to regard the hypothesis as the expression of a natural law, and, in cases where the chemical evidence available leaves it doubtful which of two or more numbers is the correct molecular weight of a compound, have appealed to the test of density as decisive. On such a foundation a great superstructure of chemical formulæ has been raised, so that the proof or disproof of Avogadro's hypothesis involves the security or fall of a great part of that which has been christened the "New Chemistry."

(To be continued.)

Parliamentary Intelligence.

PRIVATE BILLS RELATING TO GAS, WATER, ETC.

SESSION 1880.

PROGRESS MADE TO SATURDAY, FEB. 21.

Title of Bill.		Petition for Bill Presented.	Bill Read the First Time.	Bill Read a Second Time.
Ackworth, Featherstone, Purston, and Sharlston Gas Bill	Lords	Feb. 9	Feb. 10	..
Birkenhead Borough Bill	Commons . . . . .	..	..	..
British Gaslight Company, Limited (Staffordshire Potteries), Bill	Lords	Feb. 10	Feb. 10	..
Burton-upon-Trent Corporation Bill	Commons	Feb. 9	Feb. 10	Feb. 16
Cardiff Water Bill	Lords	Feb. 10	Feb. 10	Feb. 20
Chester Gas Bill	Commons . . . . .	..	..	..
Cork Gas Bill	Lords	Feb. 9	Feb. 10	..
Cork Improvement Bill	Commons	Feb. 9	Feb. 10	..
Dagenham and District Farmers (Optional Sewage Utilization Bill)	Lords	Feb. 9	Feb. 10	Feb. 16
Dartford Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 17
Dearne Valley Water Bill	Lords	Feb. 10	Feb. 10	Feb. 16
Denton and Haughton Gas Bill	Commons . . . . .	..	..	..
Doncaster Corporation Water Bill	Lords	Feb. 9	Feb. 10	Feb. 16
Eastbourne Gas Bill	Commons	Feb. 10	Feb. 10	Feb. 16
Edinburgh and District Water Bill	Lords . . . . .	..	..	..
Exmouth and District Water Bill	Commons	Feb. 9	Feb. 10	..
Gaslight and Coke, Commercial Gas, and South Metropolitan Gaslight and Coke Companies Bill	Lords	Feb. 9	Feb. 10	Feb. 17
Great Yarmouth Water Bill	Commons . . . . .	..	..	..
Hinkley Local Board Gas Bill	Lords	Feb. 9	Feb. 10	..
Huddersfield Tramways and Im- provement Bill	Commons	Feb. 9	Feb. 10	..
Hull Lighting Bill	Lords	Feb. 9	Feb. 10	Feb. 16
Hyde Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 16
King's Lynn Corporation Bill	Lords	Feb. 9	Feb. 10	..
Lancashire County Justices Bill	Commons	Feb. 9	Feb. 10	Feb. 16
Lancaster Corporation Bill	Lords	Feb. 10	Feb. 10	Feb. 16
Lincoln Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 16
Lincoln Gas Bill	Lords	Feb. 9	Feb. 10	..
Liverpool Corporation Water Bill	Commons	Feb. 9	Feb. 10	..
Liverpool United Gas Bill	Lords	Feb. 9	Feb. 10	..
London Gaslight Company Bill	Commons	Feb. 9	Feb. 10	..
Maidstone Gas Bill	Lords	Feb. 9	Feb. 10	..
Malton Gas Bill	Commons	Feb. 9	Feb. 10	..
Malton Gas Bill	Lords	Feb. 9	Feb. 10	..
Oldham Improvement Bill	Commons	Feb. 9	Feb. 10	..
Oldham Improvement Bill	Lords	Feb. 9	Feb. 10	Feb. 16
Phoenix Gaslight and Coke Com- pany Bill	Commons . . . . .	..	..	..
Portmadoc Water Bill	Lords	Feb. 10	Feb. 10	Feb. 16
Prescot Gas Bill	Commons . . . . .	..	..	..
Preston Improvement Bill	Lords	Feb. 9	Feb. 10	..
Rathmines and Rathgar Township (Varty Water Supply) Bill	Commons	Feb. 9	Feb. 10	Feb. 16
Rathmines and Rathgar Township Water Bill	Lords	Feb. 16	Feb. 16	..
Reading Gas Bill	Commons	Feb. 10	Feb. 10	Feb. 16
Reading Gas Bill	Lords . . . . .	..	..	..
Rochester Corporation Bill	Commons	Feb. 9	Feb. 10	..
Rochester Corporation Bill	Lords	Feb. 9	Feb. 10	Feb. 16
Sea Water Supply to London Bill	Commons	Feb. 10	Feb. 10	Feb. 16
Sligo Borough Water Bill	Lords	Feb. 10	Feb. 10	Feb. 16
Sligo Borough Water Bill	Commons . . . . .	..	..	..
South Metropolitan Gas Company Bill	Lords	Feb. 9	Feb. 10	..
Southwark and Vauxhall Water Bill	Commons	Feb. 9	Feb. 10	..
Stafford Borough Bill	Lords	Feb. 9	Feb. 10	..
Stafford Borough Bill	Commons	Feb. 9	Feb. 10	..
Wakefield Corporation Water Bill	Lords	Feb. 9	Feb. 10	Feb. 16
Wakefield Corporation Water Bill	Commons	Feb. 10	Feb. 10	..
Wandsworth and Putney Gas Bill	Lords . . . . .	..	..	..
Wandsworth and Putney Gas Bill	Commons	Feb. 9	Feb. 10	..
Wigan Improvement Bill	Lords	Feb. 9	Feb. 10	..
Wigan Improvement Bill	Commons	Feb. 9	Feb. 10	Feb. 17
Wrexham Water Bill	Lords	Feb. 9	Feb. 10	..
Wrexham Water Bill	Commons	Feb. 9	Feb. 10	..
Yeadon and Guiseley Gas Bill	Lords	Feb. 9	Feb. 10	..
Yeadon and Guiseley Gas Bill	Commons	Feb. 9	Feb. 10	..

HOUSE OF LORDS.

THURSDAY, FEB. 19.

Petitions against the following Bills were presented:—
Rathmines and Rathgar Township Water Bill, from Dublin
Tramways Company.
Wakefield Corporation Water Bill, from Corporation of
Halifax.

FRIDAY, FEB. 20.

Petitions against the following Bills were presented :—
 Sea Water Supply to London Bill, from (1) Conservators of the River Thames; (2) Lambeth Water-Works Company; (3) Fulham District Board of Works.
 Sligo Borough Bill, from Roger Charles Parko.
 Wakefield Corporation Water Bill, from (1) Henry Savile; (2) Owners, &c., of mills, &c. (W. H. Rawson and others); (3) Lancashire and Yorkshire Railway Company; (4) Calder and Hebble and Aire and Calder Navigation Companies.

HOUSE OF COMMONS.

MONDAY, FEB. 16.

Petitions against the following Bills were presented:—
Burton-upon-Trent Corporation Bill, from Sir Henry Flower
Every, Bart., and the Rev. Rowland Mosley.
Dagenham and District Farmers (Optional) Sewage Utiliza-
tion Bill, from James Stormonth Darling (as guardian
of the estate of Peter Lauri Mackie, an infant).

Mr. FAWCETT again gave notice that he would ask the Secretary of State for the Home Department, on Monday, the 23rd inst., if he could inform the House when the Bill relating to the Water Supply of London will be introduced.

Mr. ROWLEY HILL deferred till yesterday his notice of motion, originally fixed for Tuesday last, the 17th inst., "To ask the President of the Local Government Board whether, in view of applications from various districts to take water for their own purposes from watersheds with which they have no natural connection, the Government are prepared, in anticipation of legislation upon the subject, to initiate an inquiry into the whole question of water supply."

TUESDAY, FEB. 17.

GASLIGHT AND COKE, COMMERCIAL GAS, AND SOUTH METROPOLITAN GASLIGHT AND COKE COMPANIES BILL.

ALDERMAN COTTON: I beg leave to move that this Bill be read a second time. The objects of the Bill are to provide the means of ascertaining the pressure of gas supplied over any particular district, by self-registering pressure-gauges keeping a constant register at the testing-stations, and also by testings of the pressure at a certain number of the street-lamps, such number to be determined by the Metropolitan Gas Referees. It is likewise to provide means for obviating the present difficulty of ascertaining from which manufacturing station the gas is supplied to any particular place, and to render it possible by these means to assess the penalties, which, under existing circumstances, cannot be done, the gas from many manufacturing stations being mixed before it reaches the district where it is to be consumed. The honourable member the Chairman of the Metropolitan Board of Works is with us on this Bill. Originally, the Metropolitan Board opposed the Bill; but as they are now excluded from the 21st clause, they will not oppose the second reading.

Colonel MAKINS: I move that the Bill be read a second time this day six months. I am aware that the course I am asking the House to adopt—viz., to reject a private Bill on its second reading—is a somewhat unusual one. At the same time, where a Bill is exceptional in its character, and in all its principles and provisions is contrary to those recognized in the practice of the House, I think I shall have no difficulty in persuading the House that such a course ought to be taken. The Bill is promoted by the City of London Corporation, and its objects are to regulate the testing of the illuminating power, purity, and pressure of the gas supplied to the City—points which have all been already dealt with in the Acts of the various Gas Companies. Some of these Acts were passed so recently as 1875 and 1876; and the Corporation themselves, in a petition they presented last year with reference to a measure brought in by The Gaslight and Coke Company, and having, among other provisions, similar provisions to those contained in this Bill, stated that the regulations contained in the Act of 1876 had been most carefully considered, and were found to be most salutary in their operation, having tended greatly to improve the quality of the gas. This was said by the Corporation not later than last session; yet they now bring in a Bill to alter and amend those regulations. This is not all. The Bill, though promoted by the Corporation, deals with a large area outside their limits. We have heard the honourable member state that the Metropolitan Board are busy in promoting this measure. This, I need not say, is a recent conversion, and no doubt the honourable and gallant member for Truro will explain to us how it is that the Metropolitan Board of Works have changed their minds on the subject; for no later than the 6th of this month they passed a resolution that the Board should petition against the Bill. It may be that the Board of Works would be glad to have the Bill passed, if they could bring it forward without having to call on the ratepayers for the expenses; and knowing that the City has plenty of funds at its disposal, it may turn out that some such arrangement has been made by them. The Bill deals with three Companies, two of which supply gas outside the City. The third—The Gaslight and Coke Company—supply an area more than five times as great as that of the City. Therefore the controlling power of the City is small compared with the area over which the Bill seeks power to deal. My honourable friend (Lieut.-Col. Hogg) will perhaps explain how his opposition on that point has been done away with. There is only one other objection—but it is a rather strong one—which we urge against the Bill. In all former arrangements for testing the purity and illuminating power of gas, the penalties have been placed on the Companies only, so to speak, by consent. That is to say, when the Companies came to Parliament and asked for increased powers to raise capital, Parliament, in exchange for the powers they granted, required the Companies to submit, in the interest of the public, to certain restrictions. We have now a new way of dealing with

these matters; for the Corporation suddenly, and without any communication with us, launch upon us a Bill containing heavier penalties and more galling restrictions, and put upon us the expense of contending against this Bill in Committee. We have only one object, and that is to serve the public. We have no objection to such restrictions as Parliament may see fit to put upon us; but I think it would be perfectly possible for the Corporation and the Metropolitan Board of Works to arrange matters with the Gas Companies on terms which would be satisfactory to the public, the Board of Trade standing by and seeing that fair play is done. If such a course had been taken, our opposition would not have been necessary; but as the Bill has been introduced in a way which is an innovation on the usual practice, I must move that it be read a second time this day six months.

Sir J. M. Hogg: My honourable friend the member for South Essex has rather challenged me to make some explanations as to my course with reference to this Bill; and even if he had not done so, I should have felt it my duty, as Chairman of the Metropolitan Board of Works, representing many millions of the ratepayers of the Metropolis, to offer some observations upon the measure. On behalf of my colleagues at that Board, and on behalf of the ratepayers, I should have felt it to be my duty strongly to oppose the Bill, had it not been for the assurance of the member for the City of London that the Metropolitan Board would be excluded from the 21st clause. I may perhaps explain to the House that the Metropolitan Board, not having the power of interference, could have no control; and I need not say that my colleagues at the Metropolitan Board would decidedly object to paying money, over the expenditure of which they had no control. We had two or three meetings on the subject, and we were anxious to promote a friendly Amendment Bill. But our friends in the City wished to go farther than the Metropolitan Board. The Board only wanted to amend existing legislation. There are difficulties as to testing the gas supplied to various places, which it is impossible to carry out if there are defects in the law, and therefore the Metropolitan Board would have been glad to have had an amendment of the law. Their anxiety on the present occasion was to have a friendly amendment of the law, and not to have a costly contest with the Gas Companies. If my honourable friend will withdraw this clause, I, on the part of the Metropolitan Board, will not oppose the second reading of the Bill. But I reserve to myself and my colleagues the full power to go to the Committee and endeavour to amend the Bill, which, as it stands, the Board, on behalf of the ratepayers, cannot sanction. At the same time, I am one of those who think that when Bills are brought in here, those who advocate them should have a fair hearing, and that the Bills should have a second reading unless there are special reasons to the contrary. Therefore, on the part of my colleagues, I shall not oppose the second reading.

Mr. J. G. TALBOT: I quite agree that it is undesirable to reject a Bill of this kind unless there is a strong *prima facie* case against it, and I trust that the honourable member will not press his amendment to a division. This is a matter which the Board of Trade have not now for the first time in hand; they have been in communication with the various Gas Companies and the City of London and the Metropolitan Board of Works, and they have sent the Bill to the Gas Referees. I am quite willing to go so far with my honourable friend as to say that the Bill, as it stands, is one which the Board of Trade cannot support. But there is a case for legislation, and we propose, when the report of the Gas Referees is received, to bring the various parties together, and, if we can bring them into harmony, to have an agreed Bill. If we can have an agreed Bill, the Board of Trade will do its best to promote it; but if the different parties cannot agree, the Board of Trade will have nothing to do with it. The best course, in the interests of the public, will be for the Bill to be read a second time now, and the further stage postponed till the report of the Referees is received.

Colonel MAKINS: After the remarks of the Under-Secretary to the Board of Trade, I will withdraw my amendment.

The amendment was then formally withdrawn, and the Bill read a second time.

LIVERPOOL CORPORATION WATER BILL.

Sir BALDWIN LEIGHTON gave notice that, after the second reading of this Bill, he will move—"That the Bill be referred to a Select Committee of nine members, five to be nominated by the House and four by the Committee of Selection, and that such of the petitioners as shall have presented petitions for or against the Bill may, if they think fit, be heard before such Committee by their counsel or agents. That it be an instruction to the said Committee on the Liverpool Corporation Water Bill that they have power to inquire and report upon the present sufficiency of the water supply of Liverpool and its neighbourhood (having regard to the powers obtained by the Manchester Corporation under the Thirlmere scheme); also of any other available source for such supply. To consider whether compulsory powers should be given to acquire the water of a separate watershed, such as that of the Severn, for the purpose; and, if so, how far, and under what conditions as to regulation of water-flow, compensation water with the necessary works, and adequate provisions to enforce such obligation. And to consider the prospective requirements and vested interests and rights of the populations situated in the Severn Valley and Severn Basin as to water supply, navigation, fishery, sanitary purposes, and the scouring effects of floods; also the water supply of populations situated between the Vyrnwy gathering-grounds and Liverpool; and to inquire whether any, and, if so, what provision should be made in limitation of proposals for the exclusive use of the water of the said gathering-grounds of the Vyrnwy river head."

WEDNESDAY, FEB. 18.

Petitions against the following Bills were presented:—

Liverpool Corporation Water Bill, from (1) Captain Devereux Herbert Mytton; (2) Wallace James Arthur France; (3) Board of Conservators of the Severn Fishery District; (4) Cheshire Lines Committee; (5) Sheffield and Midland Railway Companies Committee.
Preston Improvement Bill, from Festwood Local Board.
Southwark and Vauxhall Water Bill, from West Middlesex Water Company.

THURSDAY, FEB. 19.

Petitions against the following Bills were presented:—

Ackworth, Featherstone, Purstone, and Sharlston Gas Bill, from George Bradley.
Hull Lighting Bill, from Sutton, Southcoates, and Drypool Gas Company.
Lancaster Corporation Bill, from Freeman of the Borough of Lancaster.
Liverpool Corporation Water Bill (the petitioners not praying to be heard), from Inhabitants of the parish of Llanwddyn.

FRIDAY, FEB. 20.

Petitions against the following Bills were presented:—

Dagenham and District Farmers (Optional) Sewage Utilization Bill, from (1) Commissioners of Sewers for the Levels of Havering, Dagenham, &c.; (2) Conservators of the River Thames.

Gaslight and Coke, Commercial Gas, and South Metropolitan Gaslight and Coke Companies Bill, from (1) Gaslight and Coke Company; (2) South Metropolitan Gaslight and Coke Company.
Hinckley Local Board Bill, from Hinckley Gaslight and Coke Company.
Hull Lighting Bill, from (1) Kingston-upon-Hull Gaslight Company; (2) British Gas Company, Limited; (3) Dock Company at Kingston-upon-Hull.
King's Lynn Corporation Bill, from (1) Arthur Charles Greville and Edward Bailey (derivative trustees of Lady William Bentinck); (2) Norfolk Estuary Company.
Lancaster Corporation Bill, from (1) Robert Lawson and Josiah Ball (as trustees of the will of William Kelsall, deceased); (2) Midland Railway Company; (3) Anne Coulston and others; (4) Justices of the Peace for the County Palatine of Lancaster; (5) Lancaster Gas Company.
Liverpool Corporation Water Bill, from (1) Corporation of St. Helen's; (2) Severn Commissioners; (3) Staffordshire and Worcestershire Canal Navigation; (4) Mersey and Irwell Navigation and Bridgwater Navigation Companies; (5) Upper Mersey Navigation Commissioners; (6) Lord Harlech; (7) Sir Watkin Williams Wynn, M.P.; (8) Edward Williams; (9) Trustees of the River Weaver Navigation; (10) Lancashire and Yorkshire Railway Company.
Liverpool United Gas Bill, from Midland Railway Company.
Malton Gas Bill, from Malton Local Board.
Oldham Improvement Bill, from (1) Lancashire and Yorkshire Railway Company; (2) Chadderton Local Board.
Preston Improvement Bill, from (1) Preston Gas Company; (2) John Fletcher.
Rochester Corporation Bill, from Owners, &c., of lands, &c.
South Metropolitan Gas Company Bill, from (1) Vestry of Lambeth; (2) Vestry of St. Giles, Camberwell; (3) Helen Elizabeth Page Fryer and Sir Henry Page Turner Barron.
Southwark and Vauxhall Water Bill, from (1) Lambeth Water-Works Company; (2) Conservators of the River Thames; (3) Kent Water-Works Company.
Wigan Improvement Bill, from (1) Lancashire and Yorkshire Railway Company; (2) Baron Gerard.
Wrexham Water Bill, from (1) Great Western Railway Company; (2) Chester Water-Works Company; (3) Roger Assheton Rasbotham.

SATURDAY, FEB. 21.

Petitions against the following Bills were presented:—

Cork Gas Bill, from (1) Corporation of Cork; (2) Consumers of gas in Cork and its vicinity.
Dagenham and District Farmers (Optional) Sewage Utilization Bill, from (1) Metropolitan Board of Works; (2) Her Majesty's Commissioners of Sewers for Rainham, Mucking, and other Levels in the county of Essex; (3) The National Bank.
Denton and Haughton Gas Bill, from London and North-Western Railway Company.
Gaslight and Coke, Commercial Gas, and South Metropolitan Gaslight and Coke Companies Bill, from (1) Metropolitan Board of Works; (2) Commercial Gas Company.
Great Yarmouth Water Bill, from Sir Edmund Lacon, Bart., M.P.
Hinckley Local Board Gas Bill, from London and North-Western Railway Company.
Hull Lighting Bill, from North-Eastern Railway Company.
Hyde Gas Bill, from Hyde Local Board and consumers of gas.
Lancaster Corporation Bill, from London and North-Western Railway Company.
Liverpool Corporation Bill, from (1) Widnes Local Board; (2) Midland Railway Company; (3) London and North-Western Railway Company; (4) Corporation of Gloucester; (5) Corporation of Bootle-cum-Linacre; (6) Corporation of Warrington; (7) Merchants, manufacturers, and traders of Warrington; (8) Mining Association of Great Britain; (9) Earl of Haddington and others; (10) Shropshire Union Railways and Canal Company; (11) Corporations of Worcester, Shrewsbury, and Bridgnorth; (12) Great Western Railway Company; (13) Sharpness New Docks and Gloucester and Birmingham Navigation Company.
Liverpool United Gas Bill, from Corporation of Bootle-cum-Linacre.
London Gaslight Company Bill, from Metropolitan Board of Works.
Maidstone Gas Bill, from Corporation of Maidstone.
Malton Gas Bill, from North-Eastern Railway Company.
Oldham Improvement Bill, from (1) London and North-Western Railway Company; (2) Owners of property in Oldham; (3) Royton Local Board; (4) Crompton Local Board; (5) Failsforth Local Board.
Prescot Gas Bill, from (1) London and North-Western Railway Company; (2) Ratepayers, inhabitants, and consumers of gas.
South Metropolitan Gas Company Bill, from (1) Metropolitan Board of Works; (2) Joseph Francis Swann (against clauses only); (3) Owners, &c., of lands and dwelling-houses near proposed gas-works (James Barrett and others); (4) South-Eastern Railway Company.
Southwark and Vauxhall Water Bill, from (1) Metropolitan Board of Works; (2) Corporation of Kingston-upon-Thames; (3) Hugh Hammersley; (4) Hampton Wick Local Board; (5) Duke of Cambridge; (6) Wandsworth and Putney Gaslight and Coke Company; (7) Inhabitants of Seething Wells; (8) Chelsea Water-Works Company; (9) Lea Conservancy Board; (10) Grand Junction Water-Works Company; (11) London and South-Western Railway Company.
Wandsworth and Putney Gas Bill, from Metropolitan Board of Works.
Wigan Improvement Bill, from London and North-Western Railway Company.
Wrexham Water Bill, from (1) London and North-Western Railway Company; (2) Brymbo Water Company; (3) Ruabon Water Company; (4) C. F. O. Davis (for himself and Eliza Flint) and William Johnson.
A petition against the Liverpool Corporation Water Bill (the petitioners not praying to be heard) was presented from Corporation of Droitwich.

SUFFOCATION BY GAS AT LIVERPOOL.—On Saturday, the 14th inst., the Liverpool Borough Coroner held an inquest on the body of Isabella Atkinson, aged 22, of Adamthwaite Farm, Ravenstonedale, Westmoreland, who was found dead in bed on the previous morning at the Shaftesbury Temperance Hotel, Mount Pleasant, Liverpool, she having died, according to the opinion of Dr. John Bligh, from inhaling gas, the gas having been found fully turned on in her room, but not burning. Thomas Edwards, the "boots" at the hotel, testified to having found the deceased dead. The door of the room, witness stated, was not completely closed, it being open a few inches. Mr. John W. Lloyd, proprietor of the hotel, said the gas bracket was in good order. There was no chimney in the room, which was a small one. The deceased was in delicate health, and had come to Liverpool to consult a doctor. Dr. Bligh having stated that death was due to suffocation by gas, a verdict to that effect was returned. The jury expressed a regret that there was not some evidence to show how the gas came to be full on, but considered no blame to be attached to any one.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE GAS REFEREES SULPHUR TEST.

SIR,—The letter on the above subject which appeared in last week's JOURNAL, from the hero of more than 16,000 sulphur tests, requires a few comments.

I may state that I have had ten years experience in the use of the Referees and the Lethby tests, and am fully acquainted with the ordinary sources of error in both apparatuses; of the necessity for good ventilation, freedom from leaks, and proper combustion, in order to ensure accurate results; as well as of the influence of temperature on the quantity of liquor obtained. The source of error which I pointed out is, however, one that is exceedingly likely to pass undetected; in fact, my discovery was simply due to the accident of the proportion of liquor escaping down the trumpet tube, in the particular apparatus I was using, being sufficiently large to attract attention by its action on the ammonium carbonate. Had the error been smaller, it would probably have remained undiscovered, as I have no doubt a similar error has on more than one occasion during my long experience.

"Another F.C.S." speaks confidently of his never having had "such an accident." How can he tell positively that in some of his many experiments a small fraction of the liquor may not have escaped in the way I have pointed out?

I will not trespass further on your space at present, but will simply add that I did not intend my communication to convey the impression that the source of error alluded to existed to any large extent (although, for all we know to the contrary, it might do so), but simply to point out the possibility of its occurrence, as proved by what has recently come within my own experience.

Feb. 19, 1880.

H. LEICESTER GREVILLE.

Legal Intelligence.

INVERNESS JUSTICE OF THE PEACE COURT.

TUESDAY, FEB. 10.

(Before Messrs. FRASER and GRANT.)

ILLEGAL APPROPRIATION OF GAS.

Andrew Fullarton, baker, Baron Taylor's Lane, Inverness, was charged, at the instance of the Police Commissioners of Inverness, with contravention of the Gas-Works Clauses Act, 1847, the charge consisting of two counts. Under the first he was accused of having, on Aug. 1, 1879, in the shop or premises occupied by him, laid down, or caused to be laid down, a pipe communicating with the gas-main belonging to the Police Commissioners, who are the undertakers, under the Inverness Water and Gas Act, 1875, for supplying gas to the burgh of Inverness. It was alleged that by means of this pipe, and without the consent of the Commissioners, he had improperly used or burned the Commissioners' gas, "without paying or intending to pay therefor." And it was further alleged that he allowed this pipe to remain in its position from Aug. 1, 1879, till Jan. 12, 1880—165 days. The second count was exactly similar in principle. The time, however, during which the pipe was said, under the second count, to have been used, was shorter—from Nov. 1, 1879, till Jan. 12, 1880—73 days. It was set forth in the indictment that the accused, by these actions, had rendered himself liable to a penalty of £5 for each of the two offences, as also to a penalty of 40s. for every day during which each of the pipes was so attached (238 days); also to payment of the expenses of conviction.

Mr. J. ANDERSON prosecuted; and Mr. D. J. MACKAY appeared for the defendant.

Mr. MACKAY said that on his advice Mr. Fullarton pleaded guilty to the first charge.

Mr. ANDERSON accepted the plea, and said that it was his intention, when moving for sentence, to restrict the number of days for which a penalty should be asked; but, before doing so, he desired to hear what Mr. Mackay might have to state on behalf of the accused.

Mr. MACKAY said whatever circumstances might have induced Fullarton to lay down a pipe in communication with the Commissioners' gas-pipe, the fact undoubtedly remained that a direct offence had been committed. Pointing to the words in the indictment—"without paying or intending to pay" for the gas consumed—Mr. Mackay said that, had the case gone to proof, it would have been shown that there was no foundation for that statement. It was not the case that one of the pipes was laid down on Aug. 1, 1879; it was laid down on the 29th of August. And, as the accused had not obtained the consent of the Commissioners to lay down the pipe, it was not soldered in the usual way, but simply put in by way of experiment. The pipe was in the premises for some time before Fullarton became proprietor of the shop, and for a long while he did not know whether it was communicating with the meter or with the main; but, being very much inconvenienced, in carrying on his business, by the bad quality of the gas usually supplied, he (Fullarton) wished to see what benefit could be derived from using this hitherto unused pipe in the way indicated. Subsequently he found out that the pipe was really communicating with the main, without the gas passing through the meter. He (the accused) would also have been able to prove that shortly before the 29th of August, he gave orders for a gas-meter to be supplied for the pipe in question; but his instructions were not then attended to, and, accordingly, the gas continued to be burned without a meter for some time afterwards. It showed how innocent he was in the matter, that all his men were aware that the pipe was there; and they understood that arrangements had been made with the Gas Commissioners for having it used. The gas was not used continuously, but in connection with one operation only, and did not burn longer, on an average, than about three hours per week—one hour or so every alternate day. As he had already said, a meter had been ordered by Fullarton, and it was in consequence of delay in executing the order that gas was burned in the manner indicated.

Mr. FRASER: To whom was the order sent?

Mr. MACKAY said he understood that it was sent to the Gas Office; and he went on to remark that, besides those facts, he wished their honours to understand that the pipe in question was never joined to the main in the sense that a pipe was said to be joined. It was not soldered, but merely joined.

Mr. FRASER: It was so joined that gas could be taken off by it.

Mr. ANDERSON: Yes. That is the whole question.

Mr. MACKAY admitted this was so, and he further remarked that he should also have stated that the pipes were all old, and leaking in all parts of the house, which was an old building. In all the circumstances which he had mentioned, he submitted to their honours that they ought to restrict the penalties.

Mr. ANDERSON, as prosecutor, said that of all the statements laid before the Court there was not one that could be borne out by facts. If all these statements had been correct, on the part of Fullarton, the case should have gone to trial; and if it had he would have been able to satisfy the Court that the accused went deliberately about the matter—employing a plumber to connect the pipe, and actually giving him instructions that the gas-pipe should not go through the meter. With reference to the statement, that the gas so improperly used was burned only about three hours per week, he was in a position to say that it burned, on an average, four hours per day; and on the Saturday night it burned, from the moment it was put on, throughout the whole night, and was not extinguished till seven o'clock on the Sunday night, the object being not to give light to the premises, but really to keep up the heat which was absolutely necessary for baking purposes. Taking that into account, the manager of the gas-works said that the total consumption, under the first charge in the indictment, must have been equal to that of nine hours a day for 165 days. This involved a penalty of £935. If it was the wish of the Commissioners to ask for vindictive damages, the Court would have been bound to inflict that penalty, or send the accused to prison; but he (the prosecutor) was instructed to say that the Commissioners did not insist on a vindictive sentence. He, therefore, proposed to restrict the penalty. What they had charged the accused with was a very grave offence, and one which might have gone on for a long time without the possibility of detection. It was absolutely necessary to protect the Police Commissioners from such offences; also to protect the public, who complained of the high price of gas, it being impossible, if such frauds were allowed, that the price of gas could ever be reduced; and it was also necessary to protect the honest trader from the improper competition which might be carried on by those who committed offences of the kind in question. As he had said, he proposed to restrict the penalty; but in the interests of justice, and of all concerned, it was impossible to make it less than one of 40s. for each of 25 days of improper consumption of gas, together with £5 for the offence, and the expenses of the action.

Mr. FRASER said that a plea of guilty admitted the intention, and in view of that the explanation offered was a curious one.

Mr. MACKAY said he had advised Mr. Fullarton to plead guilty, because it was clear that an infringement of the Act had been committed. In the face of that fact, it would have been quite unnecessary to go into proof with the case. He had made a statement of extenuating circumstances, in order that their honours might see that there was no desire to defraud to the extent charged.

Mr. FRASER: Since you admit the intention to defraud, you admit the whole case. I think that by the restriction to 25 days, he gets off with a very lenient sentence.

Sentence was then formally passed. The accused was ordered to pay a fine of £5 for having committed the offence; to pay a penalty of 40s. for each of the 25 days to which the charge of having improperly consumed the gas was restricted—£50; and to pay the expenses of the action—£8 18s. 1d.—the total amount being £63 18s. 1d. Failing payment, he was to be imprisoned for three months.

LAMBETH POLICE COURT.—TUESDAY, FEB. 17.

(Before Mr. CHANCE.)

ILLEGAL USE OF GAS.

George Walter, described as a wine merchant, having offices in the City, appeared to a summons taken out by Mr. Alfred E. Allen on behalf of the Phoenix Gas Company, for having unlawfully caused to be altered the fittings of a pipe belonging to the Company without the consent of the Company.

Mr. BESLEY appeared to prosecute on behalf of the Company; and Mr. JOHNSON represented the defendant.

Henry Fells was the first witness called, and he stated that he went into possession of the house, in Hetherington Road, which defendant occupied as a furnished house. Witness was put in by the owner, as defendant had not paid any rent. On Nov. 29 the gas was disconnected from the meter by the Company, and on the same day witness, at the desire of defendant's wife, made a re-connection, and gas was burned. Witness some few days afterwards spoke to defendant, as he feared what had been done was not right; and defendant said, "You need have no doubt; I will be responsible." The gas was burned every night up to Dec. 31. On Jan. 1 it was cut off from the outside. Defendant slept in the house every night.

Mr. BESLEY hereupon asked for a penalty of £1 per day for the 30 days during which gas was burned.

Mr. JOHNSON having replied on behalf of defendant.

Mr. CHANCE said he was satisfied that defendant, notwithstanding the statement to the contrary, must have been fully aware of what had been done. Defendant throughout had acted very badly, and he therefore ordered him to pay a fine of £20.

WIGAN BOROUGH POLICE COURT.—MONDAY, FEB. 16.

(Before Messrs. W. ROOCROFT and R. THOMPSON.)

FRAUDULENT USE OF GAS.

Peter Lowe, Inspector of Nuisances of the Wigan Town Council, was charged with having fraudulently abstracted gas from the pipes belonging to the Corporation.

Mr. ACKERLEY appeared in support of the summons; and Mr. LEES for defendant.

Mr. ACKERLEY said that the proceedings were taken under the 38th section of the Gas-Works Clauses Act, 1871, which provided that every person who fraudulently abstracted, consumed, or used gas was liable to forfeit for every such offence a sum not exceeding £5, in addition to the value of the gas so abstracted.

John Edgar, a gas inspector in the employ of the Corporation, said that on Jan. 24 he visited defendant's house in Miry Lane, and examined the meter. He found it disconnected, the supply-pipe being connected with the delivery-pipe by a short piece of lead pipe resting on the top of the meter, the effect of which would be that the gas would pass into the house from the main, and be consumed without going through the meter, and without being registered.

Cross-examined by Mr. LEES, witness said that the meter was not connected at all. The lead pipe which had been introduced was 6 inches or 7 inches long. He did not see any lights burning. It was soon after eleven o'clock in the morning, and the gas was passing through it into the house. There was no abstraction of gas at that time, because there were no lights burning. He only saw Mrs. Lowe while at the house. When he spoke to Mrs. Lowe about the matter, she said, "Don't tell." The pipe was attached with either soap or tallow. When he visited the house on the following Monday, the pipes and meter had been set right. When he first saw the meter, the unions were unscrewed, and the gas was being conducted over the meter by the pipe he had mentioned, without entering it.

In reply to questions from the Bench, witness said he was positive of what he saw; but could not say how long the meter had been in the state in which he first saw it.

Mr. J. G. Hawkins, the Corporation Gas Engineer, stated that he super-

intended the laying down of the mains from Miry Lane to Corporation Yard about two years ago. There was a pipe connecting the defendant's house with that main.

Mr. LEES then addressed the Bench on behalf of the defendant, who, he said, denied that he knew anything of the circumstances stated by the first witness; but if such were the case he was not cognizant of it. It was unfortunate that the mouth of the defendant's wife was closed, for she appeared to be the only person who was able to give material evidence for the defence. Since, however, the summons had been served, the defendant had made inquiries, and found that his son and a friend, who had come from Liverpool, had been trying some scientific experiments, and, in doing so, had left the meter in the condition in which it was found by the inspector; but this was entirely unknown to the defendant or his wife. He (Mr. Lees) asked the Bench to consider the position in which they would place the defendant if they convicted him for another's acts, of which he was not cognizant. The defendant was an old man, and, if convicted, would probably lose his situation and his character. He (Mr. Lees) could merely ask the Bench to consider the circumstances very carefully, and to give the defendant the benefit of any doubt they might have.

Matthew Burton was called for the defence; but stated that, although he did make some experiments unknown to Mr. and Mrs. Lowe, he did not detach the meter. He merely inserted a short brass pipe in the supply-pipe an inch or two after it had left the meter, so that whatever gas he used would have been registered.

Mr. ACKERLEY hereupon pointed out that Burton knew nothing of the meter being detached and the lead pipe being introduced, and

Mr. LEES said he would not call the son, whose evidence would only corroborate that of Burton.

The Magistrates having consented to hear what Mr. Lowe himself had to say in reference to the matter,

Defendant denied that he knew the meter had been tampered with until told by his wife that somebody had interfered with it. He knew nothing at all about it. He had no connection with his son. About a couple of hours after the inspector had been at the house and complained of something being wrong, he went and looked at the meter, but found nothing out of place.

The MAYOR (who occupied a seat on the bench, but did not take part with the magistrates) offered to ask for a mitigation of penalty if defendant would plead guilty.

Defendant said he would not do this.

Mr. ROOCROFT said the Bench considered the case proved, and fined defendant the full penalty of £5 and costs, a warrant of distraint to be issued in case of non-payment.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

Lieut.-Col. Bolton, in his report to the Local Government Board, on the water supplied by the Metropolitan Water Companies during last month, says: "The state of the water in the Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated) was very turbid and bad from the 1st to the 8th of January, when it improved, and remained in a good condition until the 17th; it was then again bad for three days, but on the 21st it fined down, and continued in fair condition for the remainder of the month. The highest flood state of the river at West Molesey during the month was 2 ft. 4 in. above summer level, and the lowest 3 inches below the summer level, the rainfall being 0.59 inch. The water in the River Lea was generally good during the month. [These remarks refer to the condition of the water previous to filtration.] The water at all the intakes was generally in an indifferent condition during the month of January; the filtration was, however, efficient, the water supplied by the Metropolitan Water Companies having been clear, bright, and properly filtered.

The Registrar-General publishes the following table in reference to the water supply of London during January. According to the returns furnished to him by the Metropolitan Water Companies, 136,937,666 gallons, or 622,171 cubic metres of water (equal to about as many tons by measure, tons by weight), were supplied daily; or 237 gallons (107.7 decalitres), rather more than a ton by weight, to each house, and 33.4 gallons (15.2 decalitres) to each person, against 34.7 gallons during January, 1879.

COMPANIES.	Number of Houses, &c., supplied in		Aver. Daily Supply of Water in Gallons* during	
	Jan., 1879.	Jan., 1880.	Jan., 1879.	Jan., 1880.
Total supply	556,513	576,694	137,099,189	136,937,666
From Thames	262,632	275,469	66,385,239	67,813,589
„ Lea and other Sources . .	293,881	301,225	70,713,950	69,124,077
THAMES.				
Chelsea	29,562	29,945	7,642,200	7,888,000
West Middlesex	51,571	53,622	10,070,414	10,573,737
Southwark and Vauxhall . .	82,289	88,636	23,852,888	24,322,990
Grand Junction	38,989	40,285	11,400,537	11,729,662
Lambeth	60,221	62,981	13,419,300	13,299,200
LEA AND OTHER SOURCES.				
New River	127,867	129,683	27,474,000	27,186,000
East London	118,910	122,746	34,584,700	33,599,000
Kent	47,104	48,796	8,655,250	8,339,077

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for January, 1880, as compared with that for the corresponding month of 1879, shows an increase of 20,181 houses, and a decrease of 161,523 gallons of water supplied daily.

The following is Dr. Frankland's report on his analyses of the water supplied to London during January:—"Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies, and by the Tottenham Local Board, was—Kent, 1.6; Colne Valley, 1.6; Tottenham, 1.7; West Middlesex, 2.2; East London, 3.4; New River, 4.3; Chelsea, 4.7; Grand Junction, 4.9; Southwark, 5.2; Lambeth, 5.9. The Thames water supplied by the Chelsea, Southwark, Grand Junction, and Lambeth Companies was greatly inferior to that sent out by the same Companies in December. The West Middlesex Company, however, whilst taking water from the same source, reduced the proportion of organic impurity to less than one-half before distribution. All the Thames water was effi-

ciently filtered, except that supplied by the Grand Junction Company, which was slightly turbid, and contained moving organisms. The Lea water, distributed by the East London Company, was of superior quality, but that sent out by the New River Company was only slightly better than Thames water. It was efficiently filtered by both Companies. The deep-well water supplied by the Kent and Colne Valley Companies, and by the Tottenham Local Board of Health, was of its usual excellent quality for dietetic purposes, and that sent out by the Colne Valley Company was suitable for all domestic purposes, having been softened before delivery. Seen through a stratum two feet deep, the waters presented the following appearances:—Kent, Colne Valley, and Tottenham, clear and colourless; West Middlesex, clear and nearly colourless; Chelsea and East London, clear and pale yellow; Southwark, Lambeth, and New River, clear and yellow; Grand Junction, slightly turbid and yellow."

Results of Analyses expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Mat- ters.	Or- ganic Car- bon.	Or- ganic Nitro- gen.	Ammonia.	Nitrogen, as Ni- trates and Nitrites.	Total combined Nitro- gen.	Chlo- rine.	Total Hard- ness.
Inner Circle.								
Thames—								
Chelsea	33.16	.241	.037	.004	.244	.284	1.6	20.0
West Middlesex	32.66	.094	.038	0	.312	.350	1.5	20.0
Southwark	33.76	.277	.028	0	.255	.275	1.6	20.6
Grand Junction	31.46	.252	.040	0	.244	.284	1.6	19.7
Lambeth	35.12	.293	.055	0	.261	.316	1.6	21.2
Lea—								
New River	33.96	.217	.034	0	.277	.311	1.6	20.6
East London	38.74	.174	.029	0	.260	.289	1.8	23.0
Deep wells—Kent . . .	43.40	.087	.013	.064	.352	.368	2.5	24.8
Outer Circle.								
Colne Valley	12.42	.083	.012	0	.347	.359	1.4	6.2
Tottenham Local Board .	39.64	.091	.008	.094	.039	.123	2.9	20.8
Corporation of Birmingham*	25.58	.163	.022	.005	.363	.387	1.9	15.9
Corporation of Glasgow†	2.98	.146	.019	0	.007	.026	0.65	1.1

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
† Analyzed by Dr. E. J. Mills, F.R.S., of Anderson's College, Glasgow.

Errata.—In the tables of analyses for October, November, and December, the amount of ammonia in the Tottenham Local Board's water was erroneously printed as 0.72, 0.64, and 0.70 per 100,000 parts, instead of .072, .064, and .070 respectively.

LONDON GASLIGHT COMPANY.

An Extraordinary General Meeting of this Company was held at the Offices, Southampton Street, Strand, on Wednesday last, "for the purpose of considering, and, if thought fit, approving of a Bill now pending in Parliament, intitled 'A Bill to confer further powers upon the London Gaslight Company, and for other purposes.'" MAJOR ROHDE HAWKINS, Esq., the Governor, was in the chair.

The SECRETARY (Mr. A. J. Dove) having read the notice convening the meeting,

The GOVERNOR said: We have asked you to come together to-day because most of you are aware that it is a regulation of the Legislature that directors of companies should not promote Bills in Parliament until they have consulted with, or laid the matter before the shareholders, explained what they proposed to do, and obtained their approval. On looking over our business, we thought there was room for increasing it in a legitimate way. Our Acts of Parliament, however, only gave us authority to make and sell gas for illuminating purposes; but you are aware that, as time has gone on, many other uses have been found for it, and especially for cooking purposes and for warming rooms; and whether gas is used for these purposes or for driving engines—that is, supplying engine power—there is a large field for its employment. Therefore we think it our duty to assist that as much as we possibly can; but as our Acts only authorize us to deal with gas as an illuminating agent, we wish to obtain increased powers, and therefore we propose to go to Parliament for authority to supply gas and other fittings, engines, and other apparatus. The Bill is a very short one, and you will see the pith of it in the second clause:—

The Company may buy or hire and may supply, sell, or let to consumers of gas within their district or limits, for use upon premises belonging to or occupied by such consumers, burners, tubes, and stoves or ranges for heating or cooking by means of gas, and any other materials or fittings for the use of gas for domestic or other purposes, and also engines and machines for domestic, agricultural, manufacturing, industrial, or any other purposes whatever, to be worked by means of gas, for the production of motive power, and any materials or fittings to be used in connection therewith.

The next clause gives power for the recovery of charges in the usual terms; and then comes the fourth clause—power to take licences, &c.—which is as follows:—

The Company may, subject to the provisions of this Act (but only for the purposes of the Company within the limits of their district, and not so as to acquire any exclusive right therein), contract for, take, and use any leave, licence, or authority to work, use, exercise, and put in practice any invention under letters patent heretofore made or hereafter to be made, granting any right or privilege of working, using, or vending any invention in relation to the manufacture, production, and distribution of light by means of gas, or the conversion, manufacture, or utilization of any products obtainable in or arising from such manufacture or production, or from the materials used therein, and for any such purpose as aforesaid may purchase, construct, maintain, and use all such apparatus and appliances connected with the manufacture of gas, and with the manufacture or distillation of the products and residuals arising from or out of the manufacture of gas, as they may require or deem necessary or expedient for efficiently and economically carrying on their undertaking.

Then, further, there is the protection of the Company's property. This is provided in the next clause:—

In case any meters, service-pipes, fittings, engines, stoves, pipes, or other appliances, or any other property of the Company, are or is lent or let for hire to any person, the same shall not be subject to distress for rent of the premises where the same may be, nor to be taken in execution under any process of any court or any proceedings in bankruptcy against the person in whose possession the same may be.

Finally, there is the application of funds:—

The Company may apply any funds belonging to them or under their control in payment of any expenses incurred by them in carrying into effect the provisions of this Act, &c.

That means that we may spend what capital we have in promoting this operation. The whole gist of the thing, however, is this—that we wish to have powers either to sell or let on hire these apparatuses, whatever they may be, other than illuminating apparatus; in fact, to increase the sale of our gas as much as possible for warming as well as illuminating purposes. We wish to have your sanction to our proceeding with the Bill we have promoted with this object. It is a very short one, involving little expense; but it is just as well we should have these powers, and then there will be no question of people using more gas than at present. I shall now move—"That the print of the Bill as introduced into the

House of Commons, now submitted to the Proprietors, is approved of by them."

Mr. NORTHOVER presumed it was the same Bill as that promoted by the Company last session.

The GOVERNOR: It is very much the same. It does differ slightly in this way: In our original draft last year we took powers to manufacture these apparatuses, but we have thought it better to omit that clause now. The Bill will be subject to any modifications Parliament may introduce.

Mr. NORTHOVER inquired whether there was any intention to ask for increased capital.

The GOVERNOR: No; we have plenty. We do not anticipate that this will be an expensive matter. We may spend £100, £200, or perhaps even £1000; but we shall not spend a shilling more than we can see profit for.

Mr. BENJAMIN seconded the motion.

The GOVERNOR: There is no amendment, so I will put the resolution for your approval, subject to any modifications, of course, which may be made or required by Parliament.

The motion was carried unanimously.

Mr. NORTHOVER supposed it would be somewhat irregular to ask any question outside the business on which they had been called together, otherwise he would have liked to ask if any progress had been made as to amalgamation.

The GOVERNOR: No; not in any way. I may answer that question candidly.

Mr. NORTHOVER said he was not at all an advocate for amalgamation unless they could do so on proper terms.

The proceedings then terminated.

LIVERPOOL UNITED GASLIGHT COMPANY.

The Half-Yearly General Meeting of this Company was held last Tuesday—Mr. D. O. BATESON presiding.

The SECRETARY (Mr. P. F. Garnett) read the Directors report, which was as follows:—

The Directors have caused to be prepared and submitted to them an estimate of the profits of the Company for the half year ended the 31st of December last, in accordance with the Company's Acts of Parliament, and, having duly considered the same, recommend the Proprietors to declare a dividend, for the half year ending as above stated, of £5 on every £100 ordinary consolidated stock, and at the rate of £3 10s. for every £100 upon the consolidated B (7 per cent.) stock, and on the capital paid up in respect of the new £7 10s. shares.

The consumption of gas has of late increased so rapidly as to necessitate an immediate arrangement for enlarging the Company's works at Linacre, and a Bill is now being promoted in Parliament for the purpose of authorizing the required additional works.

The Directors have to record, with deep regret, the death during the past half year of one of their colleagues, James Lister, Esq. The vacancy thus caused in the Board has been filled up by the appointment of Thomas Harrison, Esq., in Mr. Lister's place.

The CHAIRMAN, in moving the adoption of the report, said that the Company had, during the past six months, been going on in their usual course of unobtrusive usefulness. During this time nothing had occurred that he knew of which required any apology or explanation from him. They had been allowed to go on without the usual amount of adverse comment in the newspapers; whilst their arch-enemy, electricity, did not seem to have made very much progress—at all events, not such progress as to have done the Company great harm, if they might judge from the increasing requirements upon their supply. As the accounts were made up only in the autumn, no figures were presented at this meeting, but the Directors had satisfied themselves that they had quite sufficient at the credit of profit and loss account to be able to pay the dividends recommended in the report.

Mr. J. A. TINNE seconded the motion, which was carried unanimously; and the dividends recommended in the report were declared.

A Special General Meeting was then held, for the purpose of considering the Company's Bill in Parliament, entitled "A Bill to enable the Liverpool United Gaslight Company to erect additional gas-works, to extend their limits of supply, and to borrow further sums of money."

The SECRETARY explained that though the Bill, as presented to the meeting, contained clauses empowering the Company to borrow further sums of money, those clauses had, by a resolution of the Board of Directors, been ordered to be struck out of the Bill, and would not be presented before Parliament. He then read portions of the preamble and several of the clauses, showing that the object of the Bill was to extend the limits of the Company for the supply of gas so as to include the township of Orrell and Ford, in the parish of Sefton, and to enable the Company to enlarge their works at Linacre.

The CHAIRMAN said the Proprietors would pretty well understand what they were going to Parliament for. They owned 24 acres of land at Linacre, upon 10 of which they had powers to construct works, but the remaining 14 acres were purchased at a subsequent time, and upon them they had no power to build; and as the Legislature was very jealous about the erection of any works which could possibly be a nuisance, the Company were obliged to go for powers to build upon this land, because the 10 acres which adjoined were already almost entirely covered. Orrell and Ford formed a small district to the north-west of Walton, in which there was a large amount of building going on just now. The district dovetailed into the territory of the Company, and the plan now proposed straightened their boundary—in fact, gave them a more "scientific frontier." He went down to inspect the district with their Engineer (Mr. William King), and they found that they could light half-way down some streets, whilst the remaining half they were compelled to leave in Cimmerian darkness; and in one case they could light one of two houses under the same roof, but not the other. The proposed extension would cost very little; it would bring in a certain amount of revenue; and it would accommodate the inhabitants of the district. He moved—"That the Bill now submitted to the Proprietors, entitled 'A Bill to enable the Liverpool United Gaslight Company to erect additional works, to extend their limits of supply, and to borrow further sums of money,' be approved." The Proprietors, he said, would quite understand that the last sentence was withdrawn, and that they did not go for borrowing powers. The money clauses they would have to delay until a future occasion, and there was no doubt that it would not be long before they went to Parliament with a more comprehensive Bill. They expected, therefore, that the present Bill would be passed without opposition.

Mr. TINNE seconded the motion.

Mr. COPE asked if, in addition to studying the requirements of the out-townships, the Directors had ever turned their attention to the great good they might do by lighting up working men's homes in the parish of Liverpool. He was sure that no person could go round the town at night and look into the courts and alleys, and the homes of working men, without wishing there could be some mode of lighting up their dwellings at a small charge, without the costly meter and deposit system. He would suggest a monthly payment guaranteed by the landlord, and that the houses should be lighted, say, for four hours a night. The cost would be about 1s. 3d. a month, and he was sure that it would be a source of incalculable good for the health and welfare of the inhabitants. When they saw them sitting in their uncomfortable homes, lighted by a farthing candle, they could not wonder at the husband going away to the bright, well-lighted public-

house, and he was rather astonished that it had not suggested itself to the Board to appoint a Committee to consider whether the consumption of gas could not be more extended amongst the poorer inhabitants.

The CHAIRMAN said their price for gas was fixed; and they could not make fish of one and flesh of another. They were not a philanthropic company. They were not intended to supply gas for the benefit of the public, but primarily for their own private interests.

Mr. COPE said he was aware they were not a philanthropic company, and he did not want them to supply gas for nothing, but he thought they might combine the two things—making money and philanthropy. He did not advise that the gas should be given away, but that it should be sold at the usual price, supplied for a certain number of hours, and then turned off by a tap.

The CHAIRMAN said he thought this was more a landlord's question. The Company were bound to sell the gas by meter.

Mr. COPE thought they might get a clause inserted in their Act of Parliament obviating this difficulty. He thought the time was coming when meters would be abandoned to a certain extent.

The CHAIRMAN said it was quite clear they could not insert such a clause in the present Bill, which had been deposited.

The SECRETARY said it would not be covered by the notices.

Mr. COPE asked whether, as he considered it a subject of vast importance, the Board would appoint a Committee to inquire into the matter.

Mr. GASKELL said he thought the matter was so much one of detail that, the suggestion having been made, they might safely leave it to the Directors.

The CHAIRMAN said the Board would remember what Mr. Cope had said, and would talk the matter over, and, if anything could be done which would not militate against the interests of the Company, they might consider it. In reply to a question, he said it was possible the Company would go to Parliament in a couple of years, but he believed that all the money there was uncalled up on the £7 10s. shares would be spent before they did so.

Sir THOMAS EARLE said he thought all the calls would be wanted for the works proposed in the Bill they were now going for.

The CHAIRMAN: We expect so.

The motion was then put and carried, and a vote of thanks to the Chairman, moved by Mr. DARSEE, seconded by Mr. GASKELL, terminated the proceedings.

NEWCASTLE AND GATESHEAD GAS COMPANY.

The Annual Meeting of this Company was held on Wednesday last—Alderman HEDLEY in the chair.

The SECRETARY (Mr. W. Hardie) read the following report of the Directors:—

In accordance with the Newcastle-upon-Tyne and Gateshead Gas Act, 1879, the Directors have called the Proprietors together at this time to receive the accounts for the half year ending Dec. 31, 1879, and to elect the Directors and Auditors for the ensuing year.

As announced in last year's report, the ordinary annual meetings will in future be held in February of each year, and the accounts will be made up for the previous year to Dec. 31, which will bring them into harmony with the Gas-Works Clauses Act, 1871.

Although no half-yearly accounts have hitherto been published, the Directors beg to state that those now submitted are of a favourable character. The receipts are £58,328 16s. 10d., and the expenditure £36,283 6s. 11d., leaving a balance to profit and loss account of £22,045 9s. 11d. After paying out of this sum £2247 13s. 8d. interest on debentures and other loans, there will remain, with the balance brought forward from last year, £34,035 0s. 6d., which the Directors propose should be appropriated as follows:—

Half year's dividend, at 3½ per cent.	£15,750
To renewal-fund (making this fund £12,500)	2,500
Balance to next year	15,785
	£34,035

The Directors propose that, from the 1st of January of this year, the price of gas be reduced from 2s. 9d. to 2s. 6d. per 1000 cubic feet, less 10 per cent. discount, which will make the net price 2s. 3d. per 1000 cubic feet—the lowest, they believe, that is charged in any other town in the kingdom.

During the past half year gas-pipes have been extended from Ryton to Prudhoe, and there have been laid altogether, in extensions and renewals, about 6 miles of pipes; 680 new branches have been laid, 713 old branches renewed, and 780 meters repaired, tested, and re-fixed.

In order to meet these and future extensions, the Directors, a short time before the late rise in iron, entered into contracts for all the wrought and cast ironwork necessary to complete No. 2 retort-house, at Redheugh.

The powers conferred upon the Company, by previous Acts for raising capital, having been exhausted, the Directors have summoned an extraordinary meeting of Proprietors, to be held at the termination of the ordinary meeting, at which resolutions will be proposed giving the Directors power to raise £50,000 of the additional capital authorized by the Act of last year, in such sums and at such times as they may deem advisable.

The Proprietors, at the present meeting, will have to elect Directors to hold office until next February, when three of them will retire by rotation, and so on every year afterwards. The Directors are Messrs. William Brown, Thomas Hedley, Benjamin Plummer, James Douglas, John Bennett Alexander, Thomas Lesslie Gregson, Ralph Atkinson, William B. Wilkinson, and Charles Henry Young. They retire, but offer themselves for re-election.

The Auditors, Mr. J. H. Richardson and Mr. R. Y. Green, also retire, but offer themselves for re-election.

In addition to these gentlemen, there is to be a Public Auditor of the accounts of the Company, being a competent public accountant, and the Directors have named for this office Mr. F. R. Goddard, of the firm of Messrs. Monkhouse, Goddard, and Co., but their nomination will have to be approved by the Corporations of Newcastle and Gateshead.

The CHAIRMAN moved the adoption of the report. After congratulating the Shareholders upon the very satisfactory condition in which the Company was, he said the balance-sheet showed that, after providing for a full dividend at the rate of 7 per cent., there was a balance of £15,785 to be carried forward, and this was in addition to £12,500 standing to the credit of the renewal-fund. In consequence of this balance the Directors had recommended that the price of gas be again reduced. Five years ago the price was reduced from 3s. 4d. to 3s. per 1000 feet, and in about two years the price was reduced to 2s. 9d., and now they proposed to reduce the price to 2s. 6d., with the usual discount of 10 per cent. to the ordinary consumers. This reduction ought, he considered, to be very satisfactory to the general consumers in the large district supplied by the Company. A reduction of 9d. per 1000 feet on the gas sold in the district amounted to about £30,000 a year. If nothing extraordinary occurred this year the Directors hoped to be able to pay the full dividend of 7 per cent., and also what their last Act of Parliament allowed them to do—pay 5s. more for each 1d. they reduced the price of gas. This would make the dividend 7½ per cent. on the year if they could keep for the twelve months at the present low price. If, in consequence of the improvement now going on in the iron trade, coal advanced to higher prices, the Company had power to go back again to the price of 3s. 4d. per 1000 feet without reducing the dividend below 7 per cent. The balance of £15,000 carried forward, which was equal to a full half year's dividend, strengthened the Directors in their recommendation to reduce the price of gas, a low price of gas always increasing consumption. During the past year there had not been that great advance in the consumption of gas which there was in previous years; but they had held their own. Their works were still large and extensive enough to meet the heaviest demand in any week in the year. This heavy demand seldom continued more than two, three, or four weeks; but still they must have plant to meet the demands, or great complaints

would be made, and consequently there was a considerable standing expense always going on. They had been able to supply all the gas required, and could have supplied more, from their extensive works at Redheugh. If any accident occurred at one of the works, the supply of gas could be kept up from their other works. The price of 2s. 3d. per 1000 feet now charged to ordinary consumers, and which meant considerably less to large consumers, was, he believed, the lowest-priced gas supplied to any town in the kingdom. One of the candidates for the office of Town Clerk told him that the Corporation of Blackburn purchased the gas-works a few years ago from the Company, and that the Corporation had been able to pay, out of the profits made, the full interest on the price given for the works, and had a balance left of about £3000. He inquired what the price of gas was at Blackburn, and the gentleman told him 4s. per 1000 feet without any discount to ordinary consumers, and 8s. 9d. to large consumers. If 9d. per 1000 feet made a difference of £30,000 a year to the consumers at Newcastle, 1s. 9d. would be equal to £60,000 or £70,000 a year; and the Company could supply the district at a much less price than if the Corporation had the works in their own hands. If the Corporation, however, felt inclined to give them a very handsome price for their works, he did not suppose the Proprietors would object to it, so that they might secure 7 to 10 per cent.; but he did not think there would be much chance of their doing that.

Mr. W. BROWN seconded the motion.

Mr. TWEDDLE thought the price of gas should be reduced to 2s. 5d. per 1000 feet, in order that the Directors might have power to declare a dividend of 8 per cent.

The CHAIRMAN said that the discount of 10 per cent. off 2s. 6d. per 1000 feet brought the price down to 2s. 3d.; but if the price was 2s. 5d., the discount would be an odd sum, and not easily calculated.

The report was then adopted.

On the motion of the CHAIRMAN, seconded by Alderman PLUMMER, a dividend of 3½ per cent. was declared for the half year ended Dec. 31.

The Directors and Auditors were re-elected, and Mr. F. R. Goddard was appointed Public Auditor; and this concluded the business of the ordinary meeting.

A Special Meeting was then held, and resolutions were passed authorizing the issue of £50,000 of additional capital, to be sold by public auction in such manner and at such time as the Directors may determine.

Mr. ROBINSON proposed, and Mr. DOUGLAS seconded, a vote of thanks to the Chairman, which was passed, and the meeting concluded.

RIO DE JANEIRO GAS COMPANY, LIMITED.

A Special General Meeting of this Company was held on Friday, the 13th inst., for the purpose of altering certain of the Articles of Association of the Company—Mr. BARTLETT JAMES in the chair.

The SECRETARY (Mr. T. Dawson) having read the notice convening the meeting,

The CHAIRMAN said they had met for the purpose of altering certain of the Company's Articles of Association, the working of which had been found most inconvenient—on some occasions almost impracticable. In case of illness—and this had occurred some days previously—they had found it difficult to get a sufficient number of Directors to sign cheques; and he had therefore to request the Solicitor, who was far more competent to deal with this matter than he (the Chairman) was, to read the proposed alterations, and to explain their relationship to the old ones.

The SOLICITOR (Mr. Clements) said the resolutions, which the Chairman would shortly move *en bloc*, were, first—"That the Articles of Association of the Company be and they are hereby altered as follows:—In Article 5, the words 'the Directors' shall be replaced by the words 'the Board, or some Committee or other person thereto empowered by the Board.'" He then read the original Articles, and said the effect of the change would be to give power to the Board, or any such persons as they might authorize, to sign cheques for petty cash and the payment of small accounts. In Article 9, it was proposed that the words "of two of the Directors" should be repealed, and replaced by the following words: "of any two Directors, or of any one Director and the Secretary or person appointed to temporarily perform the duties of the Secretary." This would give the power to two Directors, or to one Director and the Secretary, to sign cheques. Article 10 was repealed and replaced by the following:—"Article 10a. All payments of the Company in England, except on petty cash account, shall be made by cheques on the bankers (drawn in pursuance of some general or special resolution of the Board, or of a Committee thereto authorized by the Board), and signed either by two Directors, or by one Director and the Secretary or person appointed to temporarily perform the duties of the Secretary." That, in fact, was the substance of all the resolutions—viz., that one Director and the Secretary, or two Directors, should sign the cheques. Article 89 was repealed and replaced by the following:—"Article 89a. The quorum of the Board shall be such as shall be from time to time determined by the Board; and in default of and subject to such determination shall consist of two Directors." This was to provide against possible illness and absence on the Company's business. The Board were lately troubled by the illness of one of their colleagues, and the necessary absence of another on the business of the Company abroad, and they were obliged to make the Solicitor of the Company a member of the Board. This was a thing to be avoided by all possible means, and it was proposed to do so in this way:—In Article 101, section (O), the words "at least two Directors, and be countersigned or initialed by the Secretary," were repealed, and replaced by the following words: "two Directors, or one Director and the Secretary or person appointed to temporarily perform the duties of the Secretary." At the end of section (EE) of Article 101 were added the words "or person appointed temporarily to perform the duties of Secretary." In some of the very largest companies the rule of two signatures was in force—viz., either two Directors, or one Director and the Secretary. It was found to work perfectly well.

The CHAIRMAN moved these resolutions *en bloc*.

Mr. HOWARD (a Director) seconded the motion.

Mr. WORDSWORTH said that, having a large interest in the Company, he wished to say a few words upon this question. First, as to the general tenor of these alterations, which were to convert this into a private firm rather than keep it as a public company. Now, of that he strongly disapproved. Of course, it was an exceptional case when their friend, Mr. James, had to go to Brazil. The Board then were weak, and the Solicitor had to be appointed a member, which was certainly not a proper course; as a paid officer of the Company ought not to be a Director. He was present at a meeting of the Company when a proposition was made that the remuneration of the Board should be increased from £1200 to £1500 a year, and he most cordially seconded that motion. When it was proposed, he believed there were six Directors; but at present, if he was correctly informed, there were only four. It was, therefore, almost impossible that they could form a quorum, and he wished to propose an amendment to the effect that the number of Directors should be increased. If the £1500 a year were divided amongst the four gentlemen appointed, they would each have £375 a year; and, for so large a remuneration, the Shareholders certainly had a right to expect

the attendance of the Board. For this reason he most strongly objected to the proposition of the Chairman.

Mr. J. G. WEIR thought that the alteration would put undue power into the hands of one Director and his nominee or the Secretary. It would be a very simple matter, if the design were conceived, for a very great fraud to be perpetrated upon the Company, and the proposed change was against business principles as ordinarily understood. He quite agreed with Mr. Wordsworth that the Board should be increased. If the gentlemen now on the Board had not sufficient time to attend to the Company's affairs, let them obtain those who had. Of course, there might be a considerable amount of trouble in Rio in connection with the Company's business; but why not elect two other Directors, and continue under the old articles?

Mr. SMITH said the best remedy would be either to increase the Board or to reduce the amount paid to them. How many Directors could they appoint?

The CHAIRMAN: As many as eight.

Mr. WORDSWORTH: Is the Solicitor acting as a Director now?

Mr. HOWARD: Mr. Clements kindly consented to join the Board, at our request, on an emergency; but as soon as that emergency had passed away, and Mr. James had returned from Brazil, Mr. Clements resigned, and is again only the Company's Solicitor.

Mr. SMITH said the explanation about the Solicitor only showed how desirable it was to strengthen the Board. He thought they should elect some competent gentleman with time at his disposal to join the directorate. The proposed alterations were, he considered, but a vote of censure upon the Board, for they were asking that one Director should do the work it was originally intended eight should perform, and he hoped the Shareholders would refuse to sanction these changes.

The CHAIRMAN said he was very sorry to find so much opposition to the proposed alterations. He would say a word or two in the first place in regard to Mr. Wordsworth's objections. He stated the Directors business was not the Company's business. He begged to differ from him, for he (the Chairman), in common with his colleagues, made it his business to look into all things. Mr. Howard was at the office every day, from the morning until late in the afternoon, looking after the Company's business, and he (the Chairman) went as often as he could. Having no other occupation of any importance at the present time, he gave nearly the whole of his time to the Company's affairs. The resolutions were simply brought forward with the view to meet an emergency. Only lately Mr. Henry was ill, and a third Director was not in a good state of health. These were circumstances that would constantly occur, and, personally, he did not see that any company could have a greater security than two signatures to a cheque. If the Shareholders thought they had not honest or capable men as Directors, let them turn out the present Board forthwith, and get a new one.

Mr. WORDSWORTH said that one of his objections to the change was that the Board were making the Secretary's position equal to that of a Director.

The CHAIRMAN said that of late there had been very delicate negotiations with the Brazilian Government. He was out in Brazil to carry them on and conclude them, and he had much difficulty in doing so, for he was detained there twelve months attending at the public offices. The contract signed ultimately was favourable to the Company, and included a clause to the effect that should the electric light be introduced the Company would have the first opportunity of applying it.

Mr. SMITH congratulated the Chairman heartily on the sagacity he had shown in this matter.

The SOLICITOR said there could be no amendment to the resolutions, but those who disapproved of them could vote against them.

Mr. SMITH: I do not object to the alterations; I simply wish to increase the Board.

The CHAIRMAN undertook at a later stage of the meeting to add two Directors to the present Board.

The SOLICITOR said he did not know any board who worked harder for a company than this one. Not a word could justly be said against the Board for inattention to the business. The present resolutions were intended not to shield them from work, but to meet an emergency, and if the Shareholders thought they were proposed with the first view, they were labouring under a great mistake.

The vote was then taken, when eight Shareholders were found in favour of the resolutions (including the Directors), and four against them.

The SOLICITOR said that as a three-fourths majority was necessary to carry the resolutions, they must proceed to a poll.

The poll was then taken, and at the close it was intimated that the shares represented personally in favour of the resolutions were 1108 and by proxy 5855, making a total of 6963; against the resolutions were 389 shares and no proxies. The resolutions were, therefore, declared carried, subject to confirmation at a subsequent meeting.

Mr. SMITH proposed a vote of thanks to the Chairman for his services at this meeting, and for his able conduct of the negotiations abroad. He hoped the Chairman would be as successful in all he undertook for the Company as he had been in these negotiations.

Mr. WORDSWORTH seconded the resolution, and it was carried unanimously.

The CHAIRMAN briefly returned thanks, and the meeting separated.

IPSWICH GASLIGHT COMPANY.

The Annual General Meeting of this Company was held on Monday, the 16th inst.—Mr. S. A. MAW in the chair.

The minutes of the last meeting having been read and confirmed, the following report was presented:—

The Directors have pleasure in presenting to the Shareholders the audited statement of accounts for the year ending Dec. 31, 1879.

The profit and loss account shows a balance available for the payment of dividend amounting to £6104 2s. 3d. The Directors therefore recommend that a dividend of 10 per cent. per annum be paid upon the shares class A, and 7½ per cent. on shares classes B and C, and that the balance of £268 10s. 6d. be carried forward to the next account.

The Directors in their last report referred to the re-construction of the original retort-house, which has now been completed, and the retorts and fittings have been renewed, effecting such improvements as were possible. This has been carried out at considerable cost, which has added to the item for repairs and maintenance of works for the past year.

The erection of the new tank and gasholder, referred to in the last report, is nearly completed, and it is expected that it will be in operation in the course of two months.

The Directors report that they have under consideration the extension and improvement of the purifying plant, and arrangements are in course for the erection of two additional patent washers and two additional purifiers; also a new exhaustor and town governor, the estimated cost of which is nearly £4000. In order to carry out these extensions, and meet other liabilities, it will be necessary to raise additional capital, and the Directors recommend that 600 new shares be created, and offered to the public by auction, and that a further sum of £4700 be borrowed upon mortgage.

The Directors report that the issue of coupons for interest on several existing mortgages will run out on the 31st of March next, and a majority of the bondholders have consented to accept a re-issue of coupons for a term of five years, at 4 in lieu of 4½ per cent. per annum.

The Directors cannot conclude their report without expressing their sincere regret

at the loss the Company have sustained by the death of their late Chairman, William Bunn, Esq., who for a period of 41 years had been a member of the Board, and for 13 years Chairman. Samuel Alexander Maw, Esq., has been elected Chairman, and Frederick Corder, Esq., as Director in his place.

[The capital of the Company consists of £71,987 10s. in £10 ordinary shares, £17,300 in mortgages and bonds, and a premium-fund account of £1736 12s. 9d., making a total of £91,024 2s. 9d. The expenditure on capital account to Dec. 31, 1878, was £74,981 10s. 7d.; additional to Dec. 31, 1879, £14,100 11s. 9d.—total, £89,082 9s. 4d.; leaving a balance to credit of capital account of £4941 13s. 5d. The reserve-fund, invested in Three per Cent. Consols, amounts to £3904 2s. 4d.]

Dr.—Revenue Account, for the Year ended Dec. 31, 1879.

To Manufacture of gas—		
Coals, including dues, carriage, unloading, and all expenses of depositing same on works	£10,547	5 0
Purifying materials, oils, water, and sundries at works	475	16 3
Salaries of Engineers, including Chief Engineer, Superintendents, and Officers at works	840	15 6
Wages and gratuities at works	1,723	17 7
Repairs and maintenance of works and plant (including renewal of retorts), machines, apparatus, tools, materials, and labour	3,849	0 1
	£17,436	14 5
Distribution of gas—		
Salaries of Inspectors and Clerks in Light Office, Repair, maintenance, and renewal of mains and of service-pipes, including materials, laying and paving, and labour	£138	18 8
Repairing, renewing, and refixing meters	219	17 11
	423	19 4
	782	15 11
Public lamps—		
Lighting and repairing	560	16 7
Rents, rates, and taxes	984	8 5
Management—		
Directors' allowances	£300	0 0
Salaries of Secretary, Accountant, and Clerks, Office-Keepers, and Messengers	266	13 4
Collectors' salary	150	0 0
Stationery and printing	65	16 3
General establishment charges and incidentals	110	13 5
Auditors	40	0 0
	933	3 0
Law charges	12	5 1
Bad debts	283	4 2
	£20,993	7 7
Balance carried to profit and loss account	6,213	13 2
	£27,207	0 9

Ca.—Revenue Account.

By Sale of gas—		
Private light rental	£18,362	7 0
Public lighting and under contracts	2,300	14 1
	£20,663	1 1
Rental of meters	563	7 3
Residual products—		
Coke, less labour and cartage	£4,236	1 4
Breeze	160	10 6
Tar	876	17 11
Sulphate of ammonia	572	6 8
	5,845	16 5
Rents	108	0 0
Gas-fittings	26	16 0
	£27,207	0 9

The CHAIRMAN, in moving the adoption of the report, said that the document fully explained why he was in his present position, the Company having, by a very melancholy circumstance, been deprived of the services of Mr. William Bunn. The Shareholders were aware that for some years past the Directors had been engaged in renovating and restoring the works. Several years ago a new retort-house was built, with coal stores adjoining, and a steam-lift and tramway in connection. After this a purifying-house was erected, with new purifiers; but these had since become inadequate to meet the demand made upon them, and a further enlargement of the purifying plant was absolutely necessary. The Directors had also fitted up apparatus for dealing with the ammoniacal liquor, and last year they commenced rebuilding the old retort-house, which had been furnished with the most approved appliances that modern engineering science could devise. In addition to this they had had an arduous and anxious undertaking in the erection of what might be termed a noble gasholder. While all this had been done, the manufacture of gas had been carried on to a greater extent than ever, the consumption having been very large during the past year. As far as possible, all demands had been met. The new gasholder, calculated to hold 700,000 cubic feet of gas, was now well-nigh completed, the tank was being filled with water, and the Directors hoped that this would be of very great advantage to them in enabling them to supply the wants of the consumers. All these works, however, locked up a great deal of capital, and the Shareholders would be asked to sanction the issue of the 600 still unallotted shares, and also the borrowing on mortgage of the balance of the sum authorized by their Act of Parliament. They had already contracted for additions to the purifying-houses, and when these were completed the Directors had confidence that they would be able to supply the large requirements of the town with as good and pure gas as could be made. Even then some further expenditure would be required for additions to the mains. In conclusion, he moved the adoption of the report, with the exception of the paragraph relating to the issue of fresh shares.

Mr. HOUGHTON observed that he had seen not only the report of the Directors, but the detached reports, from time to time, of the Inspector, and while he found no fault with the Directors or Officers, he felt that, being a Company entrusted with the sole supply of an article of imperative necessity, there ought to be the best understanding between them and their customers. The repeated testing of the gas struck him as rather a painful and humiliating thing. It was important that the article they supplied should be both pure and cheap, and he felt that there was a possibility of hampering those who manufactured the gas by loading the concern with too much capital. Money could be borrowed outside at 4 per cent., yet they went on issuing shares to themselves at 7½ per cent. Let them borrow money in the cheapest market, and they might then manufacture a purer article at a cheaper rate.

Mr. JEFFRIES asked the quantity of gas they obtained from the 14,110 tons of coal carbonized during the year; what the coke realized, or, in other words, what was the amount of the deductions for labour and cartage; what sum had been expended for the freight of coals, and whether any contract was obtained, by tender or otherwise, for the conveyance of coal to Ipswich. He expressed great surprise that it should have cost £3981 1s. 8d. for management and labour—an amount which he considered excessive. For the residual products, also, he thought a fair price was not received in comparison with other places. At Birmingham gas was of better quality—averaging 17·27 candles, at a considerably less price; and the ammoniacal liquor there produced more than the tar, while

the ammoniacal liquor and tar each produced nearly as much as the coke and breeze. Taking into account the amount of coal carbonized, he calculated that the residual products should have realized at least £4000 more than they did. He regretted having to complain of the Directors for supplying a bad article. The reply that they wanted more purifiers was, to his mind, most unsatisfactory. The Shareholders were told each year that the Directors were taking into consideration the extra demand, and were doing what they could to improve their position; but their position was not better, but worse.

The SECRETARY (Mr. E. Goddard), in reply to Mr. Jeffries, read the following clause in the Company's Act of Parliament, to show what was required of them:—

Unless prevented by frost, or other unforeseen or unavoidable cause, or accident, or during necessary repairs, all the gas supplied by the Company shall be of such quality as to produce from an Argand burner, having 15 holes and a 7-inch chimney, and consuming 5 cubic feet of gas per hour, a light equal in intensity to the light produced by 14 sperm candles, burning 120 grains an hour, and shall be so far pure from sulphuretted hydrogen as not to discolour moistened test-paper imbued with acetate or carbonate of lead, when this test-paper is exposed for one minute to a current of gas issuing under a pressure of 5-10ths of an inch of water.

There had not been a single instance during the year in which this had not been complied with, and the Inspector had never reported any sulphuretted hydrogen; but there were other sulphur compounds which it was difficult to eradicate. At the same time there were means of removing them, and these the Company were now adopting. During the past year one of Mr. Livesey's patent washers had been fixed, which it was thought would have been sufficient to remove the carbonic acid from the gas; but it had not done so. To get rid of the compounds complained of, the gas had to be exposed to sulphide of calcium; but owing to the great affinity which lime had for carbonic acid, it was absolutely necessary first to get rid of the carbonic acid. Then the lime would take up the sulphuretted hydrogen and the sulphur compounds. To effect this it would be necessary to alter the arrangement of the purifiers. A contract for the alteration had been entered into, and as soon as the Company could get a sufficient storage for gas to enable them to cease making it for a day or so, the contract would be carried out. The difficulty at present was this: To adopt the course suggested would necessitate putting the town in darkness for, perhaps, a week. They were already doing everything in their power to rid the gas of sulphur compounds, and were successful to a large extent. He might say that their presence was only ascertained by very subtle analysis, and, although the Inspector had reported 70 grains of sulphur in 100 cubic feet, with the apparatus at the works they had never been able to discover more than 55 grains. While the requirements of the Act were already met, it was to the interest of the Company as well as the public to remove all the impurities, and this they were endeavouring to do. With regard to the residual products, they were entirely subject to the market price, and there might be a better market for certain articles at Birmingham than at Ipswich. They were obliged to make a market where they could to get rid of their surplus. He was unable at the moment to give the cost of cartage and horse keep separately; and with regard to Mr. Houghton's observation, the Act of Parliament prescribed what amount should be raised in shares and what by loan, and to raise the capital in any other way would be illegal. For the freight of coal they paid the current rate, averaging from 6s. to 6s. 6d. per ton—never more.

Mr. JEFFRIES said if the Company charged a lower price for coke large numbers of the working classes would buy. At Birmingham the works were besieged with applications for coke, which was sold at 10s. per ton.

Mr. T. C. COBOLD said the Company must make sure of a sale, and to do so they must sell in large quantities. The Directors desire was to sell the coke at its value.

In answer to questions, Mr. GODDARD observed that Birmingham was not only about eight times the size of Ipswich, but was surrounded by the coal pits, so that the cost of coal was much less.

Mr. HOUGHTON, with reference to his former remarks, said if the Company were so fettered by Act of Parliament as to be compelled to raise money at 7½ per cent. instead of borrowing it at 4½, it was inevitable that the Municipal Authorities, who could borrow money at a low rate, would come in and take over the works. They could not go back to the past, but when the next offer was made he hoped the Directors would call a meeting of the Shareholders.

The motion for the adoption of the report was then put and carried, and the dividends recommended were declared.

The retiring Directors (Messrs. W. Alexander, W. B. Jackaman, and W. Turner) were severally re-elected, and Mr. S. A. Maw, jun., was re-appointed Auditor.

The meeting was then made special for the purpose of authorizing the raising of new capital.

The Directors proposed that the 600 shares should be offered to the public by auction, but it was resolved by a considerable majority that the shares should be distributed at the rate of one for every ten shares held by existing Shareholders.

The CHAIRMAN then moved, and Mr. R. M. MILLER seconded, a motion for raising a further sum of £4700 upon mortgage, which was agreed to, and the meeting closed with a vote of thanks to the Chairman.

BURY ST. EDMUND'S GAS COMPANY.

The Half-Yearly Meeting of this Company was held on Friday, the 13th inst.—Mr. G. THOMPSON in the chair.

The SECRETARY (Mr. W. Salmon) read the notice convening the meeting, and the report of the Directors, which was as follows:—

The Directors heartily congratulate the Shareholders on the present position of their Company.

Under the new Act the Shareholders are entitled to, and will now be paid 1 per cent. additional dividend on the several shares held by them. The increase of dividend has been obtained by the reduction in the price of gas to the consumers. While, therefore, the steady and successful progress of the Company enables your Directors to recommend the increase of dividend, they can only do that by the reduction in the price of gas. Thus the benefit extends alike to all.

The total cost of the new Act has been £558 2s. 10d., which is much less than was expected, and if you add to that the cost of the sale and issue of the first £1000 worth of shares, it will be seen that the premium received on the sale of the shares has more than paid the whole cost of the Act, and the sale and issue above mentioned.

The £616 18s. 6d. received for the premiums will form a distinct account, and will be applicable only in the way directed by the new Act—namely, "in extending and improving the works of the Company."

Since the last meeting the Directors have thought it desirable to change the investment of the reserve-fund, and they have done so. They believe the present investments are safe ones, and will realize 5 per cent.

The Directors have recently purchased the property, late Peckham's, at a total cost of £373 9s. 10d. This property consists of a good house and a long strip of ground, adjoining to, and running the whole length of their works on the south. This purchase gives the opportunity of finding a residence on the works for a foreman, and also the ready and easy means of adding to the present yard and coal-shed when found necessary.

The repairs during the last half year form an unusually heavy item, which has arisen from charging revenue with its full share of the new works, substituted for old and smaller ones. This item in amount is not likely to be repeated.

The capital of the Company will in future be known as the 1849 capital, 10 per cent.; 1859 do., 7½ per cent.; 1879 do., 7 per cent.

The Directors sincerely regret the cause of the late vacancy in the direction, which, under the powers of the Act of Parliament, they have filled up by the appointment of Mr. James Hoy.

At the meeting, two of the Directors—namely, Mr. Thomas Ridley and Mr. James Hoy—retire by rotation, but are eligible for re-election.

Mr. A. J. Hooper, one of the Auditors of the Company, retires by rotation, but is eligible for re-election.

Mr. James Hoy having resigned his appointment of Auditor, it will be necessary for the Shareholders to appoint an Auditor in his place at the meeting.

The Directors will recommend the payment of a dividend for the past half year of 11s. per share on the 1849 capital, and 8s. 6d. per share on the 1859 capital.

The CHAIRMAN, in moving the adoption of the report, said it would only be necessary for him to make a few observations, the report having gone so fully into detail. The Shareholders would observe that it had been rather an exceptional year with regard to expenditure. They had increased the capacity of the works by adding a scrubber, a governor, and other appliances, which, with new materials, had cost about £4000. All these works had been done under the discreet management of their Engineer, Mr. John McCrae, and the Directors believed and hoped it would be for the permanent benefit of the Company. The Company's expenses had increased, but the Shareholders would see that the revenue had been charged with what was fair and proper. They might congratulate themselves upon the possession of their new Act, and they would observe that somewhat singularly the premium on the first issue of shares had paid every expense connected with obtaining it, and left a surplus of 13s. 4d. He very much feared that they would not be able this year again to lower the price of gas; they must, therefore, reserve any further reduction till some future time. They had been very fortunate in their contracts. Their coals were all paid for, and the contract renewed satisfactorily. The same might be said of the contracts for their tar and ammoniacal liquor. The reduction made in the price of gas had tended, as was to be expected, to increase the consumption, but it produced a smaller return. He hoped, however, after a few months, they might again realize the amount they formerly had. He had much satisfaction in saying that on the 31st of December the bad and doubtful debts did not amount to more than £12. For this they had to thank their excellent Manager and their active Collector, of whom they could hardly speak too highly. He assured the Shareholders of the continued anxiety of the Directors for the welfare of the Company, and said the report was not only satisfactory to them, but he had no doubt would be equally so to all who had to receive the dividends.

Mr. SMITHYES said he observed that an alteration had been made in the investment of the reserve-fund. He did not think the Directors ought to look out for high interest, and he believed the Shareholders would be more satisfied if the reserve were in the Funds. The average price of the Colonial stock purchased by the Directors was 11½, which only gave 5 per cent. The Funds stood at 97, carrying interest on 100.

The CHAIRMAN said the Directors had very carefully considered the matter, and the Indian stock, in which their reserve-fund was invested, being about to be paid off, they thought it desirable to look out for some equally good investment.

The SECRETARY said if the money had been invested in the Funds it would have added but little to the dividends. When the Directors had the money to dispose of, the English Funds were very high, and he did not think any prudent man would have bought in stock at 98½, which was the price of the Funds at the present time. The Directors had studied safety in the investment of the Company's money. The object of their new Act was to make them as economical as possible, in order that they might reduce the price of gas as fast as they could, and so increase the dividends. As to the question of safety, there was no doubt.

Mr. BURROUGHS seconded the motion.

Mr. HOOPER said before the motion was put to the meeting there was one remark he should like to make as a Shareholder. In his capacity as one of the Auditors, he had observed an irregularity in the account sent in by Messrs. Salmon and Son. Their Parliamentary Agent had been paid £250 for services in connection with the new Act, and he sent in an account, giving all details and items; but when he (Mr. Hooper) came to the account of Messrs. Salmon and Son, it was simply stated that it was for "innumerable attendances in securing the Gas Act." He said at the time that this was not a fair way of presenting an account, and he should not pass it. He did not understand the phrase "innumerable attendances," and to him it was not satisfactory. Expenses out of pocket were put down, and that was the only item that was given. He felt this was so irregular that he ought to bring it before the Shareholders. He had been told by one of the Directors that an Auditor had no right to criticize the accounts, but simply to pass them. To that he demurred altogether. It seemed to him that his duty as Auditor was to go carefully through the accounts, and to say in his judgment whether they were right or wrong. He did not know how the Shareholders would get to know anything of any impropriety in the expenditure if the Auditor confined himself to the mere schoolboy work of seeing that the receipts on one side and the payments on the other were correctly set down. It seemed to him that the Auditor should be allowed to use his judgment as to whether the accounts paid were fair. He did not say the account in question was not fair, but he objected to the way in which it was presented.

Mr. HOY said, as one of the Auditors, he could not endorse a word of what Mr. Hooper had said about Messrs. Salmon's account. The Auditors knew nothing about lawyers' bills, even if they were made out in full; and, moreover, he thought it was not their province as Auditors to make any comments upon the accounts.

The CHAIRMAN said the amount of the bill was much within what the Directors expected, and many persons now sent in accounts without specifying the various items. He considered it would be presumptuous in them to ask Mr. Salmon to put down every visit he received from him (the Chairman) or others connected with the Company. They thought the bill very reasonable, and, under the circumstances, they did not consider it advisable to put Mr. Salmon to the trouble of sending in an account in detail. He had written to Mr. Walmisley, the Parliamentary Agent, stating that one of the Auditors had objected to Mr. Salmon's account because items were not given, and requesting that gentleman's opinion upon the subject. In his reply, Mr. Walmisley said he considered it an act of presumption on the part of an Auditor to interfere between the Directors and their Solicitor, and the Auditor had no right to call for a detailed account. He was quite satisfied that if Mr. Salmon had made a detailed account there would have been no difficulty in increasing the amount charged. He concurred with the Directors that the amount was most fair and reasonable. He (the Chairman) was very sorry these remarks had been made, and he hoped the Shareholders would consider the Board had acted properly.

Mr. SALMON said he had been the servant of the Company for 30 years, and this was the first time he had had a personal attack made upon him. He had worked through every detail of the Company's three Acts of Parliament, and the last Act of all, which he considered was worth £10,000 to the Company, was the crowning benefit to which he had been able to lend his assistance. They realized a few days previously, at a public sale, the increased value of their property; and now received the increased dividends. The Board had passed his account, and it was one he (Mr. Salmon)

conscientiously believed to be within the mark. Of that they had the best evidence from the Parliamentary Agent. He could easily have increased the amount of his bill if he had put in the details; but he believed that the Shareholders had enough faith in him not to suppose he would send in an unfair account, and that they also felt some gratitude to him for his services to the Company. This was the only thing that had occurred in the course of 30 years to mar the harmony of the Company, and it was a deliberate attack upon the Directors as well as himself. It was said they ought to have everything clear and above-board. If the Shareholders did not think this was the case in the Company, let them clear the whole Board away. Under their new Act every pound they could save was of importance, both to themselves and the public, because it helped them to reduce the price of gas and at the same time increase their dividends. They were now benefiting the consumers as well as themselves without the sacrifice of a single principle. Their property was in the most perfect order, and fitted to do the work required of it. Their capital was secure, and they would be able to go on for the rest of their lives in unbroken prosperity. The only thing that could mar it was the introduction of dissensions in the management of the Company; they were unnecessary, and if permitted to continue, he would not give much for the prospects of their property. He had had most delicate work to do, during the past year, in order that the Company's Bill might be passed in the form and shape in which it was. And as to the short way in which his account had been stated, it was not merely, as Mr. Hooper said, for "innumerable attendances." In addition to "innumerable attendances," it gave, in one item of a good many lines, a summary of all that had been done.

Mr. SMITHYES did not think Mr. Hooper intended to suggest that there had been any overcharge.

Mr. HOOPER: No.

Mr. SMITHYES: And no doubt he wished to avoid establishing a precedent which others might use as a reason for not sending in bills in detail. As Auditor, it was his duty to analyze the accounts. If this was not the case, an Auditor was no check at all—he would not have a right to make any remark, but simply certify that the accounts were correct.

Mr. HOOPER said the expression he objected to was "innumerable attendances," and he thought the Shareholders would coincide with him that it was not quite the way in which bills should be sent in to them. If it became the fashion to send in accounts in lump sums, of course they must submit to it; but he did not think they ought to submit to such a precedent on the part of a legal gentleman. He repudiated any personal feeling in this matter, and said he admired Mr. Salmon's zeal and energy, and was pained to have to bring the subject before the meeting; but felt it to be his duty, as an Auditor, to do so. As to introducing dissension, in his opinion the way to maintain union and co-operation was to have everything above-board. If there was any suspicion on the part of the Shareholders that anything was not quite right, let them have the matter thoroughly ventilated, and more union and concord would result. He had no personal feeling against the Directors. He was as thankful to them as any man could be for the time and attention they gave to carrying on the Company's business, and he should be sorry to introduce any matter of discord; but to prevent this they must prevent the cause. If their Manager (Mr. McCrae) were to send in a bill for "a great quantity of coal," he should refuse to sanction it.

Mr. SALMON said Mr. Hooper might object to the action of the Directors, but as an Auditor it was not his business to consider whether an account was right or wrong. That was the business of the Directors. If they thought fit to pay an account, the Auditor's duty was to see that a proper receipt was given for it.

Mr. J. C. BROWN regretted very much that anything should have been said in any way calculated to prejudice the Company. He thought Mr. Hooper had a little exceeded his duty. He did not think there was any reasonable ground for attacking their worthy Secretary, who had done so much for the Company; and from what he (Mr. Brown) gathered, his claim on this occasion was no more than might reasonably have been expected.

The CHAIRMAN pointed out that the expense of obtaining the last Act was more than £100 less than was expended in connection with the previous one.

The motion for the adoption of the report was then put, and carried unanimously.

The retiring Directors (Mr. T. Ridley and Mr. Hoy) were re-elected; and Mr. Hooper was re-appointed an Auditor, while Mr. J. R. Thompson was chosen as his colleague in place of Mr. Hoy, who had become a member of the Board of Directors.

The customary votes of thanks were then unanimously accorded to the Engineer and Manager (Mr. John McCrae), whose skilful discharge of his duty was warmly eulogized by the Chairman; to the Chairman and Directors, the Secretary, and the Auditors, and suitably acknowledged, and the proceedings terminated.

THE SUPPLY OF WATER TO A PRISON.—A somewhat similar case to that recently noticed in the JOURNAL as to the water supply of Liskeard Workhouse was set down for hearing in the Court of Session on Saturday, the 7th inst. It was the case of *The Prison Commissioners of Scotland v. The Glasgow Water-Works Commissioners*; which was an action of declarator at the instance of the Prison Commissioners of Scotland against the Glasgow Water-Works Commissioners, in which the pursuers sought to have it declared that they were entitled to a supply of water for the Prison of Glasgow at the ordinary domestic rates, and that they should not be charged for water by meter. After certain procedure the case was taken out of court under an arrangement between the parties.

THE SEWAGE DIFFICULTY AT KIDDERMINSTER.—There are indications that the Kidderminster Corporation will soon have to face some serious difficulties connected with their extensive sewage farm near Stourport. When the sewerage and water-works schemes were carried out in the Carpet Metropolis seven years ago, at an outlay of about £110,000, it was arranged to dispose of the sewage by pouring it upon a vast tract of what was then almost barren land lying between Kidderminster and Stourport. The sewage was first received into a large tank in the town, and from thence pumped on to the land. One portion of the original scheme has been abandoned, owing to the continual difficulties which arose, and the tanks being abandoned, the sewage is pumped direct from the mains to the farm. Another difficulty of a more serious nature has now arisen. The soil, from being sterile, has become most fruitful, and the farm is unable to absorb the enormous quantity of sewage which is daily poured on it, and rumours are current that several injunctions are threatened against the Corporation, to restrain them from pumping the sewage on to the land. The Town Authorities are considerably exercised as to the best means of dealing with the matter. It has been suggested that a large slice of poor land in the immediate vicinity should be purchased and added to the farm; but no doubt professional assistance will be solicited before any final steps are taken. Already the sewerage scheme has proved a most expensive one, but it is evident that the ratepayers will have to be taxed still further.—*Wolverhampton Chronicle*.

TOWN AND COUNTY OF POOLE GAS AND COKE COMPANY, LIMITED.

The Eighth Half-Yearly General Meeting of this Company was held on Monday, the 9th inst.—Mr. W. PEARCE in the chair.

The SECRETARY (Mr. J. Budden) read the notice convening the meeting, and the following report was presented:—

The Directors have to report that during the last half year they have raised a further sum of £500 by debenture bonds, which will complete the £2000 authorized to be borrowed by the special resolution of the Company passed on Aug. 12, 1878.

During the same period they have erected a large new coal store, sufficient to provide for the Company's operations for some time to come (the old store having for a long time past been wholly insufficient for the Company's purpose), and they have now to construct a building for housing stores of various kinds, and also a new office and board-room; the present office, which is also used as a board-room, being not only insufficient, but unhealthy, from being occasionally flooded at high tides. The Directors, therefore, propose to erect a new office and board-room and adapt the old office to a store-room; but these need not amount to any large sum.

The Shareholders will see by the accounts that there is a sum of £409 8s. 9d. owing to the Company's bankers, which has been advanced by them to pay current claims, and the Directors are desirous of calling attention to this matter, and explaining how it has occurred. It is the custom with gas companies, as the Shareholders are aware, to supply gas for three months before making any demand for payment, and consequently money has to be found for carrying on the manufacturing operations for three months before any return is available. With the companies generally, the unexpended capital in the hands of the directors, and the reserve-fund, or the two together, are used for this purpose; but for the last half year these funds with this Company have been so unusually low that it has been necessary to borrow from the bankers to supplement the current expenditure.

The Directors, under the circumstances, think it advisable to ask the sanction of the Shareholders to borrowing a further sum of £1000 on debenture bonds, which, with the balance of unexpended capital in hand at the present time, they think will enable them to complete the further improvements before mentioned, and leave a small sum in hand sufficient to carry on the business without trespassing on their bankers.

The Directors have much satisfaction in informing the Proprietors that, now the new apparatus has all been brought into operation, they have, as they expected they would, obtained some greatly improved results.

The gas made has, for the entire six months, averaged more than 10,000 cubic feet per ton of coals, and the quality has improved at the same time; and the ammoniacal liquor, which hitherto has been considered waste, is now made available for manufacturing purposes, and may be expected to produce an income exceeding £100 per annum.

There have also been improvements in other respects; for instance, coals (the largest item of expenditure with gas companies) have for the last half year cost only 14s. 7½d. per ton, as against 15s. 2½d. in the preceding half year; and the quantity of coke made and disposed of in this half year has been £247, as against £210 in the preceding half.

The consumption of gas has increased, but not in so large a proportion as usual, the increase for the last half year having been only 48,000 cubic feet as against 709,800 feet in the corresponding half year of 1878; but the Directors think this may be accounted for by the very general dullness of trade.

With most gas companies there has been a very large increase in the last half year. This increase, however, has for the most part been in private dwellings, and not in shops; and the consumption of gas in private dwellings in Poole is but very trifling as compared with that in the shops.

The general result is that the profit for the half year is in itself sufficient to pay the maximum dividend, and leave a balance of £81 9s. 11d. applicable to dividend to be carried over to the next account, and this is the course the Directors now recommend.

The Directors have, on two or three occasions before mentioned, to the Proprietors that the loss, or unaccounted-for gas, was very large, being as much as 25 per cent., and that their attention should be specially directed to this matter to get it reduced; and they have now to report that by continually following this up it has been reduced to 13½ per cent., which, though a great improvement on the former state of things, is still rather high, and they hope before long to reduce it still more.

[The capital of the Company consists of £9500 in £10 shares, entitled to 10 per cent. dividend; £10,520, limited to 4 per cent.; and £7000 in debenture bonds raised at 5 per cent. They are also authorized to raise £19,880, to be limited as to dividend to 7 per cent. The total expenditure on capital account to Dec. 31 was £26,882 13s.; £740 8s. 6d. having been expended last half year.]

REVENUE ACCOUNT FOR THE HALF YEAR ENDING DEC. 31, 1879.

Expenditure.	
To Manufacture—	
Coals, including all charges into the Company's stores, 814 tons, average price about 14s. 5½d.	£588 8 9
Carbonizing	138 19 0
Purifying, storing, and selling products in the yard, &c.	25 12 1
Repairs and maintenance of plant	75 3 0
Rent, rates, and taxes.	57 0 3
	£885 3 1
Distribution—	
Repairing and relaying services, fixing meters, &c., &c.	47 10 10
Management—	
Directors	Nil.
Auditor, Manager, Collector, and Clerk	£172 0 0
Stationery, printing reports, books, stamps, &c.	25 17 11
	197 17 11
Miscellaneous—	
Discounts to large consumers.	£76 4 11
Bad debts and allowances	5 0 10
	81 5 2
Total expenditure	£1,211 17 7
Receipts.	
By Gas supplied during the half year—	
Consumers meters, 6,903,600 cubic feet, at 5s.	£1,725 18 0
Meter-rents	59 16 0
	£1,785 14 0
Residual products—	
Coke for sale, estimated at about 40 per cent. on weight of coals, 333 tons, at 14s. 10d.	£247 6 6
Tar, estimated at 10 gallons per ton, 8140 gallons, at about 2d. per gallon	65 0 4
Ammoniacal liquor, at 20 gallons per ton; 16,220 gallons, at 60s. per 1000 gallons	48 18 9
Sundries	4 13 11
	365 19 6
Discounts	0 17 0
Total receipts	£2,152 10 6
Deduct Dr. side	1,211 17 7
Balance transferred to net revenue account	£940 12 11

The CHAIRMAN, in moving the adoption of the report, said he wished, in the first place, to show the Shareholders how the £2000 raised by debenture bonds since his election as Chairman had been expended. For this purpose Mr. Budden, their Secretary, had sketched a plan of the works that had been executed, also of the new office and board-room which the Directors hoped to have erected during the year. But here he must tell the Shareholders that on this outlay they had realized a profit of between £200 and £300 a year, besides making a better quality of gas and improving the works. He would now deal with the future. As men of business, they were aware that no trade could be carried on successfully without working capital, and, as would have been observed in the report, the Company were dependent on their bankers to carry them through the half year with credit. The Directors would call a special meeting for the purpose of obtaining authority to borrow £1000 on debentures, and at the same time of considering what course should be pursued with the Bournemouth Gas Company, who had taken possession

of, and laid down mains in the Poole Company's district, which they (the Bournemouth Company) had no right to do. This business, however, could be discussed at the special meeting.

Mr. W. PENNEY seconded the resolution, and, in doing so, said he considered the report was one of the most gratifying the Shareholders had ever received. The Directors were able to pay the maximum dividend, and to carry forward a balance. The quantity of gas produced from the coal carbonized was satisfactory, and they were making £100 per half year from the collection and sale of their ammoniacal liquor. He saw that at Exeter, where the Gas Company manufactured £23,000 worth of gas, they obtained only £957 for their coke, and this item in the report of the Poole Company, who did only one-twentieth of the business, contrasted very favourably with that of the Exeter Company. He must make one remark as to the loss of gas, which was still large—13½ per cent. It would be very satisfactory to see the percentage much lower. In London the loss was only 4 or 5 per cent. Altogether, however, the report was highly satisfactory, and he had great pleasure in seconding the motion for its adoption.

Mr. STONE objected to the borrowing of money for building a board-room and other things, because he hoped that in a year or two the Company's affairs would be in so flourishing a condition, by reason of their making an extra quantity of gas, that they would be free from obligation to the bank, and he thought it would be better even to pay the bank interest for a short time than to burden the Company with extra bonds and debentures. He moved as an amendment that paragraphs 2 and 4 should be excluded from the report.

Mr. PHILLIPS seconded the amendment, and said in his opinion the proposed works should not be undertaken until they could be paid for out of profits. They were not absolutely necessary, and if the Company kept on increasing their debenture bonds, it would leave a permanent mortgage on the original stock.

The CHAIRMAN said Mr. Stone had told them he should object to the Directors report because it recommended an increase of capital; but he (the Chairman) desired to say a few words on this subject. As he had already told them, £2000 had been borrowed on debentures since he had been in office, yet Mr. Stone and one or two other gentlemen objected to the £200 clear profit which was made. They did not seem to care much for the attention the Directors gave to the business of the Company, or for their exertions on its behalf. They had been attacked by the Town Council, and had to spend money in an extraordinary way. The works were formerly a perfect wilderness; but the Shareholders could go and see what they were now, and if they did not find them worth double the money, they were no judges. He did not wish to take to himself the credit of all this work, for the Directors had greatly aided him, and it was due to Mr. Budden to say that he had rendered him every assistance. The Company would not have been able to pay dividends unless the Directors had done what he had mentioned. The new capital required was not for the board-room only. They did not want any money to be raised for that; they could erect the building without any extra capital. Mr. Livesey, their Auditor, however, said they were obliged to contract debts at the bank, and to pay interest for them, and it was absolutely necessary the Company should raise £1000 to carry on the business profitably, and in order to be clear at the bankers, to whom they had to pay a sum of money which would be better paid to the Shareholders. Another serious matter was as to the works at Bournemouth. There was a large district, where a great number of houses were being built, and it would hereafter prove a very profitable part of their business, though not immediately, for they could supply gas at a cheaper rate than the Bournemouth Company could do. Lord Alington had also applied to them to have gas extended to his property, to which they had almost acceded. They could not do this, however, without increasing their capital. If they cramped everything that was done, it was of no use extending their works. He must leave the matter in the hands of the Shareholders. If the Directors had not taken up nearly all the pipes in the town and relaid them, there would have been a constant waste, and it was by the continual improvements they introduced that they were able to pay large dividends.

Mr. FARMER: Supposing the report is passed as it stands, will it not be necessary to have an extraordinary meeting before a resolution as to the £1000 can be passed?

The CHAIRMAN replied in the affirmative.

The amendment was then put and lost—7 voting in its favour, 9 against it. The original motion was therefore declared carried. Some discussion having taken place as to the admission of proxies, it was decided to accept them. The numbers were again taken, when there appeared—For Mr. Stone's amendment, 7 votes by show of hands and 10 proxies—total 17; against it, 9 votes by show of hands and 1 proxy—total 10. The amendment was therefore carried.

The CHAIRMAN then proposed that a dividend be declared at the rate of 10 per cent. on the A shares and 4 per cent. on the B shares, for the half year ending Dec. 31, 1879.

Mr. GREEN seconded the proposition, and it was carried *nem. con.*

The retiring Directors, Messrs. Mills and Farmer, were then re-elected, and a vote of thanks to the Chairman concluded the proceedings.

SUTTON-IN-ASHFIELD LOCAL BOARD GAS SUPPLY.—At the meeting of the Sutton-in-Ashfield Local Board on the 6th inst., the Chairman of the Gas Committee (Mr. Littlewood) said that at the close of the first year since the transfer of the gas-works to the Local Board they had in hand a small surplus after meeting all expenses. Considering the dullness of trade, they had reason to be thankful for this. However, they would require about £500 more to complete the purchase, and he moved that power be given to the Committee to raise £1000, when they might be able to extend their mains. The proposition was unanimously agreed to.

CLEVELAND WATER COMPANY.—The twenty-third half-yearly meeting of this Company was held on Thursday, the 12th inst., at the offices, Saltburn-by-the-Sea.—Mr. T. Wharton in the chair. The report stated that the revival of trade in the mining districts is beginning to largely increase the consumption of water both for household purposes and for mining engines. The receipts of the Company have slightly risen in the past half year, instead of declining as in previous half years; so that, after providing for interest, rent, and other preferential charges, there remains a balance of £2186 4s. 8d., out of which dividends were recommended of £6 10s. per cent. on the original and A shares, and of £4 11s. per cent. on the B shares (free of income-tax), leaving a balance of £266 to be carried to the credit of next half year's account. The capital account showed that the total expenditure to the end of last year was £77,479 6s. 2d.; while the receipts were in ordinary shares exclusively, all loans and mortgages having been paid off. The receipts on revenue account for the six months were £2746 14s. 6d.; balance from previous half year, £298 5s. The half year's working expenses absorb £734 17s. 4d., interest on redeemed loans and prepayment of calls require £123 17s. 6d., leaving, as above stated, £2186 4s. 8d. available for dividend. On the motion of the Chairman, seconded by Mr. Whitwell, the dividends recommended in the report were declared. The retiring Director (Mr. F. Fox) and the Auditor (Mr. J. C. Simpson) were re-elected; and a vote of thanks to the Chairman, Directors, and Officers of the Company was unanimously awarded.

MR. WARNER'S MACHINERY AT THE JARROW WORKS OF THE SOUTH SHIELDS GAS COMPANY.

Last Thursday, at the invitation of Mr. W. J. Warner, the Engineer of the South Shields Gas Company, a large party of Gas Engineers and Managers, and others interested in the question, visited the Company's Jarrow works, to inspect his patented machinery, more especially in connection with the charging and drawing of the retorts, but also for raising and lowering the covers of the purifiers and discharging their contents. In last week's issue we gave a general description of the apparatus, and may now add that complete drawings of the machinery are being prepared, and from these we shall have illustrations engraved for insertion in an early number of the JOURNAL.

The inspection of the machinery occupied a considerable time, an extended trial of the drawing and charging machine being made. Twelve retorts were drawn and charged in less than 13 minutes, and this time would have been somewhat lessened had not delay been caused by one of the retorts being choked. Mr. Warner then minutely described the various parts of the machine proper and their uses, as well as the appurtenances—such as the arrangement for filling the coal hoppers, the removal of the coke from the retort-house, &c. In the purifying-house the very neat arrangement of the cranes for moving the covers of the purifiers was much admired, the facility of its working being put to a thorough test. The other parts of the works came in for a large share of attention, though naturally the greatest interest was manifested in Mr. Warner's retort-house arrangements.

At the conclusion of the inspection, the company sat down to luncheon in the basement of the purifier-house. Dr. R. WALLIS, J.P., the Chairman of the South Shields Gas Company, presided; and was supported by Messrs. HALL and HENDERSON, Directors of the Company.

The toast of "The Queen and the rest of the Royal Family," after a right loyal speech from the CHAIRMAN, was drunk with much enthusiasm. After which,

The CHAIRMAN said: Gentlemen, it is easy enough to address a large mixed assembly, or a party of old and valued friends, on whom you can depend to be lenient to your shortcomings; but to address a small select meeting of scientific gentlemen, and gentlemen of education and refinement, on a mechanical invention, is more than I can do, and therefore I will not attempt it. And yet I was proud to take the chair to-day, as it enables me to do what I can do with the greatest sincerity and pleasure, and that is propose the health of my esteemed and valued friend, Mr. Warner, and success to his invention. The invention you have seen to-day is not the outcome of a hasty inspiration; it is the result of many years of earnest and deep thought. During the whole of these years I have enjoyed Mr. Warner's full confidence, and have watched the progress of his invention, as it proceeded step by step to what I firmly believe to be perfect success. It is only for you scientific gentlemen to-day to endorse that opinion, to place my friend on the flow of that tide which leads to fortune—to place him amongst the most honoured and successful gas engineers of the day. He is, I am aware, not unknown in the annals of gas engineering. He has already made his mark by other inventions, and has been chosen President of the British Association of Gas Managers. Mr. Warner has the full confidence of the Directors and Shareholders of the South Shields Gas Company. They believe him to be an able Engineer, a warm, attached friend, and an upright, conscientious man. The works which you see around you, which are now drawing very near to completion, have been planned and executed solely and entirely by himself. Many of you can see for yourselves that they have been well done, and we (the Directors of the Company) can say they have been done cheaply, and with an earnest desire to promote the interests of the Shareholders. We are apt, on such occasions as this, to over-estimate, to attach too great importance to the subject we wish to advocate. But, gentlemen, if by your verdict to-day you stamp this invention as a success, I really think we cannot estimate it too highly. In discussing that great question of the day recently—the merits of gas *versus* electricity—it was admitted that gas was a more pleasant, more controllable, and more useful light, but could it be produced as cheap as by electricity? The question was answered in the affirmative; and if this were so then, what must it be now, when we are ready to affirm that by this invention, by the substitution of machinery for manual labour, we can do away with that severe unhealthy toil—that wasting of the flesh and blood of the stokers—which must bring depression to both mind and body, possibly shortens their existence, and certainly creates a craving for strong drink? If by this invention we can add dignity to labour; if we can call forth a large demand for skilled labour, which will improve the mental and physical condition of the people; if we can, by the same means, lessen the cost of production of gas by reducing to one-half the expenses of the retort-house; if we can get more and better gas per ton of coal—I think you will agree with me that gas shares will and can hold their own against all present or future competition. Considering the immense capital invested in gas manufacture, the importance of Mr. Warner's last invention can hardly be over-estimated. The man by whose talent and ingenuity we are enabled to do this is worthy of public acknowledgment, and I would suggest this could not be more usefully and graciously shown than by forwarding the promotion of the Company now about to be formed for the working of the patent.

The toast was received with musical honours.

Mr. WARNER, in responding, acknowledged the reception accorded to him and his invention, and said: Gentlemen, the most important matter in connection with this gathering to-day is the fact which has been educed by it, that the subject of retort-house machinery is now receiving the serious attention of many of those engaged in the manufacture of gas. I have been favoured with some very encouraging letters on the subject, but the most satisfactory, and that which I have no doubt will be the most interesting to you, is one from the Chairman of the Phoenix Gas Company, London. It is as follows:—"London, Feb. 17, 1880.—Sir, I have received through Mr. Moore an invitation to view the machinery in action whereby the whole work of the retort-house is done without ordinary manual labour. I regret that I am unable to accept it. For years I have strenuously advocated the use of machinery instead of the ordinary method; hitherto unsuccessfully. I read the account sent to me, extracted from the *Shields Daily News*, which fails to show the pith of the matter—viz., how does the cost compare with manual labour? The machinery itself may do its work perfectly, but, in a money point of view, not economically. Do not trouble yourself to reply to this, but inform the gas world through the JOURNAL as to the cost of working, &c.—I am, &c., E. Horner, Chairman of the Phoenix Gas Company." Nothing, gentlemen, I take it, could be more gratifying to us, upon such an occasion, than Mr. Horner's letter. The Chairman of this large and prosperous London Company has for years been advocating the use of machinery, and yet nothing has been successful. I have to-day shown you machinery that has had, in one respect, the wear and tear of 2½ years. I take this to be the most important fact in connection with the matter—the successful working of retorts by steam power—for the reduction of cost must, as in every other case of the substitution of this power for manual labour, follow its successful application. But this, to use Mr. Horner's own words, is not "the pith of the matter;" it is the comparative cost; and I

will at once answer this question. The system is more economical. The saving that will be effected by the house which you have just inspected will amount, when the house is in full work, to £1000 a year. I will give you the facts upon which I base this estimate. I take the cost of plant at £200 per bed; but as in this amount is included the cost of plates for the floor, with framing and pillars for supporting the same, it seems hardly fair to do so; but I take the £200. Well, 10 per cent. on this for interest, though we are paying but 7, will amount to £20; to this I will add a sum for wear and tear, £20; making a total cost for machinery of £40. Now, if we take a fireman's wages at 35s. per week, which will amount to £91 a year, and add for coke trimming, &c., £9, making £100; deducting for wear and tear and interest £40, leaves £60 a bed as a balance. Multiply this by the number of beds—30—and we have for labour and profit, or gain, £1800. Now as to the labour. At the present rate of working one retort a minute, two men could work 6-hour charges every two hours through each shift, and would have an interval of an hour between. The wages of the two men for each shift, at 30s., would come to £6; to each shift I will give four men, at 25s., or £10. For working hoists and fire-making the cost would thus be £16 per week. Multiplying this by the weeks—52—gives £832. This deducted from £1800 leaves, in round figures, £1000. To this also we might add wear and tear of ordinary working, which you know is considerable. I have not either charged anything for steam power, because we work the same boilers as for the exhausters and purifying-house; and fuel I have assumed will be more than amply compensated for by the lessened waste of stacking the coke. The £200 which I have taken as the cost of each bed, and for which sum the work may at once be done, is somewhat startling when placed in juxtaposition with the £100 a year, which may be taken as the cost of working a bed. Thus two years work will redeem the plant. But, gentlemen, there is a still more startling fact, and it is this: Taking the cost of carbonizing at about 3d. per 1000 feet, we have a charge for labour, with coals at the price they were not long since, amounting to something like 50 per cent. of the gross cost of the coal; that is to say, we in this neighbourhood pay half as much for simply lifting the coal a few feet and putting it inside the retorts and disposing of the coke as is paid for winning the coal, for royalties, for interest on machinery, for railway dues, and for the coal itself. This state of things is a grave reflection upon our manufacture in these mechanical times. I have not here taken into consideration any advantage arising from regularity of the charges, or the reduced waste of gas during the operation; but experience will show a decided gain. There is, too, another advantage arising from the use of machinery which is of great value to such a manufacture as ours; that is, the diminution of the risk of strikes. It has been said that if this advantage alone could be secured, it would justify the use of machinery. With regard to the cost of working, I should say a few words as supplementary to the explanation which I have given. First, with regard to the staff for working. I have alluded to the full working of the house; but, as in the case of manual labour, the number of men may be reduced as the beds are let down—indeed, the work may be so arranged as to have only one man on during each shift, with a small number of retorts in action. It was for this purpose—the economy of labour in working moderate-sized houses—that I decided on single beds being constructed in the house. As to the machinery itself, it will have been seen that it may be divided into three separate and distinct portions—the coal-feeding, the charging and drawing, and the delivery of the coke. Now, it is manifest that the whole of this will not be needed in every house. With stage working, the coke will be removed in the usual way; and as to the coal, as long as the buckets are filled and suspended, the requirements of the machine are met. Hence the machine may be used alone, or in combination with the other two. But the arrangements made for doing the work should be such that it should be as far as possible progressive. By this I mean that the charges should be prepared first and made quite ready to feed the machine, that it should then do its work of drawing and charging, and after that the coke should be removed. Thus the work is systematized and carried on with the greatest economy. It has been remarked that the responsibility of the Directors in connection with this matter has been very considerable. Well, I will not say one word to lower the estimate of their bold and enterprising spirit. I commend it to you. But may it not be asked whether there would not have been a greater responsibility attaching to them, had they not, in putting down such works as these, attempted to deal with this question? and I ask, were they not justified in running the risk by the large cost and great irregularity of manual labour?

Mr. HALL, after referring to the proceedings of the day, and the important invention of Mr. Warner, said he and the other Directors of the Company were glad to see present with them so many distinguished and scientific gentlemen connected with the manufacture of gas. He could assure them the invention by Mr. Warner had occasioned the greatest possible interest among the Directors, and they were rejoiced to know of its success. He had great pleasure in proposing the health of the visitors, associating therewith the name of Mr. Hunter, of the Salford Corporation Gas-Works.

Mr. HUNTER said his attention had long been given to the various inventions introduced in connection with the manufacture of gas, and he had had much pleasure in attending at South Shields and witnessing the improvements introduced by Mr. Warner. Speaking from what he had seen, he must say that great credit was due to Mr. Warner for the very ingenious contrivance he had introduced to their notice. He (Mr. Hunter) had seen several machines which professed to be capable of doing the work similar in character to that of Mr. Warner's machine. The vital point, of course, was the reduction in the working expenses; and, as far as he was able to judge from what he had seen, Mr. Warner's invention appeared to meet this. He had taken the opportunity of noting the time which it required to do the work, and it was very satisfactory. Of course, under the circumstances, before he expressed any definite opinion, he should like to have an opportunity of maturing his views; although, he must say, from what he had seen, he was pleased with the invention. Mr. Warner was a gentleman who occupied a high position among gas engineers, and he was thought so highly of by them that they had given him the highest possible position they could confer upon him—namely, that of President of the British Association of Gas Managers, the duties of which he had discharged with credit to himself and with honour to the Association, and they looked upon him as the leading man of their time. When they came to South Shields and saw the success which had attended his efforts, and the esteem in which he was held by the Directors of his Company, it was highly gratifying to them, and they sincerely wished him still greater success.

Mr. W. ROBSON, Chairman of the Sunderland Gas Company, gave the health of the Directors of the South Shields Gas Company.

The CHAIRMAN returned thanks on behalf of himself and his co-Directors.

The health of the Mayor of Jarrow (Dr. Huntley) was proposed by Alderman WILLIAMSON; and several other toasts having been duly honoured, the Company separated.

Mr. Warner, in his attendance on the visitors, was ably assisted by Mr.

Whyte, the Resident Engineer at the works; while Mr. Joseph Fenwick, the Foreman, performed his part in a most satisfactory manner, having, during the six months the machinery has been at work, thoroughly mastered every detail of the arrangement, so that no hitch occurred. The proceedings were at intervals enlivened by the strains of the bagpipes, efficiently performed by Mr. John Calder, late of the 72nd Regiment, but now in the employ of the Company.

BIRMINGHAM CORPORATION GAS SUPPLY.

A Special Meeting of the Birmingham Town Council was held on Tuesday last—the Mayor (Mr. R. Chamberlain) in the chair—when the annual report and accounts of the Gas Committee to Dec. 31, 1879, which appeared in the last number of the JOURNAL, were presented. The report having been taken as read,

Alderman CHAMBERLAIN said: I have to move—"That the recommendation of the Gas Committee, that the balance of the profit and loss account be appropriated as follows—namely, £25,000 to the borough improvement rate, and £26,165 18s. 4d. to the sinking-fund for the reduction of loans and annuities—be approved." I shall have to follow that up by resolutions authorizing the Committee to obtain tenders and enter into contracts for the extensions proposed in the report, and to confirm the provisional agreements which have been made for the purchase of land, which I will explain in due course. The interest of what I have to say has been to a very large extent forestalled by the necessary previous publication of the accounts of the Gas Committee, and what would, under other circumstances have been a really marvellous and exciting story, must now become in my hands, and under the conditions in which I speak, a mere common-place recital of a rather complicated series of figures. If I could have handed you the accounts at the same time that I rose to address you, I think I might have kept you in suspense, if not in anxiety, for a considerable period. In that case I should have led you back to last year, and I should have reminded you that, standing then in my present place to move the annual report of the Gas Committee, I had the pleasure to announce a profit of £54,832; but I should also have to have said that you approved on that occasion of a recommendation to reduce the profit by reducing the price of gas. You authorized a reduction of 3d. per 1000 cubic feet, which we anticipated would cost the Corporation £30,000, and as a matter of fact it has cost £33,000, and there at a stroke the £54,832 is reduced to £21,000. It would be further reduced by certain items in which we have to lament an increased expenditure. During the year which has passed we have spent £1000 more on legal proceedings, and I may say that there is no item of expenditure which is more thoroughly unsatisfactory, or which I regret more than I do this one. We have also had to pay, in the shape of increased income-tax, something like £600. No explanation, I think, will be necessary as to that item, and the experience of all business men present will suggest that in our case, as probably in theirs, the zeal and activity of the officers of the Revenue Department have produced results satisfactory perhaps to the Chancellor of the Exchequer, though anything but satisfactory to the parties who have to pay the tax. We think this zeal has, in our case, been a little misdirected, and we have a dispute with the Revenue Department as to the principle upon which they hold us assessable to the income-tax. This matter has not yet been settled; if we cannot agree with the officers here, we shall certainly appeal to London; but, in the meantime, we have had to pay £600 more for the twelve months than for the preceding year. Together, these items make £34,600, and would leave only £20,000 profit. Here I should have paused. I should have called your attention to the frightful consequences to the Corporation and the town if it had been found that the profits of the gas department had not sufficed to pay the sum which we had allotted to the improvement rate, and did not leave one penny for the sinking-fund; but, knowing that all of you have before you the accounts, which show a profit for the present year, in spite of these circumstances, of £51,165, it is not open to me to employ this rhetorical device, and to keep you on the tenter-hooks. It remains only for me to carry out the prosaic duty of building up again this profit, and to show you how what we have lost has been compensated for by various items of decrease. In the first place, we have bought coals at a lower rate than formerly, and, during the past year, we have saved on this item £7500. The liquor contract, which was in existence the previous year for six months only, has been running for the whole of the past twelve months, and that has brought us in an additional £8000. In the shape of repairs, including repairs to mains and meters, we have expended on the whole £2000 less than previously. These three items would bring the profit up again to £37,500; but, in addition, we have to add for the first time an item for interest on the reserve-fund. The reserve-fund having been made up to the full parliamentary standard, the interest upon it is no longer added to the fund, but comes into the profit, and we get £2000 under that head. The burden of the loans is less in proportion to the amount returned by £2500—that is to say, that if the loans had increased in the proportion in which trade has increased, we should have had to pay £2500 more than we actually have found it necessary to pay. These two items, added to the figure I previously gave, brings the profit up to £42,000. Then we have—thanks in a great measure to the improvement which has been made since the transfer of the gas-works to the Corporation—lessened considerably the cost of manufacture, and under the heads of wages and general management we have saved the sum of £2000. We have also saved £500 in bad debts, which are less by that amount than they were before, and now stand at a lower figure than they have ever done, I venture to say, whether during the period we have had the works, or in the previous history of the Companies. The remainder of the sum which is required to make up the profit shown in the accounts is due to the increased sale of gas, which, as the report states, amounted last year to 6 per cent. Now, just let me say, in passing, that I think it is very satisfactory, and greatly to the credit of the Manager, and especially the permanent officers of the department, that the bad debts have been so considerably reduced. During the four years we have had the control of the gas business, this item has stood thus: In the first year, £3800; in the second, £3400; in the third, £2700; and last year, £2200. If you consider that this is the entire amount of loss on credit for a return which amounts to half a million sterling, and that it is at the present time less than half per cent., I think you will feel that it is a very satisfactory result, and that traders generally would have good cause to congratulate themselves if they could show anything of the same kind. Now, the point for the consideration of the Council, having obtained this profit of £51,165, is to decide what they will do with it. We have already appropriated £25,000 of the amount to the relief of the rates, and we suggest that the £26,000 odd should be carried to the sinking-fund. Last year I ventured to impress upon the Town Council that, having regard to the risks of a great undertaking like this, and the extent of our capital obligations, it would be the wish of our constituents, as I am quite certain it is consistent with all rules of safe business, that our sinking-fund should in the future be not less than £25,000 per annum. As I believe the Council approved that suggestion, very little need be said to-day in order to induce them to accept our present recommendation. I do not think that £25,000 is a penny too much to write off each year from this great undertaking.

On the other hand, I think it is amply sufficient, having regard to all the circumstances of the case. I should like to call the attention of the Council for a few minutes to the state of the capital account, and to certain considerations which it naturally suggests. At the present time the capital amounts to £2,153,000. This seems an enormous sum of money; but, having regard to the business which is carried on by its means, I say that it is an extremely moderate capital, and in my opinion is much less than the works of the undertaking are worth, provided they are worth anything at all. Now, I have had the curiosity to make a comparison between the value of our property as it stands on our books and the value of the property of another great gas undertaking as it is estimated in the market; and for the purpose of this comparison I have taken the figures of the Phoenix Gas Company, because I happen to be a Shareholder in that Company, and in possession of their report. Taking the Phoenix Company's capital at its present market value—it has been in the last two or three years slightly reduced—I find that it stands at £2 per 1000 cubic feet upon the annual make. Apply that to our annual make of 2645 million cubic feet, and I find that our capital, if it were at the same rate as the market value of the capital of the Phoenix Company, would be not £2,153,000, but it would be over £5,200,000; that is to say, the market value of another gas undertaking—one of the principal gas undertakings in London—stands at more than two and a half times the amount of our capital. This, I think, is at all events a satisfactory comparison. But now I want to dissect our capital a little, because of this sum of £2,153,000 there is a considerable proportion which is as good as cash, and can be realized for cash at any moment. There are, for instance, the reserve-fund, the sinking-fund, and the stores of coal and coke, and other materials of that kind, and they amount together to £170,000. Then the balance of debts owing to us, over and above debts which we owe, and which, of course, by this time have been collected, as regards the year is £90,000. The freehold lands belonging to the Corporation in connection with the gas undertaking have recently been the subject of a careful valuation which was made for the Gas Committee by surveyors appointed for the purpose in Birmingham and West Bromwich, and they amount to £250,000, and would, of course, always have their value whatever might become of the gas undertaking. Then four of the neighbouring Local Boards are pledged to buy of us a portion of the undertaking. Assuming that the award which has already been given in the case of West Bromwich is sustained, and that the Corporation are unsuccessful in their attempt to upset it, and assuming the other Boards have to pay in the same proportion, I find that something like £170,000 is coming to the Corporation for this item, and these together make £680,000, which, deducted from our capital, leaves £1,473,000 as the net value of the machinery, plant, buildings, and the goodwill of this vast undertaking. Now, the sinking-fund which I ask you to make up to-day, added to the £4000 which the Committee have already carried to the same fund, will give you £30,000; and £30,000 per annum, reckoned at 4 per cent., will wipe off every penny of this million and a half in 28 years—that is to say, in less than one generation. I think when we do that we may consider we are careful stewards of the property of the ratepayers, and at the same time making a prudent provision against a possible future. Assuming for a moment that I have carried the Council with me so far as the past is concerned, it will be interesting, perhaps, to say a word or two as to the future. In the future we have to face, for the first time in our history, a greatly-increased price of coal. Already the quotations that come to us are much higher than they have been, and we do not know to what point they may be carried. Of course, in talking of the future, it is a mere matter of estimate; but I assume we shall have to pay £20,000 more for our coal during the ensuing twelve months than we did during the last. If the matter rested there, the Committee would be justified in asking you to raise the price of gas at once by 2d. per 1000 cubic feet. Well, we do not do this for two reasons. In the first place, because we are not desirous of disturbing the present price of gas more than we can possibly help. We would sooner submit to a somewhat lessened profit, or a rather lower sum carried to the sinking-fund, than be continually changing the price consumers are called upon to pay for gas. And then the state of our accounts and the system on which they are kept is now such that we have prepared and submitted to us every month a statement of profit and loss during the month, and, although this is not exactly accurate, yet it is sufficiently so to keep us always pretty well informed as to what we are doing; and if we found that we had made a mistake, and that it was necessary to come to you for a rise in price, we could do so at any moment, and certainly this is one of the occasions on which we would rather come a little too late than be at all premature. I have one or two grounds also for hope that any such claim upon the consumers will be unnecessary. In the first place, although we shall have to pay more for coal, we may reasonably hope that we shall get something more for our coke, which, as I have always told the Council, is to be considered at the same time as you consider the other items of expenditure. Last year I pointed out that this coke question was the great difficulty of the Gas Committee. At that time we had a very great deal too much. Now, I am sorry to say, we have a great deal too little. We have certainly relieved ourselves of all anxiety in this respect. We have reduced the stock of coke by something like 28,000 tons. It is less at the present moment than it has ever before been at a similar period, and I think we are in a position to ask and obtain higher prices for what we may still have to sell. I must stop here to say that this result, which has relieved the Committee of very much anxiety and trouble, is largely due to the assiduity, business ability, and skill of our Secretary, Mr. Edwin Smith, of whom I do not find it possible to speak in too high terms. He has taken a great deal of pains with reference to this particular matter, and in consequence of the arrangements which he and others have made, I find that in the town the sales, which we were very anxious to increase, have been raised by 30 per cent.; while the surplus of old coke, which troubled us so much last year, has been exported from the district, at what I venture to say is, under the circumstances, a fair price. The extent of the difficulty will be best understood by the Council if I tell them that I have heard of a very large gas undertaking in another place which has actually had to export its coke to Belgium and the Continent, not only getting nothing for it, but actually paying a considerable price to the contractor to take it away and clear it from the yard. I reckon that this year we may count on £5000 extra from this item, and this will reduce the increased cost of coal to £15,000. For that increase I hope to find compensation in an increased sale of gas. The present sale of gas is 2645 million cubic feet per annum, which is, I think, the highest sale of any company in the world, except, perhaps, the largest of the London Companies—it certainly is very much larger than that of any other provincial town. Large as it is, however, I want to remind the Council that it is really much less, and not more than it was estimated it would when the transfer of the gas-works was made to the Council. The fact is that circumstances have so far been rather against the Council than in their favour. We might have done better if trade had been in a healthier condition. When the matter was first recommended to the Council, I think I said we could rely upon an increase at the rate of 5 or 6 per cent. compound, and subsequent experience and the knowledge I have gained, and my experience of other undertakings, convinces me that 6 per cent. compound is not at all

too much to reckon upon. That 6 per cent. compound, in the four years during which we have had possession of the gas undertaking, ought to have increased our sales 26 per cent. As a matter of fact, we have only increased them 16 per cent. We have therefore 10 per cent. to make up. To put it in other words, the increase in the sale of gas, making allowance for the loss of Walsall, is 325 million cubic feet in that time, whereas it ought to have been during the same period 680 million cubic feet. I do not doubt for a moment that this falling off in the normal rate of increase is only temporary. My own conviction is that it is partly due to the fact that the Council have supplied better gas than the Companies did; and, in the second place, that they have rearranged the mains and the pressure, and that consequently there is a more equable pressure throughout the town and district than there used to be in time of great stress. Making allowance for this, I see no reason to doubt that, with continued improvement in trade, we may not only increase our sale in the future at the rate of 6 per cent. compound, but make up for what we have lost in the past, and may find, as I believe the Companies did, that in a single year the increase amounts to as much as 15 or 20 per cent. If this should be so, then I think we have every reason to hope that even the large deficiency of £15,000, to which I have referred, may be made up by the profit upon an increased sale. I hope whoever stands in my place next year may have a statement to make as satisfactory as that which I have made to-day. There is one other point to which I wish to call your attention. I observed some time ago a report of a meeting of the Council, at which there was a discussion in reference to the gas profits. On that occasion one member argued that the Council were not entitled to estimate any profits at all. I would ask, in the name of common sense, why not? The inducement—the chief, I may say the only inducement which has ever been offered to the Council that they should undertake the vast responsibility of the gas supply was the promise that if they would do so they would make a profit, and be able to apply that profit in relief of the rates. What other possible ground could there be for saddling the ratepayers with the responsibility of this enormous concern, or laying upon the shoulders of the Council and the Gas Committee all the burden and anxiety of managing this great undertaking? I may add that when we were applying for the Act of Parliament by which these concerns were transferred to the town of Birmingham, the evidence turned entirely upon this question of profit. I was examined during, I think, the best part of three or four days, upon my estimates, and the amount of profit which I had said I believed the Council would make, and I then declared my conviction that, with anything like decent management, these profits would amount to £20,000 a year to begin with, and would rapidly go up to £50,000 a year or more in the future. It was upon this evidence we obtained our Bill, and in the Bill you will find the most careful arrangements, the most definite details as to the application of the profit when we have made it. Again, do not let it be supposed that we are singular in making a profit out of our gas undertaking. We are not the only Corporation who have control of the gas supply. The other day we sent round a circular to the leading Corporations in the kingdom, and I believe in every case, with one exception, they were carrying large sums from the profits of the gas undertaking to the relief of local taxation, beginning with Manchester, which stood at the head of the list, carrying the sum of £54,000 to its improvement rate. I cannot help thinking that this argument is really based upon a delusion which seems to prevail rather widely amongst a certain political party in the town—namely, that you can take two from two, and two will remain. There may be people who think you can reduce the price of gas 2d., 3d., or 4d. per 1000 cubic feet without increasing the rates proportionately at the same time. What I must ask members of the Town Council and gentlemen outside to keep in view is this—that the two things go together. You can reduce the price of gas to-day if you like, and your profits are sufficient to admit of it. You can take off 2d. per 1000 cubic feet; but if you do, you must revise your estimates for the improvement rate, and add 5d. in the pound to that rate; for every 1d. per 1000 cubic feet taken off the price of gas means 2½d. additional to the improvement rate. This is the exact proportion, and it is not fair, it is not honest for gentlemen to go to any meeting and talk to people about the propriety of reducing the price of gas, unless at the same time they tell them that it would necessitate the raising of the rates. If the Corporation and the ratepayers, then, desire that the rates should be raised in order that gas should be supplied for nothing, I, personally, have not the slightest objection; but it is absolutely impossible that one thing should be done without the other. But let me point out that there are certain classes of people whom an arrangement of this kind would suit very well, and to whom it is distinctly a matter of interest that they should get their gas cheaply, even if the rates are raised. For instance, there is the case of the Local Boards, who do not pay rates at all. It would suit them very well indeed that the Corporation should undertake to do this work, to give its attention and its time and the business ability it can command to serve the gas department, and make a great saving by means of its credit and its capital, and give all these away to the inhabitants of Aston, Handsworth, Balsall Heath, Wednesbury, and West Bromwich, asking nothing in return; but I cannot see how anybody but a ratepayer in those parishes can say that such an arrangement would be satisfactory to the people of Birmingham. Then, again, there are, no doubt, certain manufacturers in Birmingham, the exigencies of whose trade require that they should use a very large and exceptional quantity of gas, and in such cases it would suit them better to pay 1s. extra to the rates if they could get 3d. per 1000 cubic feet taken off the price of gas. But this is not the case with the majority. I warn the Town Council that the vast majority of the hard-working, industrious people of Birmingham—whether they belong to the smaller and middle-class manufacturers or to the working-class—have a much greater interest in the reduction of the rates than they have in the reduction of the price of gas; and that to reduce the price of gas inordinately without reason, to insist on giving away the profits we have made, and which nobody else could have made, would be simply to commit a sort of financial suicide, to which I do not believe the Council would ever agree. As I have said before, all turns on that last point. If it can be shown that we have not fairly made the profit we carry to the rates, then I ask you by all means to correct my figures, and make such reduction as you think the circumstances justify; but at present my own conviction is that, so far from carrying too much to the rates, we are carrying too little, and that this will very shortly have to be altered. I told the Council, to begin with, that I expected in a short time to make £50,000 per annum from the gas undertaking. The thing has turned out better than I had expected, and I say we ought to make £50,000 per annum earlier than I had anticipated or predicted. We should long ago—I venture to say two years ago at least—have carried a larger sum than we have done to the reduction of taxation if we had not thought it wiser, under the circumstances, to increase the provision we have made for extinguishing the debt in the future. But having carried that provision up to what I think is pretty nearly its maximum point, you have a right now—and I invite you to turn your attention in the future to this point—to see whether it would not be fair at no distant date to carry a larger proportion of your profit to the relief of the improvement fund. I showed last year, and therefore I do not propose to repeat the demonstra-

tion that we are at the present time selling gas lower than any other town in the kingdom, except two, where the circumstances are very exceptional. I showed further that we were selling gas cheaper, having regard to the proportionate price of coal and coke, than the Companies ever did, and, therefore, than the Companies would have been likely to do if they had continued to go on with their work. And I showed still further how it was we were able to do this—from what source we derived this additional profit. I laid it before the town and the Council, and I asked them to show whether they could fairly believe that this saving which we had made would not have been made by the Companies if they had continued as separate institutions. Since that time nobody has attempted, either in the Council or at any meeting outside, to disturb these figures in the slightest degree. Nobody has submitted others for them, and until they are altered I maintain my previous opinion, and I hope the Council will support me in it—viz., that the profit we have made is ours, that we have a right to do with it what we like, and that what we shall like to do with it is to carry it to the relief of taxation. In conclusion, I venture to say that at the present time this vast undertaking was never in better order. It is admirably officered. I have already had occasion to refer to the services of Mr. Edwin Smith; but I may say now we have equally good reason to be pleased with the work of our Engineers, Mr. Hunt and Mr. Hack. Indeed, we have thorough cause for satisfaction with all the officers of the establishment. I have never known, in my experience, a vast undertaking work so smoothly and so entirely to the contentment of its proprietors. I venture to say also that we are now well furnished with the latest appliances in every respect. There is not one of these works which belong to you which has not been materially and strikingly improved since they have been in the hands of the Corporation. You will see that the money which has been expended in this has not been thrown away, as you will find if you will follow me for half a minute in some of the results of the undertaking. There are three or four matters to which every gas engineer would at once turn his attention if he were called upon to pronounce upon the comparative merits of the different undertakings. In all these respects the improvement is generally owing, I think, to the greater care taken in the management. The improvement in the works has been very marked during the last four years. I find, for instance, that during that period the amount of fuel required to carbonize the coal which is made into gas has been reduced from 21 per cent. to 17 per cent.—a reduction of 4 per cent. in the amount of fuel used. The production of gas per ton of coal during the same period has been increased from 8700 cubic feet to 9100 cubic feet, being an increase of 400 cubic feet per ton. The waste or unaccounted-for gas has been reduced during the same period, I may say, by 2½ per cent. It is very difficult to speak positively upon this subject, because we only arrive at the result by a series of complicated and compensatory calculations; but I believe I should be speaking the truth if I said that we had reduced the waste by 4 per cent. I am certainly moderate in putting it at only 2½ per cent. At the same time the wages at the works are, I find, £500 less for the last twelve months than they were in 1876, and yet in the interval the make of gas has increased no less than 250 million cubic feet. If the wages had increased in the same proportion, they would have been £3500 more, instead of being £500 less. These are the four points to which I believe I have never before called your attention. They are four points of the greatest importance, with respect to which we have made this considerable saving. I have never made any claim for the Corporation on behalf of this saving. I have assumed that exactly the same results might have occurred under the management of the two Companies; but at the same time it is not common sense not to recognize that, when a great undertaking like this improves continuously in every branch, there is some special credit due to those who have control of it, and that you may give to them their reward in allowing them to allot a proportion of the consequent profit which has been made. Under these circumstances, I appeal to the Council to confirm the recommendation which the Committee have made to them by my mouth, and I hope that in so doing they will approve the principles upon which this undertaking has been conducted, and will justify the Committee in continuing the work upon the same lines which in the past have produced such excellent results, and which, if they are fairly and consistently adhered to, will produce still better, still more signal and striking advantages at no distant future.

Alderman MANTON, in seconding the motion, said every member of the Council must feel himself much indebted to Alderman Chamberlain for the clear and satisfactory statement to which they had listened.

Mr. BEARD criticized the work of the Gas Committee at some length, and, comparing the statistics of the old Companies with those of the Corporation, asserted that no profit was to be found except in the speeches of members of the Council. There was nothing to show but what the whole of the £80,000 which had been carried to the relief of the rates for the last three years had not been obtained from the exceptional charges and advantages in the lower price of coal and increased value of ammoniacal liquor, by which the Corporation had benefited, and every farthing of which ought to have gone in a reduction of the price of gas. So long as he had the opportunity of occupying a position in the Council, he should defend that which he believed to be honest and right, and he said it was not fair and it was not equitable to saddle the whole of these charges upon the gas consumer, without his receiving from time to time some consideration at the hands of the Council. He asserted that there was nothing upon the face of the balance-sheet to show that the prophesied savings had been made other than by the charges on the gas consumer. They were told that the Directors' fees were saved, but then the Gas Committee had established a reserve-fund which had taken a sum of money that would not only have paid the Directors' fees, but have left a surplus. With regard to leakage, Alderman Chamberlain had placed the matter before the Council in a way which was not only misleading, but was not to the advantage of the Gas Committee. He (Mr. Beard) could tell them why Alderman Chamberlain took the years 1874-5, and compared them with the results of to-day.

Alderman CHAMBERLAIN: No; 1876 and 1879.

Mr. BEARD said that to compare 1876 was not fair, because in order to have a fair and equitable comparison they should go back to the time before anything was disturbed by the purchase.

Alderman CHAMBERLAIN: There were no previous returns.

Mr. BEARD said Mr. Robert Jones, an eminent engineer, was employed to inspect the works, and in his evidence before the House of Commons Committee he said that he found the leakage under both Companies was 7 per cent., which was very low. When asked what advantage would be obtained by the purchase, he replied that when large mains were substituted for the two smaller mains the leakage would be reduced to 3 or 4 per cent. Now, he (Mr. Beard) asked what was the leakage for last year. He took the official statement of the Secretary of the Gas Committee, and compared it with the total gas sold to the consumers, and he found the leakage was 8½ per cent., and if he went back to 1878 he found it was 9½. Therefore, he said that, instead of there being a saving under this head, there was a positive loss. After alluding to the Corporation giving away coke, which he described as a most extraordinary thing to do, he contended that it was to the interest of Birmingham that the Council should at all times recognize the great smelters in the districts surrounding

Birmingham. If the Corporation had been more liberal in the prices at which they sold their coke in 1876-8, there would have been no necessity to give it away in 1879.

Alderman AVERY said that, with regard to the very admirable address of Alderman Chamberlain, he fully accepted the substance of the arguments and the very interesting and conclusive facts which had been adduced. He regarded the statements of Mr. Beard as exceedingly erroneous, that gentleman not only misleading and deceiving himself, but making statements which had a tendency to mislead others. In his (Alderman Avery's) opinion, Alderman Chamberlain's figures had not yet been impeached; for, in fact, they were unimpeachable.

Alderman CHAMBERLAIN, in reply, said he was not inclined to complain of honest and impartial criticism of the proceedings of the Gas Committee, because he was quite sure that all such criticism was likely to be fruitful. He did not complain, and had no right and no wish to complain of what Mr. Beard called his independent position; but he did complain that when Mr. Beard fancied he had established, on information which must necessarily be imperfect, charges which, if they were true, would be extremely serious charges against the Gas Committee, he did not in the first instance give them the benefit of the doubt, and ask for a little further information before he utterly condemned them. Mr. Beard said in effect that the Gas Committee had sold gas which was worse in quality than that which the Companies supplied, and was also dearer in price. Now, as a matter of fact, the tests of a person who was perfectly impartial, being employed by the magistrates, did not show any deficiency whatever in the quality of the gas; on the contrary, they showed that it was improved under the management of the Corporation. That, he supposed, was so much the worse for the tests, because they did not agree with Mr. Beard's estimates. The Committee, according to Mr. Beard, were getting £105,000 a year more than the Companies had after they had paid their usual dividends and made a sufficient reserve. And Mr. Beard asked where was it gone to? What was the explanation of this sudden disappearance of £105,000 a year? There were only two explanations, and he offered them both to Mr. Beard, so that he might take his choice. The first explanation was that the Gas Committee were knaves and fools. The other explanation was that Mr. Beard was—well, that Mr. Beard was mistaken. Mr. Beard complained that the Gas Committee had grievously injured the iron trade of the district by not reducing the price of coke, but at the same time he had accused the Committee of giving the coke away. The Committee reduced the price of the coke quick enough to clear their yards when they became over-full. With regard to the leakage, Mr. Beard furnished some calculations which were not correct, and then he said this proved that he (Alderman Chamberlain) had made a misleading statement. Now, the official returns of the leakage were as follow:—In 1875 it was 10.5 per cent.; in 1876, 10 per cent.; in 1877, 9.8 per cent.; in 1878, 9.24 per cent.; in 1879, 8.5 per cent. Mr. Beard informed the Council that the Companies under their Acts could not have established sinking-funds. Certainly, there was no provision for it, but they laid aside large sums for depreciations whenever they made large profits, and were thus enabled to establish that which answered all the purposes of a sinking-fund. Dealing with other statements of Mr. Beard, Alderman Chamberlain said he did not complain that Mr. Beard amidst a mass of complicated figures, made mistakes, but he felt bound to remark that they all seemed to be mistakes on one side. Alderman Avery had pointed out that the Committee's present price for gas was only 2d. more than the lowest average price of the old Companies. If that were correct, while the Committee were losing 3d. upon the price of coal and coke, they were only charging 2d. of it to the gas consumers. He would move—"That the Committee be authorized to obtain tenders and enter into contracts for the construction of a new retort-house, new exhauster, and engine and boiler house, at the Windsor Street works, at an estimated cost of £75,000." At present they had ample powers for carrying on the works, but in about two years time there would be a deficiency, which would become a great one if there were any considerable improvement in trade. The completion of the extension of the works would probably last over two or three years, and if they were to be safe it would be necessary to commence the extension almost immediately. It was proposed to use the new houses all the year round, as they would be erected on a new system, and the present retort-houses on the older system would be used only as winter works, when a larger supply of gas was needed. As to the capital account, it was not desirable, he urged, to allow it to continue increasing more rapidly than they could help. When the Council first undertook the management of the gas supply, he pointed out that they might assume that, if the capital increased at the rate which the capital of the Companies increased, something like £70,000 per annum would be required in extra capital expenditure. They had, however, done much better than was anticipated in this respect, for in four years the capital was only increased from £2,000,931 to £2,153,336. If the reserve and sinking funds were taken from this amount, the total increase of the capital was only £36,000, or 1½ per cent. in four years; while during the same period the maximum daily make (which was a test of the capacity of the gas undertaking) had increased from 14,700,000 cubic feet to 18,250,000 cubic feet, or 24 per cent. The present demand was for manufacturing power only, but sooner or later additional storage would also be required.

The motion was agreed to, as were two others relating to the acquisition of additional land.

Alderman CHAMBERLAIN then proposed that the Gas Committee be authorized to make an application to the Local Government Board for sanction to borrow sums not exceeding £125,000 for the purposes of the gas department. This was purely a formal matter, as it merely gave the Committee the right to apply for the necessary parliamentary sanction to borrow. He brought forward the motion in the name of the Gas Committee, but he thought it was a pity to ask for so small a sum. The Committee could not spend a penny without the sanction of the Council, and as money would ultimately be required, he would accept an amendment that they ask to borrow £250,000.

Mr. MARRIS moved, and Alderman BIGGS seconded, that the application be for £250,000; which, after a short discussion, was agreed to.

Alderman CHAMBERLAIN next moved that the Committee be authorized to enter into agreements with the Local Boards of Oldbury, Smethwick, and Tipton, and the West Bromwich Improvement Commissioners, for the transfer to them of those portions of the gas undertaking within their respective districts.

Alderman HEATON asked if the costs of the arbitration were included in the law and parliamentary charges of £1639, and, if not, what were the charges estimated at.

Alderman CHAMBERLAIN said the charges of the arbitration were not included in the £1639, and no estimate had been made out; but there was not the least doubt they would be enormous.

The motion was agreed to.

Alderman CHAMBERLAIN next moved that the report be approved. The efforts made by the Committee to keep from all possible squabbles with the Local Boards were attended with ill success. There was a time when he regretted that they had any intention to separate from the Corporation of Birmingham. He thought it was a pity to break up the great concern, and he believed the Council might amicably provide for their

requirements; but after the painful experience of the last four years he himself most devoutly wished that the time had come when the Boards separated themselves from the Corporation once and for ever. With reference to the proposed improved illumination of New Street, he remarked that only a few evenings previously the members of the Gas Committee, accompanied by the Chairman of the Public Works Committee, went to the works and saw a collection of improved burners, and in a short time the Committee would be prepared to carry out the experiments. He thought the Committee would find it desirable to alter the locality of the experiments, one of the reasons being that the footpaths in New Street were too narrow to admit of trials being successfully made. He believed that the best place for the display would be in front of the municipal buildings and in front of the Town Hall.

Mr. BEARD said Alderman Chamberlain had stated that he omitted to refer to coke when quoting his speech. The paragraph he referred to alluded to coal only. In 1875 the consumption of coal was 296,000 tons, and from that the Companies made 2579 million cubic feet of gas. In 1878 the consumption of coal was the same, and the statement went to show that the Committee had made more gas with the same quantity of coal. There was really no reference made to coke, and yet it was a fact that during the year 50,000 tons of coke were used in gas manufacture. He had made no mistake whatever in the statement. He had received information which showed that at Plymouth the present charge for gas was 2s. 2d. per 1000 cubic feet, to which must be added the meter-rent, which did not average more than 2d. per 1000 cubic feet. At Sheffield the total amount was 2s. 4d., and at Leeds, 2s. 3½d., while at Birmingham it was 2s. 7½d., showing an excess of 3d. or 4d. per 1000 cubic feet. He argued that there might be a reduction in the price, considering that there were greater facilities for obtaining coal in Birmingham than at Plymouth.

Alderman CHAMBERLAIN, in reply, said that Mr. Beard had read a quotation from his speech, "that in 1878 our price for ordinary coal, excluding cannel, was 9s. 6d.;" but the real quotation continued, "the value of 11 cwt. of coke was only 4s. 5d., and the net cost of a ton of coal was therefore 5s. 1d., or 2s. 8d. more than in the earlier period." He contended that Mr. Beard had ignored the quotation in its most important feature, and it was just as probable that, being incorrect in one thing, he was incorrect in the figures he had quoted regarding other towns.

The motion was then agreed to, and the Council proceeded to other business.

THE GAS SUPPLY OF LONG EATON.

BOARD OF TRADE INQUIRY.

The Long Eaton Gas Company having applied to the Board of Trade for a Provisional Order to enable them to raise £14,000 for the extension of their works, Major MARINDIN, R.E., one of the Board's Inspectors, attended at the Local Board Room, Long Eaton, on Tuesday, the 10th inst., to inquire into any objections that might be raised to the application.

Mr. B. BROWNE appeared for the Gas Company; Mr. EDWARDS opposed the application, on behalf of the Spondon, Ockbrook, and Borrowash Gas and Coke Company, and Trent College; Mr. G. CORBETT appeared for the Derby Canal Company; Mr. ACTON for Mr. T. A. Drennon, and owners of property, &c., who had memorialized the Board of Trade; and Mr. BLACK represented the Long Eaton Local Board.

The INSPECTOR having formally opened the inquiry and viewed the works,

Mr. BROWNE addressed him in support of the application. He said he asked for a Provisional Order to enable the Long Eaton Gas Company to construct additional works and make and supply gas. The Company were formed in 1864 with a small capital, but up to that time the gas had been made by a Mr. Bush as a private speculation. The Company consisted of large consumers. The works were continued up to 1872, when it was found that an extension was necessary, and the Company increased their capital to £8000. In 1877 their works were again found to be insufficient, and they purchased some ground and erected another gasholder. Since then they had gone on increasing, and in 1879 it was found expedient again to extend their works, which were now employed to their full capacity. The Inspector would hear that gas was absolutely necessary for the manufacture of lace, which was carried on to a large extent in Long Eaton, and it was clear that as the place grew, more gas would be required. The Company, knowing this, thought that in extending their works they ought to place themselves under parliamentary control. As they now stood they could supply gas of any quality and at any price, or they could refuse to supply any one; but if they were under parliamentary control they would be obliged to supply good gas and at a moderate rate. He contended, therefore, that the extension of the works would be to the interest of the consumers. In the past there had not been a single objection raised to the quality of the gas; and, although there had been complaints about the price, he should be able to prove that it was supplied at a reasonable rate. No one would dare to say that the Company had worked badly, or squandered their capital. At one time the Local Board were anxious to purchase the works, but made the Company an offer which was altogether inadequate. With respect to the new site, he considered that a better place could not have been selected; but the Inspector would probably hear what was to be said in opposition to it. It was alleged that four or five little houses would be seriously affected by the manufacture of gas being carried on, but he did not think such would be the case. The site was high up, so that it could not be affected by the floods, and, besides this, the Company would have the great advantage of being close to the railway sidings, so that they would be able to get their coals at a cheaper rate, and the consumers would therefore be benefited. The gasholder had been on the site since 1878, and, so far as the Company knew, no one had complained. It was true that Mr. Drennon wrote to the Company, complaining of the existence of the holder, and legal proceedings had been threatened; but, of course, nothing came of it, and, with this exception, there had not been a single complaint until the memorial recently submitted to the Board of Trade. The necessity for an extension of the gas-works had been admitted at all the public meetings which had been held on the subject. The people of the town, ratepayers, and the Local Board considered the site well chosen, and it seemed to have given general satisfaction except to a few persons residing in Union Street. The only reason the Local Board had withheld their consent up to the present time was because they had proposed that the works should pass into their hands; but they did not now attend to oppose. They held a meeting on Dec. 23, 1879, and a motion was then made that the Order should be opposed, but the proposal could not find a seconder. Other meetings were held, but nothing was done, the Board only complaining of the Company's monopoly. The Local Board eventually held a meeting, at which they decided not to oppose the Company, and although he would admit that five out of the twelve members were Shareholders in the Company, those five refrained from voting. With regard to the outlying districts, the Company proposed to go to Sawley, and also supply those places which the Ockbrook Company had been promising to supply for some time, but had not yet reached. The Order, he contended, was not in favour of the Company, but of the town. The Company would be bound to supply a good quality of gas, be open to an inspection of their works at any time, and, besides all this, would be

liable to a very heavy penalty if their works caused any nuisance; so that instead of Mr. Drennon being worse off by the new works he would be protected. Respecting the memorial put in by Mr. Acton, he might say that there were 600 owners and occupiers within 300 yards of the new site, and yet only 57 of these had been induced to attach their signatures. Further than this, there were some who signed but had since changed their minds, and who were now anxious to remove their names from the memorial. He considered Mr. Drennon very inconsistent, because although he told the Board of Trade that it would be a good thing for the gas-works to be placed in the hands of the Local Board, he at the same time was a Shareholder in a new Company which had started in rivalry to the present one.

Mr. CORBETT said, as the representative of the Derby Canal Company, he wished to state that he did not desire to oppose the Order, but was only present to ask the Company to use all necessary precautions in taking the gas over the bridges of the Canal Company, so that no damage might be caused.

Mr. BROWNE said the Canal Company need have no fear of any injury being done to their bridges, because the Gas Company were bound by law not to do any damage, and it was to their advantage to lay their mains properly.

Mr. Corbett's opposition was, therefore, withdrawn, as was also that of Trent College.

Mr. BROWNE then called Mr. Blythen, Secretary to the Long Eaton Gas Company, who said he had been in the Company's service since 1870, and during that time had watched the manufacture of gas. He believed the Company had done their duty to the consumers, and that the site proposed was the best that could be obtained. He had not had any complaints of the quality of the gas, but had had complaints as to the price. The residents in Union Street had not objected to the site.

In answer to Mr. ACTON, he said there had been many complaints of the price of gas. The average price was 4s. 2d. per 1000 feet, but some consumers paid 5s. For the last five years the Company had paid a dividend of 10 per cent., and during that time had increased their capital £300 or £400. Mr. Fletcher, the Chairman of the Local Board, was a Shareholder in the Gas Company, having about 100 shares.

Mr. Charles Taylor, Resident Engineer of the Derby Gas Company, and Manager of the Long Eaton Gas Company, examined by Mr. BROWNE, said he knew the Long Eaton Gas Company proposed to increase their capital, and he considered it was quite necessary. The gas supplied had been of very good quality, and there had been no complaints. He believed the site chosen to be a very suitable one, and the gas could be sent from there much cheaper than if the works were taken farther away. He did not think they would be injurious to health and property, and was quite satisfied that gas could be manufactured without causing a nuisance.

By Mr. ACTON: The proposed price is 5s. 6d. per 1000 cubic feet.

Mr. BROWNE objected to any question being put to the witness on the point of price, as no objection as to that had been sent to the Board of Trade.

The INSPECTOR was of opinion that, under the circumstances, Mr. Acton had no right to go into the question of price.

Re-examined by Mr. BROWNE, witness said he considered 5s. 6d. per 1000 feet a fair standard price, but he also thought that if coal became cheaper the Company would be able to supply gas at 5s. per 1000 feet.

Mr. C. E. Jones, Engineer of the Chesterfield Water and Gas Company, examined by Mr. BROWNE, said he had examined the plans and the site proposed, and he considered the latter well chosen. He did not think the works would be injurious to the surrounding property, and he knew many instances where valuable property was built round gas-works. He did not think 5s. 6d. per 1000 feet for Long Eaton, and 6s. 6d. per 1000 feet for the outlying districts, was an excessive price for gas. He never knew gas-works to be injurious to health.

Mr. EDDOWES addressed the Inspector on behalf of the Spondon, Ockbrook, and Borrowash Gas Company, who opposed the Order. He said the Company were started in 1868. In 1877 it was proposed to extend the works, and their Engineer was instructed in the matter. It was intended to supply some villages which the Long Eaton Company now proposed to supply, and the greater portion of the mains were laid into the village of Draycott. He also produced a resolution passed by the ratepayers of Draycott, to the effect that they rejected the proposal of the Long Eaton Gas Company to bring gas into Draycott. He contended that the Spondon Gas Company were able to supply the neighbourhood without the Long Eaton Company taking any steps in the matter.

Mr. Stevenson, Secretary of the Spondon Company, was called, and, in answer to Mr. BROWNE, said the Company were not bound to supply any one with gas, and could charge what price they pleased. If the present Order were rejected, the Spondon Company would not care about supplying Sawley, which would, therefore, have to remain without gas.

At the request of Mr. ACTON, Mr. Blythen was recalled, and said there was other unoccupied land close to the site the Company now had, but he was not aware that it could be obtained.

Mr. ACTON then stated his objections to the Company's application, which were that the proposed works would be injurious to the surrounding property and to health; but he added that, in consequence of his clients having neglected to lodge an objection as to the price of gas, he was unable to go into the most important question. He suggested that the more important site should be obtained, but if that were not done, the purifying-house, which was so near Mr. Drennon's house, should be removed to a more convenient place.

Mr. BROWNE having replied,

The INSPECTOR closed the inquiry, stating that he would submit his report as soon as possible to the Board of Trade.

A PHOTOMETER FOR INTENSE LIGHTS.

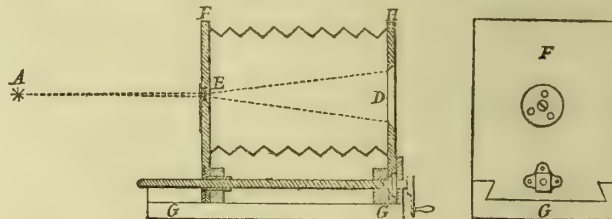
In the JOURNAL for Dec. 30 last, page 1018, we gave a short notice of a paper, on "A Dispersion Photometer," read by Mr. John Perry, one of the authors—Mr. W. E. Ayrton being the other—before the Physical Society, on Saturday, Dec. 13. The Authors have since favoured us with a copy of the paper. It is as follows:—

In measuring what is usually termed the power of a light, it is common to have a screen placed at such a distance from the light that its illumination is equal to that which it or another screen receives from a standard candle. Now, if a standard candle is, say, 1 foot from a screen, an electric light of, say, 6400-candle power must be placed at the distance of 80 feet from a screen to give the same illumination. That a great distance like this should be necessary, and in a chamber whose walls are supposed to be blackened, in the laboratories of works where electric lights are usually examined, has placed great difficulties in the way of exact determinations of the powers of lights. Our experience in experimenting with electric lights leads us to believe that, but for this difficulty, we should have a vast body of information on the subject of electric lighting, instead of the vague and conflicting statements which fill the scientific journals. Perhaps only those who have made experiments will appreciate fully the great advantages of our having some compact form of photometer. The mem-

bers of the Society will no doubt see many applications of a compact photometer, such as measuring the light from various parts of the sky, for instance, in which ordinary photometric methods are unavailable. Now, our instrument will resemble a camera, and it may be turned in all directions.

We were delighted to hear from Dr. Guthrie that his principle of a "retention-image photometer," recently communicated to the Society, has proved to be correct quantitatively. The success of his test must be as interesting to physiologists as to physicists. Besides testing his principle by using powerful lights, he will have experiments to make concerning the loss of light in reflection, as we shall have concerning loss in refraction. Probably, however, he does not intend to apply his instrument to powerful lights, on account of the very great difficulty he would meet with in measuring the breadth of the fine slot which would be needed.

In ordinary photometric methods, the rays of light illuminating unit area of screen, if coming from a powerful source, are contained in a very small solid angle. We use the very simple expedient of causing these rays to fill a much greater solid angle by passing them through a thin concave lens, and in this way obtain the same amount of illumination as before, but on a screen placed at a short distance behind the lens. Thus we not only save space, but prevent a great deal of the absorption which occurs when light passes through air. This absorption is sometimes very great in London. We have, however, absorption in the lens as a disadvantage; but with a very thin lens this may probably be reduced to an almost inappreciable amount.



A is the light to be measured; D is a paper screen illuminated by light passing through the concave lens, E. The frame, F, which carries the lens, slides on a stand, G, which has marked divisions, so that a pointer tells the distance from the focus of the lens to the screen, D. The sides of the space, F H, are of black cloth, like the sides of a folding camera; and the inside is all blackened except the screen, D. A circular plate with three round holes of different sizes is in front of the lens. A diaphragm of this kind is not necessary if we can be assured of there being no reflection from the inside of the box. Beside the instrument, and containing the standard candle, is a box blackened inside, in one end of which is a screen similar to D. If D is the distance from the light to the lens, and δ is the distance from the principal focus of the lens to the screen; if δ is the focal length of the lens, then, roughly, a bundle of rays of unit solid angle gets to have, after refraction, an angle $D^2 \div \delta^2$, as D is always great in comparison with δ . If L is the total light, then the unit angle of incident rays and the unit angle of refracted rays have amounts of light

$$\frac{L}{4\pi} \text{ and } \frac{L}{4\pi} \cdot \frac{\delta^2}{D^2};$$

so that a screen at the distance d from the focus of the lens has illumination of the intensity

$$\frac{L}{4\pi} \cdot \frac{\delta^2}{D^2} \cdot \frac{1}{d^2}.$$

If, now, another screen has the same illumination from a candle of which the total light is unity, at the distance D_1 , this illumination is

$$\frac{1}{4\pi D_1^2} = \frac{L}{4\pi} \cdot \frac{\delta^2}{D^2} \cdot \frac{1}{d^2};$$

and hence

$$L = \frac{D^3}{D_1^2} \cdot \frac{d^3}{\delta^2}.$$

A double concave lens, of focal length 1 centimetre, being employed, and d being capable of variation from 40 to 10 centimetres, and D being as much as five times D_1 , we can measure in a very small space a light which is from 40,000 to 100 times the standard candle.

We propose to make careful experiments on the absorption in passing through the lens; and by interposing thin plates of glass between the standard candle and its screen, to produce there a similar absorption, we have no doubt measurements may be made with this instrument with much greater accuracy than is possible by the ordinary method.

The power of the light is practically, therefore, proportional to the square of the product of the measurable distances. It will be, of course, unnecessary to measure the variations both in D and in d , as the scale can be so graduated as to give both distances at one reading.

THE WATER SUPPLY OF CHAPELTOWN, NEAR SHEFFIELD.—The question of providing an adequate supply of water for the parish of Chapeltown, which has been before the public for several years, has (says the *Sheffield Independent*) just been brought to a successful issue. Under the provisions of the Public Health Act, the Sanitary Authority (the Guardians of the Wortley Union) were charged with the duty of providing a sufficient supply of water for their district, which included the parish of Chapeltown. The matter continued to occupy the attention of the Authority, and they, in 1875, made an application to the Sheffield Water Company for a supply. In reply, the Company, through their Manager, stated that they were prepared to furnish a supply of water for Chapeltown at the rate of 70,000 gallons per day, at a cost of 7½d. per 1000 gallons. In order to carry out their part of the scheme, the Sanitary Authority applied to the Local Government Board for sanction to borrow £5000 from the Public Works Loan Commissioners, and an inquiry was held. Shortly after the inquiry, the Sanitary Authority obtained the consent of the Board to borrow the money, and the work was soon after commenced. The scheme is now completed, the water having reached Chapeltown a few days ago. A good deal of discussion has taken place amongst the ratepayers as to whether all persons will be compelled to take a supply from the mains, and all ratepayers be compelled to pay water-rates, whether they have water or not. In reply to a communication on these points, Major Tulloch, one of the Local Government Board's Inspectors, states that "every person, being a ratepayer and residing in the district, will be charged with a rate for the repayment of the loan; but in case any person has a good supply of water, he will not be obliged to take a supply from the mains. If, however, the Sanitary Authority consider that any property is inadequately supplied, they may compel the owners or occupiers of such property to take a supply."

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Throughout the coal trade generally of this district there seems to be the most discouraging prospect with regard to the immediate future. As I pointed out some time ago, there is every probability of all classes of round coal, and the better classes especially, being exceedingly plentiful during the ensuing summer, and already prices in many cases are quite as low as they were last summer. House-fire classes of fuel are naturally in less demand, and as the production of these during the winter has been quite, if not more than equal to the demand, there are heavy stocks on hand, and holders are willing to sell, at least over the summer, at lower prices than those which have recently been ruling. With regard to the lower classes of round coal, the improved demand for iron-making purposes has been altogether outweighed by the largely increased production, and I hear of large consumers in the iron trade being able to buy over the next nine months at very low figures. The only class of fuel that shows any signs of revival is slack, which is in considerable demand for engine purposes, consequent upon the improvement in the cotton trade, and as there is a probability that supplies will be scarce as the summer advances, prices have a tendency to harden, slight advances being already obtained in some cases. The average quotations at the pit mouth are about as under:—Best qualities of Wigan Arley, 8s. to 8s. 6d.; common, 6s. to 6s. 6d.; Pemberton four-feet, 6s. 3d. to 6s. 9d.; common round coal, 5s. 8d. to 5s. 9d.; good slack, 3s. to 3s. 6d.; and common about 2s. 6d. per ton.

Coke continues in good demand, and firm at about the prices quoted last week.

The shipping trade has been very dull, and with the large quantity of coal now offering in the market, sellers are obliged to take very low figures to secure orders.

In the iron trade there is still only a moderate demand from local consumers, most of whom, with the exception of some of the forge proprietors, appear to be well covered for the present. A very fair inquiry for export is, however, maintained; and as there is an expectation of a brisk trade being done when the spring shipping season opens, makers, as a rule, are very firm in their prices, and it is only second-hand iron that can be bought under late rates. Lancashire makers of pig iron are still well sold, so far as their present production is concerned, and for delivery into the Manchester district their quotations remain at about 70s. per ton, less 2½ per cent. Finished iron is without material change. The forges continue very busy, and for delivery into the Manchester district quotations remain at £9 to £9 10s. for bars, to £10 5s. to £10 10s. for hoops.

In other branches of trade the improvement is only slow, but some of the large engineering and machine-making firms in this district are pretty full of orders, and are asking higher prices.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The weather was stormy in the North Sea last week. There was much delay in the arrival of coasting, over-sea, and collier steamers. The shipments fell short. There is a good supply of coasting sailing tonnage; there are more small sailing vessels than there are orders. Most of the vessels employed in the sea-borne gas coal trade are known as "gas-house ships," and, as a rule, belong to the gas companies in the eastern counties, or ports in the British Channel. Hence very little shipping business for the conveyance of gas coals is arranged for in the open market. The gas coal trade is firm. All the best Durham collieries are busy. The output of some of the Durham gas pits is about to be increased by opening seams which have not been wrought hitherto. The Baltic business will open in about three weeks, and there will be extensive shipments of gas coals for the large Russian gas-works immediately following. The contracts for gas coals seem to have been made up for the season. Little or no fresh business has been entered upon over the past week or ten days in that direction. The shipments of gas coals to the Mediterranean are not very large at present. The steam coal is doing very well, but house coals are in little demand. The small and manufacturing coal trade is firm. The local demand improves every week, and prices are better. The coke trade is very strong, recent advances being fully sustained. The demand is better than it has been for the past three or four years. The make is increasing in quantity. Fresh ovens are being built in various parts of the Durham district.

The freight market is quiet. Coasting rates keep low. There is not any probability of an advance in freights coastwise this spring, not even after the Baltic trade is opened. The figure for London is about 4s. 8d. steamers, and 6s. 6d. to 5s. 9d. sailing vessels. Channel rates are equally low.

The iron trade of the Cleveland district showed some improvement last week. The blast-furnaces and rolling-mills are busy, as a rule. The foundries, too, are very full of work.

The fire-brick trade, as I have already reported, is active. Prices have been advancing steadily since Christmas. A large quantity of fire-bricks and fire-clay goods will be shipped from the Tyne this week for the Continent.

The lead market is quiet. The inflation of prices in the timber trade, which arose out of speculative transactions about Christmas, has collapsed. The demand which was expected has not arisen, and recent sales have been made at more moderate prices, and somewhat in proportion to the consumptive demand. The chemical market, too, is void of speculation. A quantity of chemicals were bought a month ago for delivery in March. The shipments, from the amount of tonnage which has been taken up, will be large that month, especially to the United States.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The arbitration case connected with the acquisition of the gas supply undertaking of Wishaw by the Police Commissioners of the burgh, under the Burghs Gas Supply (Scotland) Act, seems to have got into a condition of suspended animation. So far as I can learn, the arbiters have not held a meeting for many months. They are—Mr. G. R. Hislop, Paisley Corporation Gas-Works, for the Gas Company; and Mr. B. M. McCrae, of Dundee, for the Commissioners; with Mr. A. Smith, Aberdeen Gas-Works, as the oversman. Judging by the apparently entire absence of action on the part of the arbiters, or of the parties on whose account they were chosen to act, it can scarcely even be said that the case "drags its slow length along." And the Elgin case does not seem to be doing much better. In this case the arbiters are—Mr. Hislop, for the Gas Company, and ex-Provost Robertson, of Dundee (an engineer), for the Town Council—Mr. W. Foulis, Engineer to the Glasgow Corporation Gas Commissioners, being the oversman. It seems that the gas-works were opened in April, 1881, and that in June of the following year a dividend of 4 per cent. was paid to the Shareholders. The annual dividend remained at that rate for some years. Then it was raised to 5 per cent., and subsequently to 6 per cent., and it is stated that latterly 7 per cent. has been paid on a nominal capital of £9935 10s. There are 621 shares of the nominal value of £16 per share. I understand that the Town Council

offered, in the early history of the negotiations, to pay the Gas Company at the rate of £17 10s. per share, but the offer was declined, and the price asked was a lump sum of between £23,000 and £24,000. It is stated that the delay in the arbitration was caused by the reluctance of the Gas Company to allow their minutes and statement of accounts to be put into process, as had been requested on the part of the arbiter for the town. The request, however, has now been complied with.

At the last meeting of the Greenock Police Board, Bailie Paul drew attention to the fact that Mr. Stewart, the Manager of the gas-works, had asked that regulators and meters be put on the public lamps, so as to ascertain whether or not they were burning more than was calculated on or was allowed for; and he (the Bailie) suggested that, in addition, large meters should be put down in sectional parts of the town, so as to find if any section burned more gas than another. They would thus discover the more readily in what district of the town the waste complained of took place. Bailie Shankland, the Convener of the Gas Committee, said the Provost highly approved of Bailie Paul's suggestion as to the use of district meters in endeavouring to discover where the waste of gas occurred, and he had no doubt that it would be attended to by the Sub-Committee.

The Directors of the Gourrock Gas Company have resolved to extend their gas-works by the erection of a new and enlarged telescopic gas-holder, retort-house, and station-meter. The alterations and extensions, which are to be carried out during the ensuing summer, will probably cost about £2000.

A meeting of the Gas Corporation of Forfar was held on Monday, the 16th inst.—Provost Lowson in the chair—when reference was made by Bailie Laird to the borrowing powers of the Gas Corporation, the purchase of annuities, and the propriety of obtaining a Provisional Order giving power to borrow up to £8000 or £10,000. It was ultimately remitted to a Committee to inquire as to the expense of obtaining a Provisional Order, and to report.

Active measures are about to be taken to carry out water supply works for West Kilbride, in Ayrshire, and for Bothwell, in the Middle Ward of Lanarkshire. The plans of the works in both cases have been prepared by Messrs. Leslie, Civil Engineers, Edinburgh.

A very extensive business was done daily in the Glasgow pig iron market last week, the price ranging from 70s. 10½d. cash on Monday, to 67s. 1½d. on Friday. Up to 67s. 9d. was paid before the close on Friday afternoon. Many weak holders have now cleared out, and the market is on a pretty solid basis.

The coal trade is becoming so dull that wages are beginning to decline, and a difficulty is experienced in a number of instances to find continuous work for six days a week.

THE MALTON GAS COMPANY'S BILL.—In the last issue we noted that at a meeting of ratepayers called to decide as to whether or not the above-named Bill in Parliament should be opposed by the Local Board, a poll was demanded. This was taken, and the result announced last Tuesday. There are about 2000 ratepayers in the borough, and about 1500 voting-papers were issued. The result showed—For opposition, 1245; against, 120; majority, 1125.

THE WATER SUPPLY OF HORNSEA, NEAR HULL.—The Local Board of the favourite South Yorkshire watering-place of Hornsea have recently completed the construction of water-works at a cost of more than £9000. The bore of the well which has been sunk is about 300 feet deep, 12 inches in diameter, and penetrates a considerable distance into the rock, yielding a plentiful supply of water of excellent quality. The pumping tower is erected on the north side of the town, on Ley's Hill, the site being 70 feet above the level of the sea. The tower is 40 feet high, with a tank on the top capable of holding 60,000 gallons of water. The mains are already laid throughout the town.

PONTEFRAC T GAS COMPANY.—The half-yearly meeting of this Company was held on Thursday last, when the Directors presented a report in which they stated that the amount divisible among the Shareholders was £1882 19s. 9d., out of which they recommended the payment of a dividend for the half year ending Dec. 31, 1879, at the rate of 10 per cent. per annum. From the accounts it appears that the total expenditure on revenue account for the six months amounted to £1251 6s. 1d., while the receipts were £1899 19s. 4d. from sale of gas, £78 6s. 11d. for rental of meters, £355 12s. 2d. for residual products, and £4 5s. for rent, making a total of £2338 3s. 5d. There were 1151 tons of coal carbonized, which cost, including carriage, £527 17s. 11d. The total share and loan capital of the Company amounts to £17,300, and there has been expended on capital account to date £2832 more than this.

BROMSGROVE GAS CONSUMERS COMPANY, LIMITED.—The eleventh ordinary general meeting of this Company was held on Monday, the 9th inst.—Mr. W. Jefferies in the chair. The report of the Directors, recommending a dividend for the past year at the rate of 10 per cent., was adopted. The balance-sheet showed a profit of £985 1s. 8d., of which the dividend will absorb £900, leaving £85 1s. 8d. to be carried to the reserve-fund, making that fund £562 1s. 4d. Messrs. Bennett and Saywell, the retiring Directors, and Mr. F. N. Gosling, the Auditor, were re-elected; and a sum of £70 was voted to the Directors for their services during last year, and the like sum for each succeeding year, the amount to be divided *pro rata*, according to attendance. Votes of thanks were passed to the Directors, to Mr. H. Wright (the Secretary), to the Auditor, and to the Chairman.

LONGRIDGE GAS COMPANY.—The annual general meeting of this Company was held on Saturday, the 14th inst.—Mr. D. Irvin in the chair. The accounts presented showed that on Dec. 31, 1878, there was a balance of £480 6s. 1½d., which, added to miscellaneous receipts during 1879, £110 3s. 11½d.; gas and meter rents, £795 12s. 2½d.; and interest and commission account, £4 12s. 3d., made a total of £1390 14s. 6½d. The payments for 1879 were—Dividend, £287 17s. 2d.; dividend warrant not presented, 5s. 1d.; cost of Provisional Order, £180 16s. 3d.; amount appropriated to reserve-fund, £11 7s. 7½d.; salaries and wages, £142 1s. 6d.; canal, coal, and lime, £185 4s. 0½d.; rates, taxes, and sundries, £119 2s. 9d.; leaving a balance of £464 0s. 1½d. The Directors proposed to pay a dividend of 6 per cent., and carry the balance to the reserve-fund. The Chairman, in moving the adoption of the accounts, said he had pleasure in meeting the Shareholders, especially so when they were able to pay a dividend of 6 per cent. The Company had passed through a period of great commercial depression, but he was happy to say the Directors had, by good management and strict economy, secured a result which he thought would please them all. The motion was carried unanimously. The Chairman moved that a dividend of 6 per cent. be paid, and it was carried. The retiring Directors (Messrs. R. Walne, J. Walne, and R. Howarth) were re-elected. Votes of thanks to the Directors and the Secretary (Mr. R. Booth) for their services, and to the Chairman for presiding, terminated the proceedings.

NORMANTON GAS COMPANY.—The half-yearly general meeting of this Company was held on the 7th inst. The Chairman (Mr. W. Statter) said so far as the works were concerned, he had to report that they were in

good order, and the Directors thought they should not have to lay out much more on account of capital. Last year they expended £508, but they thought that another £100 would cover all they would have to lay out at present. The principal item had been the new scrubber, which had produced a considerable increase in the quantity of ammoniacal liquor, and their residuals account had been proportionately made larger. Last year their three years contract for the supply of gas to the Normanston railway station expired, and he had the satisfaction to inform the Shareholders that they had renewed the contract for the same period. The amount of leakage was rather against them, being 19 per cent., which was about double what it ought to be. But in all districts where coal was worked the leakage of gas was serious, owing to the ground constantly giving way below the mains. Their revenue from the sale of gas was somewhat diminished—£77 less than it was twelve months before; but the Shareholders must bear in mind that they had lowered the price of gas 4d. per 1000 feet. They had really sold more gas by 100,000 feet, which, though not much, was better than if the difference had been in the opposite direction. But while their revenue from gas had been £77 less, their residuals account was over £100 more, which was to be accounted for by the circumstances he had already mentioned. The total expenditure for the half year, in the production of the gas, &c., was £759 15s. The sale of gas in the ordinary way produced £487 19s. 7d., and by contract £742 7s. 5d., making a total of £1230 7s. Residuals had realized £265, against £137 last year, which, with other small items added to the revenue from gas, made a total of £1532 19s. 8d. This left a profit of £773 4s. 5d., as compared with £730 last year. It required £750 to pay their ordinary dividend of $7\frac{1}{2}$ per cent., so that after paying that dividend they would have £23 4s. 5d. to carry to the reserve-fund. Last half year they had to dip into the reserve-fund to pay the dividend, instead of adding to it, as they were doing this time. This fund would now stand at £1099. The accounts were then adopted, and a vote of thanks to the Chairman and Directors terminated the proceedings.

Register of Patents.

4288.—SNUGGS, E., Windsor, "Improvements in water-taps." Patent dated Oct. 25, 1878.

This invention relates to improvements on patent No. 2959, Oct. 12, 1869, and consists in substituting a quick-set screw, working in a moveable cap, for raising and depressing the plug, in place of the lever, and instead of a solid plug and shaft, a plug and central shaft revolves or rises and falls within a brass cylinder, around which is placed, when the tap is a cold-water tap, leather discs dressed with oil and French chalk, in order to resist the action of the water, and to diminish friction at the same time that it renders it impervious to the action of frost.

4290.—GALE, G., New Wortley, near Leeds, "Improvements in the means or apparatus for igniting, regulating, and extinguishing the lights in street and other lamps." Provisional protection only obtained. Dated Oct. 25, 1878.

These improvements consist in pneumatic apparatus attached to the taps of gas-lamps, so that by exhausting or drawing off the air from the apparatus the light may be reduced to any height, or entirely extinguished, and by the admission of air into the apparatus the gas may be ignited or adjusted, or *vice versa*. The pneumatic apparatus is worked by an air-pump or other convenient means.

4309.—BRUNTON, J., Westminster, "Improvements in sluice-valves or sluice apparatus." A communication. Patent dated Oct. 26, 1878.

In this apparatus, a counterbalanced lever with a segmental arch head at each end, and in length suited to the extreme variation of "head" that the water will undergo, is supported by a spindle in the centre. Attached to one head is a float and a chain, which passes to a winch, so as to cause the lever to turn on its pivot. The sluice-valve plate is attached to rods that are acted upon by a cam surface on the lever. By this means an equal discharge of water may be obtained in a given time, no matter how the head of water varies.

4312.—JOHNSON, S., Wood Green, London, "Improvements in apparatus for preventing waste of water in water-closets, urinals, lavatories, and other situations where intermittent supplies of water are required." Provisional protection only obtained. Dated Oct. 26, 1878.

To carry out these improvements, a syphon-pipe is placed in a cistern containing water not quite rising to the bend in the syphon, so that by plunging a block into the water the level is raised, and the water passes down the syphon tube into the water-closet until the end of the shorter leg of the syphon is uncovered.

4333.—ORME, D., Oldham, "Improvements in wet gas-meters." Patent dated Oct. 28, 1878.

In constructing a meter according to this invention, an ordinary float and valve are used at the inlet end or side of the meter, and at the front or back of the meter a compensating float of a semi-cylindrical or hemispherical form is placed. This float will descend into the water as it evaporates, and by so doing will maintain the water in the case at an uniform level, or nearly so. The meter is constructed so that the inlet pressure of gas will be on the water both in the front and back parts. The gas passes from the inlet valve into the body of the meter and into the measuring drum by the openings at the back, and after being measured is conducted by a bent pipe extending from the space within the cover of the drum to the outlet of the meter.

4352.—CUTLER, S., Millwall, "Improvements in gas-valves, and in the arrangement of the pipes connecting them with the vessels with which they may be employed." Application dated Oct. 29, 1878. (Void by reason of the patentee having neglected to file a specification in pursuance of the conditions of letters patent.)

This invention consists in forming a hollow vessel or chamber closed on all sides, and from the bottom of which and within it rise as many pipes as there are inlets to the valve. These pipes extend to about half the height of the vessel, and are connected at their lower portions to the respective mains over which the valves have control. Each pipe is covered by a bell or cylinder closed at the top, and capable of being raised above the mouth of the pipe. Each of these bells may have fixed to it a central vertical rod, which extends downwards through a guide to the bottom or near the bottom of the pipe, and upwards through a stuffing-box in the top of the chamber, the upper part of the rod that protrudes being screwed or having a rack attached to it. On the top of the outside of the vessel is a frame through which the screwed ends or racks of the rods pass, each rod being furnished with a nut and hand-wheel, or a pinion wheel and handle, so as to raise or lower the bell over its corresponding pipe. In the upper part of the chamber is formed an orifice which serves as an outlet. The chamber being partially filled with liquid, and all the bells down, on gas attempting to pass from any of the inlets into the chamber, it will be unable to do so, the bells being sealed in the liquid; but on raising any one or more of the bells above the surface of the liquid, a free way will be offered to the passage of the gas, and it will pass to the

outlet without obstruction. In order to prevent any sudden check to the flow of the gas when closing the valve, and as a means of regulating the flow, the bottom edge of the bell may be formed with deep serrations, so as gradually to reduce the area of the gas way, and in like manner increase it when opening the valve.

4353.—IMRAY, J., Southampton Buildings, London, "Improvements in the treatment of ammoniacal liquor for the separation of ammonia compounds therefrom." A communication. Patent dated Oct. 29, 1878.

In carrying out this invention, the ammoniacal liquor is placed in a vessel, and to it is added a quantity of calcium chloride, proportioned to the quantity of water in the liquor, and the contents are well mixed by stirring. There is then added a small proportion of either chloride of iron, or of chloride of iron and calcium, or of sulphate of iron. When sulphate of iron is used, it is suspended in the liquid in a bag of open fabric. After allowing the mixture several hours to settle, the upper portion is run off by the cock into a flat evaporating vessel of iron plate, heated by the waste heat of the furnaces. It is of advantage to put into the evaporator a small quantity of the double chloride of ammonium and lead, as this furnishes (by deposit of lead) a protecting surface on the interior of the evaporator, rendering the use of lead lining unnecessary. The liquid in the evaporator is then concentrated to any desired degree.

4423.—JOHNSON, J. H., Lincoln's Inn Fields, London, "Improvements in pumps or apparatus for raising liquids." A communication. Patent dated Nov. 1, 1878.

This invention consists in raising liquids by the employment of pumps or apparatus operating by pulsations under the action of steam intermittently supplied at one side of a flexible diaphragm in a suitable chamber; while at the opposite side of the diaphragm is drawn or admitted the liquid to be raised. The pump or apparatus is provided with valves all arranged in combination one with the other and with the diaphragm.

4514.—WRIGHT, W., Herne Hill, London, "Improvements in valve apparatus for regulating or controlling the supply and discharge of water or other fluids." Patent dated Nov. 7, 1878.

In this apparatus, at the end of the supply-pipe over the cistern is a small cylinder which forms a continuation of the pipe, and presents its mouth downwards, so that the water will be discharged into the cistern when the valve is open. The interior of the cylinder is rounded at the upper end, and forms a seat for a ball of flexible material, which, when pressed tightly to the seal, closes the aperture leading from the supply-pipe, and prevents the flow of any water.

4525.—CHANDLER, S., Newington Causeway, London, "Improvements in the construction of apparatus used in the manufacture of gas." Provisional protection only obtained. Dated Nov. 8, 1878.

This invention has special reference to the method of construction of apparatus mentioned in patent No. 4928, Dec. 29, 1877. [See JOURNAL, Vol. XXXIV., p. 443.] In that patent it was proposed that "annular plates" should be connected together, leaving spaces between for the gas to pass through, the objection to this being the inconvenience of having to remove a very considerable portion of the machinery to get at even one set of annular plates, besides irregularity in the spaces. The patentee in consequence devised a plan of forming the spaces by means of segments of material being bolted together in blocks, leaving narrow spaces for the gas. They are made taper, slide into a frame, and are secured to a cross-bar at the lower part, and bolted to either side of the frame at its upper part. Thus when the whole of the segments are placed in the frame, annular plates will be formed, although not connected together as described in the former patent.

4539.—PRESTON, F. P., PRESTIGE, J. T., PRESTON, E. J., FOWLER, J. A., and SIMMONS, W. G., Deptford, Kent, "Improvements in apparatus for measuring, regulating, controlling, and arresting the flow of fluids." Patent dated Nov. 8, 1878.

This apparatus consists mainly of a cylinder with a piston working therein, and fixed on a hollow piston-rod, or trunk, or tube. The piston may be made with an easy fit and without packing, or it may be provided with cup leather or other packing, and there is a small passage (which may be made adjustable by a cock or valve) communicating with both sides of the piston, but by preference the communication is made by a small aperture through the piston, and having a plug loosely fitting through it. The tube or piston-rod seats itself at one side against a valve, which is actuated by a screw or lever, or other suitable appliance, and at the other side it is open to the outlet. When the valve is withdrawn from the end of the tube, the water can pass to the outlet through the tube, the latter with its piston gradually receding from the end of the cylinder, while fluid passes from one side of the piston to the other, until the tube seats itself against the valve again.

4585.—HADDAN, H. J., Strand, London, "Improvements in purifying and increasing the light power of illuminating gas." A communication. Patent dated Nov. 12, 1878.

This invention consists, first, in purifying illuminating gas by passing it through bone-black or animal charcoal, whereby sulphur and ammoniacal compounds, and so forth, are separated from the gas; secondly, in carburetted gas by passing it through bone-black or animal charcoal which has been impregnated or saturated with hydrocarbons.

4700.—MILLER, A. and A., Glasgow, "Improvements in the manufacture of illuminating gas, and in the utilization of the impure products resulting therefrom." Patent dated Nov. 19, 1878.

This invention was fully described and illustrated in the JOURNAL for Sept. 30 last [Vol. XXXIV., p. 514].

4727.—LOWRY, G., Salford, "Improvements in rotary engines, pumps, blowers, and meters." Patent dated Nov. 21, 1878.

In carrying out this invention, a cylindrical casing is formed with passages to convey the fluid to and from the apparatus, and fitted with end plates, in which a central shaft revolves. This shaft carries a crank which fits in a drum, the semi-diameter of which, plus the radius of the crank, is equal to the semi-diameter of the cylindrical casing, so that as the crank revolves some part of the periphery of the drum always touches the interior of the casing, and the two ends of the drum work in contact with the ends of the casing. The drum, which acts as a piston, does not rotate, being prevented by a partition secured to, and projecting from the interior of the casing towards its axis, and extending across the casing parallel to its axis and into a slot extending across the drum.

4728.—GREATHEAD, J. H., Westminster, and MARTINDALE, M. D., Anerley, Surrey, "Improved means and apparatus for the supply of high-pressure hydrants or stand-pipes." Patent dated Nov. 21, 1878.

With this apparatus, a system of small pipes is employed, each of which is charged with water at a high pressure from an elevated cistern. A nozzle is introduced from one of these pipes into the hydrant stand-pipe; and, by causing a jet of the high-pressure water to issue from the nozzle into the current of low-pressure water furnished by the main, the velocity of the latter is increased, and the combined jet may be employed to command the desired height.

4730.—GENT, J. S., Manchester, "Improvements in gas-burners." Application dated Nov. 21, 1878. (Void by reason of the patentee having neglected to file a specification in pursuance of the conditions of letters patent.)

The case of a burner constructed according to this invention is tubular, and is formed with an internal shoulder, above which is a small cap or gasholder able to move freely lengthwise of the case, and of such size as to leave an annular space for the passage of gas between the interior surface of the case and the cap. Above the cap is a ring of curved cross section, forming a seat against which the top of the cap may bear as a valve. The tip, in which are the exit holes for the gas, is, at its under part, of tapering form, terminating with a shank which serves as a stop for the cap, and also to heat the gas so that its combustion may be more perfect.

4760.—DUNCAN, G., and WILSON, W. A. and G. A., Liverpool, "Improvements in gas motors." Provisional protection only obtained. Dated Nov. 22, 1878.

This gas engine is constructed with two essential parts—(1) a cylinder, piston and fittings, in which the combustion of the mixed or diffused gas or vapour and air takes place, and (2) a pump operated from the crank-shaft of the engine into which or out of which the gas or vapour and air are drawn, preferably side by side in layers, and then compressed. This compressed gas or vapour and air is allowed to pass into the working cylinder by means of automatically operated cocks, valves, or their equivalents. The mixture is then ignited by any well-known methods, and power obtained from the explosion in any of the usual ways. The engine is provided with governors, check-valves, and other appliances of the ordinary kind.

APPLICATIONS FOR LETTERS PATENT.

712.—MAUGHAN, B. W., Cheapside, London, "An automatic apparatus for regulating the varying pressures, or controlling the supply of gas or other fluid." Feb. 18, 1880.

728.—CHANDLER, S. and J., Newington Causeway, London, "Improvements in gas apparatus." Feb. 18, 1880.

735.—WILKINSON, W. B., Kingston-upon-Hull, "Improvements in apparatus used with gas or other lights for holding the globes or other glasses used therewith." Feb. 19, 1880.

744.—WRIGHT, J., Tipton, Stafford, "Improvements in apparatus for heating and purifying water." Feb. 19, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

3347.—BRAY, G., Leeds, Yorks, "Improvements in street and other lamps and burners, also in means employed for increasing the illuminating power, brilliancy, and steadiness of gas-flames." Aug. 19, 1879.

4340.—WILLIAMS, H., Southport, Lancs, "Improvements in and relating to atmospheric air and gas motor engines." Oct. 24, 1879.

5103.—THOMAS, J. T. C., Minorities, London, "Improvements in apparatus for lighting and heating purposes." Dec. 12, 1879.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

448.—WIGHTMAN, G., and ALLEY, S., "Improvements in water-meters." Feb. 2, 1877.

451.—FINCH, B., "An improvement in valve water-closets and in water supply-valves." Feb. 2, 1877.

487.—MATHER, W., "Improvements in apparatus to be used in raising water from artesian and other wells." Feb. 5, 1877.

502.—CHATWIN, T., "Improvements in screw-wrenches or screw-spanners, and in gas-grips." Feb. 6, 1877.

523.—THOMAS, J., "Improvements in direct-acting steam-pumps." Feb. 7, 1877.

550.—ROWATT, T., jun., "Improvements in lamp-burners." Feb. 8, 1877.

556.—LAKE, W. R., "Improvements in water engines and pumps." Feb. 9, 1877.

601.—NAWROCKI, G. W. VON, "Improvements in water-meters." Feb. 14, 1877.

PATENTS WHICH HAVE BECOME VOID

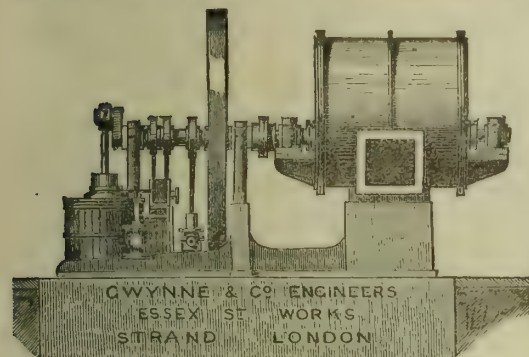
BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

205.—WILLIAMS, M., "Improvements in the manufacture of gas." Jan. 17, 1873.

236.—STIDDER, J. G., "Improvements in apparatus for drawing and preventing waste of water from pipes, mains, cisterns, and other sources, also ball and supply valves for domestic and other purposes." Jan. 20, 1873.

274.—PATTERSON, R. H., "Improvements in the purification of coal gas, and in the production of alkaline sulphides to be employed for such purpose." Jan. 23, 1873.

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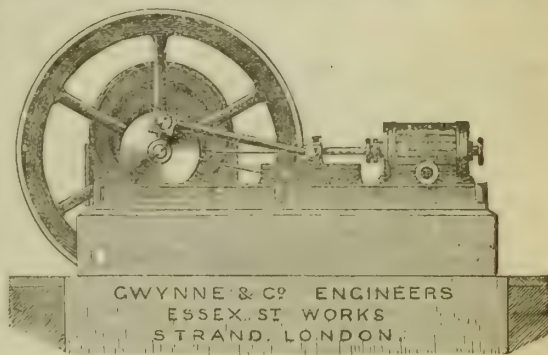
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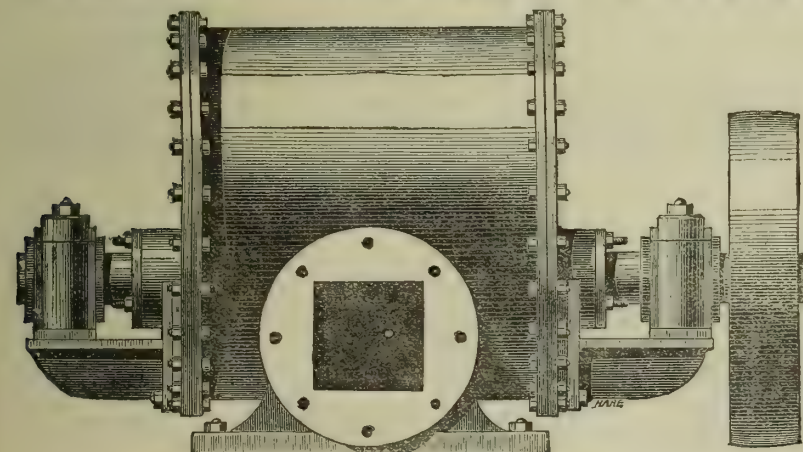


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Address, with copies only of testimonials, No. 630, care
of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Working Manager for a
small Gas-Works in Gloucester-hire. He must
be well acquainted with the Manufacture and Distillation
of Gas, Main and Service Laying, General Repairs, and
the Taking of Meter Indices. Annual make under 3 mil-
lion. House, coal, and gas free.
Applications, by letter only, to be made to No. 631, care
of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

METER INSPECTOR, &c.

WANTED, by the Banbury Gas Com-
pany, a competent person to take the entire charge
of the Meters (chiefly wet), and Inspection of Service-
Pipes and Public Lamps.
State age, reference, and wages. None but those who
can produce first-class references need apply.
Address Mr. W. R. COOPER, Gas-Works, Banbury, OXON.

THE NORTHWICH GASLIGHT AND COKE
COMPANY, LIMITED.

WANTED, a Gas Manager. Make
20 millions. Salary £100 per year, with house,
coal, gas, water, rates, and taxes free.
Applications, stating age, &c., to be sent in not later
than Saturday, March 6, 1880, addressed to the Chairman,
sealed and endorsed “Gas Manager.”
HENRY PICKERING, Secretary.
Northwich, Feb. 14, 1880.

THE Leominster Urban Sanitary Autho-
rity require a Competent WATER-FITTER and
INSPECTOR of Mains and Fittings.
For particulars apply by letter, prepaid to Mr. G. T.
ROBINSON, Clerk to the Authority, 9, Church Street,
LEOMINSTER, stating wages.
Good references required.

SPENT OXIDE OF IRON—About 100
Tons for Sale at the Manchester Corporation Gas-
Works.
Samples and further particulars on application to Mr.
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PLANT Erected for Working Nitro-
genous Matters, such as Night Soil, Sewerage,
Hair Waste, &c., into Ammoniacal Liquor, Liquor Am-
monia, Sulphate of Ammonia, and Residuals; or plans and
specifications supplied. Price on application. Also
Working Models of above apparatus sent c.o.d., carriage
paid, price £8 8s.
Address JOHN G. HARVEY, Milnsbridge, HUDDERSFIELD.

FOR SALE—Gas Governors of very sub-
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Particulars on application to the IMPERIAL METER COM-
PANY, LIMITED, King's Road, St. PANCRAS, N.W.

FOR SALE—A Set of Four Purifiers,
each 18 ft. long by 8½ ft. wide, and 6 ft. deep, with
Centre-Valve and 12-in. Connections complete.
Parted with as being too small.
Offers to be addressed to the MANAGER, Edinburgh and
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Re HARRISON AND YOUNG.

WORKS for Sale, containing complete
and almost new Plant for Manufacture of Muriaie
of Ammonia, Sal-ammoniac, and Carbonate of Ammonia.
Good water frontage, ample room for extensions, and 23
years lease.
Apply LAUNDY AND CO., 33, King Street, CHEAPSIDE, E.C.

NOTICE TO MANAGERS OF GAS COMPANIES.

THE LAW UNION FIRE AND LIFE INSURANCE
COMPANY, of No. 126, Chancery Lane, London, grants
Policies of Insurance on Gas-Works, and Buildings con-
nected therewith, which cover risk of explosion and spon-
taneous ignition of Coal, on very advantageous terms.
Full particulars will be sent post free on application to
FRANK M'GEDY, Secretary.
126, Chancery Lane, London.

WATER-WORKS DEBENTURES TO PAY SEVEN
PER CENT.

TO BE SOLD—Debentures in the Truro
Water-Works Company, having about 3½ years
further to run, at a price that will pay the buyer 7 per
cent. The debentures constitute a first mortgage on the
whole of the property of the Company and form part of
a series of £4000, the only amount the Company is autho-
rized to raise by their Act of Parliament.
Applications, by letter, to be made to No. 632, care of
Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BOROUGH OF OVER DARWEN.

THE Gas Committee of the above Cor-
poration are prepared to receive TENDERS for the
Supply of 112 RETORTS, and the necessary Bricks, Tiles,
&c., for setting same.
Specifications and forms of tender may be had from the
undersigned, and tenders, endorsed “Tender for Retorts,”
to be delivered to C. Coker, Esq., Town Clerk, Darwen,
on or before Tuesday, March 16, 1880.
THOS. DUXBURY, Manager.

GUILDFORD GASLIGHT AND COKE COMPANY.

THE Directors of the above Company
are prepared to receive TENDERS for a Supply of
COAL and CANNEL for One or Two years, commencing
April next. Probable quantities per year, 3000 Tons Coal,
1500 Tons Cannel.
Tenders, stating price per ton delivered at Guildford
Railway Station, to be delivered on or before Tuesday next,
March 2, 1880, to Mr. LONGWORTH, Gas Offices, GUILDFORD.

AMMONIACAL LIQUOR.

THE Best Continuous Method for Work-
ing Large or Small Quantities of Liquor. This is an
improvement on what is known as the “Coffee Still Pro-
cess.” The result in sulphate of ammonia is very large,
nearly every atom of ammonia gas being driven out of the
liquor before it is liberated, also a saving in acid. Small
Working Models to work about 5 gallons per day, with
steam boiler and every requisite, sent c.o.d., carriage paid,
price £4 4s.
Address JOHN G. HARVEY, Milnsbridge, HUDDERSFIELD.

RAMSGATE IMPROVEMENT COMMISSIONERS—
GAS AND WATER DEPARTMENT.

THE Gas and Water Committee invite
TENDERS for about 60 Tons of SULPHURIC
ACID, delivery to extend over Twelve months.
The Committee do not bind themselves to accept the
lowest or any tender, which should be sent in not later
than 2 p.m. on the 26th of February, addressed to the
Chairman.
Particulars on application to
WILLIAM A. VALON, Engineer.

RAMSGATE IMPROVEMENT COMMISSIONERS—
GAS AND WATER DEPARTMENT.

THE Gas and Water Committee invite
TENDERS for about 490 ft. of Machine-made CLAY
RETORTS, particulars of which may be obtained on
application.
The Committee do not bind themselves to accept the
lowest or any tender, which should be sent in not later
than 2 p.m. on the 26th of February, addressed to the
Chairman.
WILLIAM A. VALON, Engineer.

CORPORATION OF LEICESTER—GAS
DEPARTMENT.

EXHIBITION OF GAS-ENGINES, COOKING-STOVES,
BURNERS, AND OTHER APPARATUS.

THE Gas Committee of the Corporation of
Leicester intend holding, from the 12th to the 17th
of April next, an EXHIBITION of all kinds of Apparatus
or Appliances showing the Advantages and Economical
Uses of Gas for Engine, Cooking, Domestic, and other
purposes. They will provide space, gas, and connections
free, and give Certificates of Merit.
Intending Exhibitors will be furnished with printed
conditions, forms for allotment of space, and any further
information, on application to
G. A. AND C. S. ROBINSON, Managers.
Gas Offices, Millstone Lane, Jan. 23, 1880.

GAS PLANT FOR SALE.

THE Coventry Gas Company have for
Sale—
PURIFIERS.—Two Sets of Four Purifiers each; each
vessel 12 ft. square and 4 ft. 6 in. deep. 12 in. Connections
and dry Centre-Valve (Cockey's make), Lifting Apparatus,
&c., complete.
SCRUBBERS.—One 5 ft. 6 in. diameter, 20 ft. high. One
5 ft. 6 in. diameter, 15 ft. high. One 5 ft. diameter, 20 ft.
high; with or without 8-in. Connections and Valves.
METER.—One 12,000 feet per hour (Parkinson's make),
8-in. Connections and Valves.
GASHOLDER.—One Telescope, 40 ft. diameter and 34 ft.
high, in two lifts; Cast-iron Tank for same, 41 ft. 6 in.
diameter, 15 ft. high.
VALVE.—One 12 in. Cathel's Four-way Valve.
The above are being replaced by large apparatus, and can
be removed at once. Also a 100-light Gas Apparatus,
(Porter's make.)
For particulars and prices apply to
W. L. ROBINSON, Manager.
Gas-Works, Coventry, Feb. 21, 1880.

TO IRONFOUNDERS.

THE Dover Gaslight Company invite
TENDERS for certain CASTINGS, the drawings
and specifications of which can be seen at my Office, or at
the Office of Mr. T. N. Kirkham, 20, Abingdon Street,
Westminster.
The party whose tender may be accepted will be required
to enter into an agreement for the performance of his con-
tract; but the Company do not bind themselves to accept
the lowest tender.
Tenders to be sent on or before Friday, the 5th of March
next, marked “Tender for Castings,” addressed G. FIELD-
ING, Secretary, Dover Gas Company, 14, Suargate Street,
DOVER.

CORPORATION OF BIRMINGHAM—GAS
DEPARTMENT.

THE Gas Committee of the Corporation
of Birmingham are prepared to receive TENDERS
for the TAR to be produced at their various Works for a
period of One, Three, or Seven years, from the 30th of June
next.

The quantities produced in 1879 were as follows:—
Saltley Works. 8,500 Tons.
Windsor Street Works. 5,000 ”
Adderley Street Works. 2,500 ”
Swan Village Works. 3,000 ”

Total. 19,000 Tons.

The Committee will receive tenders, either at a fixed
price per ton, or at a price to be calculated on a sliding
scale, varying with the selling price of products.
The Corporation are prepared to let on lease a portion of
their surplus land, on which Tar Works could be erected.
Forms of tender may be obtained on application to me.
EDWIN SMITH, Secretary.

Old Square, Birmingham.

Price 5s., post free. Limp cloth.

ANALYSES of COALS & CANNELS,
MADE FROM BULK.

By ROBT. I. TOOTILL,

COAL AND CANNEL ANALYST AND PRACTICAL GAS CHEMIST.

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THE Tawd Vale Colliery Company,
Limited, are prepared to Contract for the Supply of
their superior Arley and other GAS COALS, and to send
samples to the order of Gas Engineers and others, or
complete Analysis, on application. Shipped at Liverpool,
Preston, Fleetwood, Garston, or Birkenhead.
Mr. James Paterson, C.E., F.G.S., in his analysis of
T. V. Arley Coal, says: “Some parts merge into a semi-
Cannel; gas per ton, 10,300 cubic feet; illuminating power,
16·96 candles; coke of high quality, 1431 lbs. per ton.”
Collieries, Skelmersdale, near Ormskirk; Offices, 5, New
Hall, Old Hall Street, LIVERPOOL.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had
considerable experience in matters connected with
Gas, Water, and Sanitary Improvement, begs to say that
he continues to assist Inventors in the perfection of their
designs, and to obtain for them PROVISIONAL PRO-
TECTION, whereby their invention may be secured for
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3 quires, 36s.; other sizes and bindings to order.

THE

**GAS COMPANIES
EXPENDITURE JOURNAL,**

Being a Ruled Account-Book with Printed Headings,
and Analyzing Guide for Keeping, upon the easiest
and most correct method, the Expenditure of a Gas
Company, in accordance with the provisions of the
Gas-Works Clauses Act of 1871, and suitable for all
Companies.

Specimen, with illustration and full particulars;
2s. 6d. returned on the purchase of a “Journal.”

Published by SANDELL AND SON, Accountants,
2, Great George Street, WESTMINSTER, and W. KING,
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Court, FLEET STREET, E.C.

Now Ready, Price One Guinea,

PRECEDENTS IN PRIVATE BILL LEGISLATION AFFECTING GAS AND WATER UNDERTAKINGS.

COMPILED BY MR. G. W. STEVENSON, C.E., F.G.S.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

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TO CORRESPONDENTS.

We are obliged to hold over till next week the reports of several gas companies meetings, which have been forwarded to us; as well as communications that arrived too late for notice to-day.

F. D.—We think you have misunderstood the remarks of the gentleman you mention. We are, however, obliged to you for calling attention to them.

A MEMBER OF "B. A. G. M.," AND SUBSCRIBER TO ITS BENEVOLENT FUND.—The Secretary of the Company was right in regarding a letter sent him, under the circumstances you name, as a private communication not to be given over to you.

G. WARREN DRESSER, New York.—Thanks for pamphlet received, "Report on the Topophone and the Electric Light." By Professor Henry Morton, Member of the Lighthouse Board; being the Appendix to the Annual Report of the Board for the Year ending June 30, 1879; Washington, 1880.

RECEIVED.—"Lightning Conductors, their History, Nature, and Mode of Application." By Richard Anderson, F.R.S., &c. London: E. and F. N. Spon.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 2, 1880.

Circular to Gas Companies.

WE had some hopes that the scheme for the amalgamation of the Phoenix and South Metropolitan Gas Companies would have been confirmed at the Privy Council held on Thursday last. This, however, was not the case. The matter still stands over, and now we have rumours that the last amended scheme has been altered and put into the shape in which it is

to be presented to Her Majesty in Council. So far as we can learn, the difference between the last "amended" scheme and this final document are not very great. We know how averse some people are to the payment of Directors, no matter how much their services may be required, and therefore we are not surprised to learn that under the scheme the Board of Trade have cut down the number of these functionaries from twelve to ten, the number to be ultimately reduced to eight. The remuneration of these Directors is, we believe, not to exceed £400 per annum each, and those retiring will only be entitled to seven years purchase of their emoluments. So far as the capital arrangements are concerned, we understand that these will remain the same as settled in the last "amended" scheme. Why this business has hung so long on the hands of the Board of Trade we cannot imagine. All that has been done might have been easily settled within a week or a fortnight, and yet the two Gas Companies concerned have been kept on tenter-hooks, and have had to make innumerable journeys to Whitehall Gardens, only to be told that everything was settled, when something turned up to unsettle the arrangements. We may be thankful that, if what we hear be true, the Companies will henceforth be free from any other interference from the Board. There is, it is said, "many a slip between the cup and the lip," and it may be that this last and, as reported, finally settled and irrevocable scheme will be withdrawn for further consideration. The Metropolitan Board of Works have not yet approved of it, but have referred it to their Works and General Purposes Committee to report thereon. We cannot imagine that anything the Metropolitan Board may say on this matter will influence the Board of Trade in their action; but, as unlikely things do sometimes happen, we cannot feel certain, even now, that the scheme is definitely arranged.

We object to these delays, on account of the present position of the two amalgamating Companies, who have, each of them, a Bill before Parliament. That of the Phoenix Company has not yet passed the Examiners, and we may be excused in expressing a hope that it never will. The Bill of the South Metropolitan Company, which, in its essential provisions, is identical with that of the Phoenix, has passed the first reading, and will, no doubt, go forward—that is, if a speedy dissolution does not put off for a time all private parliamentary business. On this account we cannot help thinking that the unnecessary delay of the Board of Trade has acted prejudicially to the interests of the Companies concerned. Supposing the scheme had been confirmed, the Bill of the South Metropolitan Company might have gone forward, and by this time almost have passed the Commons. There is really no opposition to it, except from the Metropolitan Board of Works, who are anxious to cut down the initial price from 3s. 6d. to 3s. The Lambeth Vestry protest against the acquisition of land at Greenwich for the erection of new works; but opposition of this kind will only afford food for laughter. Lambeth is not at all likely to be annoyed by gas-works at the far end of Greenwich, and probably no one will pay the smallest attention to opposition of this kind. If the members of the Vestry are really serious in their opposition, we would recommend them to engage, if they can, the services of Sir E. Beckett, Q.C., Mr. Venables, Q.C., and Mr. Pope, Q.C., and when these gentlemen have exhausted their eloquence, cheerfully pay the surcharges that will be made by the Auditor.

It remains to say a few words on the question of initial price. When the sliding scale was adopted, it was understood that the Gas Companies would have a fair margin of profit, if they could make it at the initial price, while higher dividends might be secured if the price were brought below the standard. Now that circumstances place the Companies in a position to make additional profits by reduced prices, a cry is immediately raised that the standard must be lowered. The fact is altogether overlooked that the sliding scale works upwards and downwards. Just at present the Gas Companies, with low-priced coal, are making good profits; but the cost of the raw material is rising day by day, so that in the course of a year or so we may find the price of gas raised, and the dividends will thus be reduced. It would, then, under existing circumstances, be extremely unfair to pull down the initial price of the South Metropolitan Company. This would fall with greater hardship when the Company are united with the Phoenix. The latter Company have struggled manfully to keep down the price of gas, and have succeeded up to a certain point. When joined with the South Metropolitan, further concessions must necessarily be made to the consumers in the Phoenix Company's district. The effect of a reduction must inevitably be felt by the South Metropolitan Company when the scheme is brought into full operation, though we do not anticipate that any directly evil results to the Company will follow from the combination. The "A"

shares will, of course, continue to receive the enhanced dividends to which they are entitled under the schemes of amalgamation, and can only suffer in common with others. We are no alarmists, but we feel bound to protest against the continued attempts to depreciate the value of gas property. When the Bill of the South Metropolitan Company comes before a Committee of the House of Commons, we shall hear all that the Metropolitan Board have to allege in support of a reduced initial price. We venture to assert, however, that nothing will be brought forward which will satisfy a Committee that any change should be made in the standard price fixed by the Committee of 1876. If any change be made, we are satisfied that it will be in an upward direction; and but for the fact that the South Metropolitan Company have not applied for it, we think it not unlikely that the price asked for by the Phoenix Company—viz., 3s. 9d. per thousand feet—might have been granted. It is useless, however, to speculate now. The amalgamation scheme is, we understand, virtually sanctioned; the Bill of the South Metropolitan Company will go forward, and that of the Phoenix Company be dropped, and there, for the present, the matter ends.

A Local Government Board Inquiry has been held at Stone, the Local Authority of which wished to obtain power to set up gas-works. Now there is already at Stone a Company supplying excellent gas at a very moderate price, but the Company is non-statutory; hence, of course, it offers points of attack which could not be made if it were under parliamentary authority. For instance, the Company are charged with making enormous profits, and applying revenue to extensions; and this they have a perfect right to do. The Local Board have been long anxious to purchase the undertaking, but could never arrange terms with the Gas Company, who asked £20,000 for their undertaking, and refused to take a less sum. As a consequence, the Local Board determined to apply for powers to set up competing works, and hence the inquiry we notice. There can be no doubt that it would be quite within the power of the Local Board to erect gas-works if they could obtain the money; but it was explained to them that a place like Stone could not support two works. One or the other, if not both, must prove unsuccessful, and most likely that of the Local Board would suffer most in the course of a competition. However, all thought of competition has been dissipated by the expressed opinion of the Inspector that power to raise a loan would not be granted. At the same time he appears to have seen that the Company had made large profits, and were under no legal restrictions. He therefore obtained from the Chairman of the Company a promise that next year they would go to Parliament for an Act of Incorporation, and so place themselves under all the usual limitations imposed by modern gas legislation.

A sparsely-attended meeting of owners and ratepayers, under the Borough Funds Act, 1872, was recently held at Hanley, to authorize the Corporation to expend the rates in opposing the Bill of the British Gaslight Company now before Parliament, which is to empower the Company to expend a sum of £75,000 on their Staffordshire Potteries undertaking. The allegation of the Corporation is that this £75,000, which the Company have in hand, and only wish for power to expend, is, in reality, accumulated profits, which should have been applied to a reduction of the price of gas. But gas is not dear at Hanley, and the Company have made several reductions. The price now charged is 5s. per thousand feet, with a discount of tenpence per thousand for prompt payment, making the net price 4s. 2d., and even less to large consumers. Of course, one object of the Town Council, as we have previously mentioned, is to gain possession of the undertaking, which the Company absolutely and positively refuse to sell. The Bill promoted by the Company has been read a second time, and will soon be in committee, and then we shall find how the land lies.

It is a curious thing that the Corporation of Norwich, who have a standing feud with the British Company, never quote the case of Hanley. They make all they can of the difference in price between Hull and Norwich, but they say nothing of Hanley, in which the conditions more nearly resemble those of Norwich. The last step taken by the Norwich Town Council has been to obtain a report from their Parliamentary and Bye-laws Committee on the gas supply of Norwich as compared with other places; but the Committee seem to have avoided all comparison with Hanley. It has been clearly explained to them why gas can be supplied so much cheaper at Hull than in Norwich; but the Norwich Corporation will not accept the explanation. They must, however, admit that they are in nowise worse off than the Corporation of Hanley, who make no direct reference to Hull. We shall

be very glad when these everlasting squabbles with the British Company are ended. We believe that the Company can hold their own against all opponents, and the proceedings which will be presently commenced before a Committee of the House of Lords, in the case of the Staffordshire Potteries Bill of the Company, will, we expect, demonstrate that the Company are acting quite within their powers, and in reality in the interests of their customers.

The Wakefield Gas Company are, we may say, as remarked above, reaping the advantages of the sliding scale. They pay for the past half year a dividend of eleven per cent., and, after that, carry the large balance of £1258 to the reserve-fund, which now amounts to £6515. The quality of the gas supplied is exceedingly well maintained, and no complaints of any kind are heard against the Company.

The Croydon Commercial Gas and Coke Company are doing exceedingly well under the sliding scale. The profits that they made at the reduced price of gas during last year enable them to pay a dividend of twelve per cent. on their original, and nine per cent. on their additional capital for the past half year. The Directors report and accounts for the six months have been issued in anticipation of the meeting to be held to-morrow. The report sets forth what we have said above; but beyond this, and an account of the construction of some new gasholders, it possesses no features of interest. It stands to reason that the stock of a Company so prosperous should command a high price in the market, and accordingly last week at a sale of £5 shares, which, of course, have been fully paid up, each share entitled to ten per cent. realized, on the average, £11 7s. 6d., while the others, entitled to only seven per cent., brought £8 7s. 6d. Who can say, after this, that gas property is depreciated in value? The records of the Stock Exchange bear witness that the shares in the London Gas Companies fully maintain their value, and in the case of the South Metropolitan Company rise in worth. The last quotations, indeed, show that the South Metropolitan Company's shares have risen to an extent which we must regard as something more than their worth. "Hope springs eternal in the human breast," and it may be that the purchasers of these gas shares expect that imminent combinations will enable the Company to pay even larger dividends than at present.

We are happy to say that an understanding has been come to between the Prescot Gas Company and the Local Board, by virtue of which all opposition to the Company's Bill now in Parliament will be saved. The question in dispute was one more of price than quality, and accordingly we find it settled that the price shall range between 5s. 10d. and 5s. 4d. per thousand feet, according to the total sale of gas by the Company, with a reduction of ten per cent. for prompt payment. Thus one more parliamentary contest is avoided.

The second meeting of the Town Council of Maidstone, under the Borough Funds Act, has been held, and it now only remains for a town's meeting to give their sanction to the opposition by the Town Council to the Bill of the Gas Company now before Parliament. The opposition is, perhaps, hardly justified, for the Maidstone Gas Company have always supplied gas of good illuminating power. With respect to sulphur, it may, at times, have been what some would call in excess; but when the Company's plant is enlarged, all this will be made right. As regards what should be the initial price under the new Act, that must be arranged before Committee. We cannot think 4s. per thousand feet too high for Maidstone, but we have no doubt that others may regard it as excessive.

Pintsch's light is receiving extended application in the lighting of buoys, and continues to meet with approval. The light placed on the Shoals Rock in the Firth of Clyde is voted a great success, and now we read of a proposal to place a series of these lights between Glasgow and Greenock, which will give the river the appearance of an illuminated street, and allow the steam traffic to be carried on by night with as much safety as it is by day. We have, on a previous occasion, remarked on the wastefulness of the Pintsch system, by which it is necessary to keep the light burning continuously during the twenty-four hours. We recommended an automatic apparatus for lowering the light in the daytime, and turning it on full for the dark hours; but really, if what we now read be substantiated, economy of this kind is needless, for it is said that the light of the buoy costs only threepence per day of twenty-four hours. We feel bound, however, to remark once more that if the lights be no better than those supplied to railway-carriages, they can be of very little use to the mariner threading his way on a dark night up the Clyde. Still it is a triumph for gas; but we may express a hope that it will soon be eclipsed.

Water and Sanitary Notes.

MR. FAWCETT sticks to the Home Secretary with great pertinacity. Last evening he again wanted to know from Mr. Cross when the Bill relating to the Water Supply of London would be introduced. For answer, he received the assurance of the Home Secretary that he would ask permission of the House to bring in the Bill and make a statement this evening, promising Mr. Fawcett that if the Bill were introduced, copies of it should be in the hands of honourable members to-morrow morning.

The Liverpool Corporation Water Bill, which is to authorize the Corporation to carry out what is known as the Vyrnwy scheme, came on for second reading last Tuesday. The unusual course was adopted of attempting to strangle the measure by an endeavour to prevent the second reading. It is almost a wonder that the attempt was not successful; it would have been if Mr. Selater-Booth had not come to the rescue, and urged the House to consent to the Bill being read, and then referred to a Hybrid Committee. To this course the House consented, and presently we shall have the spectacle of a grand fight between the Corporation of Liverpool and the opponents of the scheme, who have not yet clearly declared themselves. The reasons put forward against the second reading of the Bill by Mr. Rowley Hill, the member for Worcester, were neither strong nor were they strictly accurate. He argued that the Vyrnwy watershed did not geographically belong to Liverpool, whom he recommended to go to their own district for an additional supply of water. The fact is that no further supply can be obtained in the district of Liverpool, and the Corporation must, therefore, look abroad for some other source from which to satisfy their needs. It is perfectly true that it has been recommended by a Royal Commission that no corporation or other water authority should be allowed to invade the natural watershed of another authority, unless strong reason could be shown for departing from the rule. But who besides Liverpool want the water of the Vyrnwy? The water runs to waste during the greater part of the year, sometimes assisting in flooding the banks of the Severn and doing enormous damage. There is every reason to believe that if the scheme of the Corporation of Liverpool be carried out, all the inconveniences which ensue from the present condition of things will be remedied. The Corporation will store flood water when heavy rains prevail, and so prevent inundations. Again, they will, in dry seasons, let out the water so stored, and so prevent droughts. In fact, in the minds of reasonable people, a strong belief exists that the operations of Liverpool will conduce to the improvement of the Severn. At all events, 151 riparian proprietors believe this, and have petitioned in favour of the Bill. The Local Authorities who have threatened opposition will probably be frightened from going on, when they come to consider the enormous expense they will be put to, and the little they will have to gain. The various towns and cities of which the water supply is drawn from the Severn will, after Liverpool has supplied its needs, have an ample quantity to meet all their possible requirements. Beyond the natural supply, which is not drawn upon by the Corporation, this body contracts to give compensation water of not less than eight million gallons per day. This regular addition to the natural run of the Severn will certainly, so far as we are able to judge, be sufficient to keep the river in free flow, and at the same time assist in giving to the cities and towns whatever water they may want for the supply of their districts. As for the possible destruction of the salmon spawning-grounds, on which so much stress is laid, that is a question which is certain to be thoroughly threshed out before the Committee, and nothing need be said about it here, further than to express a hope that all the fears of the "croakers" will be dissipated by the scientific evidence of the naturalists and others who will be called by the Corporation. It will probably be proved to the Committee that no real danger to the spawning-grounds will be threatened if the Bill of the Liverpool Corporation be carried out. But what if they were? As we said last week, the value of a few salmon cannot be placed against the wants of a vast population like that of Liverpool. Salmon may, in time, become a luxury available to only the rich; but the poor of Liverpool want water, and must have it. To say that the Corporation are anxious to obtain water to sell to the manufacturers, and so make profits which may be used in supplementing the rates, is no argument against the scheme. They want water for every purpose for which it is required within their limits—whether it be for manufacturing operations or domestic use. He is certainly no friend to a poor population who would curtail the supply of water for manufacturing purposes.

To increase the charge for water to manufacturers would, no doubt, have a tendency to diminish the quantity consumed; on the other hand, a lower price would tend to encourage a larger consumption. The Corporation of Liverpool have reduced the charge for water to manufacturers, but left the cost of a domestic supply at the same rate; and a question has arisen as to the legality of the step taken by the Water Committee. It has been argued that, by an Act passed in 1847, a reduction of rates and charges shall be made equally to all consumers. There is in Liverpool, as many of our readers will remember, a House and Land Owners Association, and this body have determined on having the water accounts of the Corporation thoroughly overhauled. They therefore applied to the Recorder, at the Borough Sessions, on the 20th ult., to appoint a competent accountant to examine those accounts. It is well that Corporations should be called to book, for their proceedings are not always in consonance either with the law that should govern them, or the principles that should regulate them. An accountant is certain to be appointed, and we are sure to hear a good deal more of this matter.

Liverpool is still troubled with its refuse. The Corporation are now carrying it out to the mouth of the Mersey, and there shooting it into the water. This, as we have already pointed out, is a waste, and it becomes a question for the Health Committee of the Corporation to consider whether or not another mode of dealing with the refuse may not be found, by which a portion, at all events, of the valuable ingredients in the accumulations may not be realized. The proposal now is to follow the example of some other large towns in the North, who, after separating the vegetable and mineral refuse, burn the former for charcoal, and the latter for ash, both of which are utilizable products. Of course, the difficulty at Liverpool is the large quantities daily thrown on the hands of the Corporation; otherwise it might be found that the vegetable charcoal could be used for sanitary purposes, while the ash might be worked up by the brickmakers.

The Colne Valley Water Company held their half-yearly meeting on the 23rd ult. The Company certainly make progress, but very slow, and their balances are still on the wrong side. A question arose at the meeting as to the advisability of the Company endeavouring to obtain some consideration from the Metropolitan Water Trust, if ever that body shall be constituted. Some day or other we believe that London must have the Colne Valley water. Supposing the Trust to be formed, we have no doubt that the Company would be bought up within a short space of time; but at the present moment, perhaps, no dreams need be indulged in. The Water Trust is not constituted, and perhaps never may be.

The Corporation of Colchester have achieved the object of their ambition, and have obtained power from the Local Government Board to borrow £83,000 to complete the purchase of the water-works. Now we shall see what we shall see. Doubtless the water supply of Colchester may be improved, but will the Corporation do it? We shall watch their proceedings with much interest, and if they really do any good, we shall not be slow to chronicle the fact. In the meantime, we may express a doubt whether the inhabitants of the town will be any better off as regards their water supply, or the charges made for it.

THE PURCHASE OF THE COLCHESTER WATER-WORKS BY THE TOWN COUNCIL.—A special meeting of the Colchester Town Council was held last Wednesday, when the final arrangements for the completion of the purchase of the water-works were carried out. The sanction of the Local Government Board had been received to a loan of £82,500 for the purpose, the period of re-payment to extend over 50 years. It was stated that the present net revenue was £2900, and that only £300 more per annum would be required to pay the interest on the amount of the loan. A strong opinion was expressed that, although there would at first be a small charge upon the rates, the works would, when extended, pay all the purchase-money themselves.

BELPER GAS AND COKE COMPANY.—The ordinary general meeting of this Company was held on Monday, the 23rd ult.—Mr. I. Hanson in the chair. The report of the Directors was adopted, and a dividend of 5 per cent. for the half year declared. Mr. W. E. Webster was elected a Director in the room of Mr. Crossley, and Messrs. Hanson and Pym were re-elected Directors. Mr. R. Pym was re-elected Auditor. In responding to a vote of thanks, the Chairman alluded to the extensions that had been made by, and the prosperous state of the Company, and said he thought there was no occasion for the Shareholders to fear that they would be snuffed out by the electric light.

THE GAS SUPPLY OF LONG EATON.—The negotiations in reference to the transfer of the undertaking of the Long Eaton Gas Company to the Local Board have advanced another step. Last Thursday a conference was held between a Committee of the Board and the Directors of the Company, when an offer was made by the former of £8 10s. for each original £5 share, and £4 19s. a piece for the new shares (£2 10s. paid). This was declined by the Directors of the Company, and the Committee of the Board then retired for a further consultation, at which it was decided to increase the amount to £8 16s. for the old, and £5 5s. for the new shares. A special meeting of the Shareholders of the Company will take place this evening, to consider the propriety of agreeing to this last offer.

URBAN WATER SUPPLY.

WE commence in the present article the consideration of the water supply of the towns within the drainage areas of the Ouse and Humber, so far as they are given in the parliamentary Return on this subject. With few exceptions, all these towns are in Yorkshire, and with about the same number of exceptions all the towns in Yorkshire are included in the drainage area now under consideration.

The River Ouse is essentially the water channel, cut in the soft rocks of the new red sandstone, to convey to the great estuary of the Humber the drainage of the eastern slopes of the high moorlands separating Yorkshire from Lancashire, and extending southwards to the High Peak of Derbyshire. The drainage is effected by seven principal streams, all rising on the mountain limestone or millstone grit, and originating in the heavy rainfall of the Penine chain. This rainfall averages $35\frac{1}{2}$ inches in Yorkshire, but is not more than $31\frac{1}{2}$ in Derbyshire. The Swale, the Ure, the Nidd, the Wharfe, the Aire, and the Calder are fed by the country on which the greater rain falls, and the Don by the rest. The rocks traversed by these rivers belong chiefly to the mountain limestone and millstone grit series, overlaid towards the south by coal measures, and then again towards the east are covered by a narrow strip of magnesian limestone, and then a wide expanse of new red sandstone. Farther to the east the rocks of the oolitic series form an eastern moorland. Draining into the Ouse near to its confluence with the Trent, are the surface rocks in the southern part of the main tract, and owing to their vicinity, to the extraction of the coal by hundreds of pits, and to the use of coal in obtaining steam used for driving machinery and for other purposes, a vast manufacturing population has here grown up, collected into more than two hundred towns, of which the total number of inhabitants greatly exceeds a million.

Receiving these waters from the west, the Ouse is also joined by the Derwent, which drains the large but much less thickly peopled oolitic district to the east, already alluded to, and afterwards by the Trent from the south. Of this latter river the history, so far as water supply is concerned, was given in our last article. The combined waters now take the name of the Humber, and, as an estuary or open tidal channel, continue their course to the sea, receiving on their way streams from the north and south passing some towns of importance.

It results from these conditions that, except in the case of the towns situated near the mouths of the tributaries or on the Ouse and Humber banks, there is little opportunity for water supply from wells, and most of the populations of the important towns receive the streams, springs, or collected rainfall stored in reservoirs in the upper valleys, and conveyed down by gravitation. Some of the most magnificent engineering works of modern times are the result of the need for conveying to these urban populations a sufficient supply of pure water for domestic and manufacturing purposes. A complete history of such works and also of the towns supplied would possess very great interest and some value, but was not to be expected in the Return now under notice. We will endeavour to put before our readers, in systematic form, the amount of information actually communicated.

The northernmost of the Yorkshire rivers flow only over the mountain limestone and millstone grit, and have a comparatively small population. Thus, in the drainage area of the Swale, Richmond and Northallerton are the only towns referred to in the Return, though Thirsk, Bedale, and Reeth are other towns each with a population exceeding a thousand. Richmond has a constant supply from springs, the water being collected about two miles from the town. The quantity supplied is 36 gallons per head per day. The cost of works has been rather less than 10s. per head of population, and the charge for water is little more than 2d. per thousand gallons. Northallerton has no works, and is supplied by wells.

In the Ure drainage area there are several small towns, but only three of which the population exceeds a thousand. Ripon has a constant daily supply of 25 gallons per head of filtered water drawn from the river. The cost of works has been nearly 47s. per head, and the charge is about $3\frac{1}{2}$ d. per thousand gallons. At Masham, the next largest town, there are no works. Hawes, nearly as large as Masham, is not mentioned. The Nidd drainage area contains Harrogate and Knaresborough. The former important town is supplied by a Company, and the Sanitary Authorities referred to can give no information. Knaresborough receives daily upwards of 20 gallons per head of the filtered waters of the river that flows past it. The works have cost about 48s. per head of population, and the charge is about 5d. per thousand gallons. There are no other towns of any magnitude in this drainage area.

We come now to the Wharfe, the last of the streams draining the millstone grit uncovered by coal measures. In this catchment area there are few towns, and Otley is the largest. It has a daily supply per head of about 27 gallons of water taken from small streams, collected in a reservoir, and charged for at the rate of 4d. per thousand gallons. The cost of works is equivalent to £2 2s. 5d. per head. Ilkley, a smaller town of less than half the population, is also supplied from springs collected on the moorland in service reservoirs, and carried to the town by gravitation. The quantity available is said to be equal to 100 gallons per day for the present number of inhabitants, but the actual quantity used is not stated. The cost of works has amounted to upwards of £6 per head of the present population, and, assuming the consumption to be limited to 20 gallons per head per day, the charge is as much as 1s. 7d. If, however, as is more probable, 40 or 50 gallons are taken, the charge can only be regarded as half, or less than half that sum. Burley, another town in this drainage area, is also supplied with water from springs, collected in a reservoir. Here the works have cost nearly £5 per head of the population. The supply is said to be constant and sufficient, and, assuming 20 gallons as the average, the charge per thousand gallons amounts to 10d. In this matter of charge, the same remark applies as that just made. There are two other towns in the Lower Wharfe Valley—Wetherby and Tadcaster—not included in the Return.

The Ouse commences at the confluence of the Swale and Ure, but there is no town on the combined waters till after it has been joined by the Nidd, and also by another small stream from the left, on which is the town of Easingwold, not mentioned in the Return. Soon afterwards the Ouse reaches York. This important city has a constant supply of more than 40 gallons per head per day of filtered Ouse water, the charge averaging a little more than $4\frac{1}{2}$ d per thousand gallons, and the cost of works per head of population having been £3 15s. A little below York the Wharfe comes in, and between it and the confluence of the Aire are the towns of Cawood and Selby. Of the former there is no mention. Selby, situated on the new red sandstone, is supplied with about 20 gallons per head per day of well water, the cost of works having been about 20s. per head of population. The charge cannot be ascertained, as, although the water-rate is stated to amount only to £264, the annual cost of carrying on the works, and the instalment for repayment of loan are said to amount to nearly £400. There is probably some error in the figures.

We now come to the consideration of the towns on the drainage area of the rivers which flow over the coal measures. Of these, the Aire and Calder may be regarded as independent streams, though they unite shortly before they reach the common channel of the Ouse. The Aire drains only 340 square miles of country before being joined by the Calder, but within this area there are fifty towns, each having a population exceeding 1000, and nearly all above 3000. The total urban population is about 670,000, to which must be added the population of a number of crowded villages more or less connected with manufacture. It will be evident that such populations must seek for a supply of pure water from a distance. The water from colliery pits is not likely to be satisfactory, and the streams are necessarily loaded with impurities. The great towns within the district have, therefore, taken advantage of the adjacent moorlands, which receive a heavy rainfall and are very thinly peopled, and have established for themselves, in the upper valleys of these streams, which are numerous and favourably constructed for the purpose, numerous large storage reservoirs, where the flood waters are preserved for the use of the towns in time of drought, and when the rivers have become unfit for domestic use and manufactures by passing so many thickly-peopled towns. Within the Aire drainage area there are two principal towns—Bradford and Leeds—of which the gigantic reservoirs not only form lakes in the upper valley of the Aire itself, but also take advantage of those of the Wharfe, and secure ample supplies of excellent water available for 600,000 out of the total urban population of 700,000 dwelling in the Aire Valley.

Situated in the upper part of the valley of the Aire are some towns with independent supplies. Gargrave and Skipton are the first of these. The former is small, and not mentioned in the Return. Skipton has a small catchment of 380 acres, with storage reservoirs, from which is obtained at all seasons a constant daily supply of upwards of 30 gallons per head. The cost of works was about £5 per head of the population, and the charge for the water is $5\frac{1}{4}$ d. per thousand gallons. Next in order is Keighley, a large town supplied

by the springs and streams on the moorlands, the water being stored and filtered. The supply is said to be abundant, but the amount is not stated, and there are no figures given from which we can determine the cost of works or the charge per thousand gallons. The town and district of Bingley (including a population of 18,000 in all) are supplied with water from the Keighley reservoirs. Oakworth is also supplied from Keighley, at the rate of 5d. per thousand gallons. Shipley, a large town, has an independent supply from reservoirs, the works having cost nearly £6 10s. per head of the population. They were still incomplete at the date of the Return, but the water supply was constant and large. The charge was nearly 4½d. per thousand gallons. Windhill is supplied from Shipley with about 11 gallons per head, at a charge of 7½d. per thousand gallons. The town of Oxenhope is supplied with water from springs on the hill sides adjoining, but has no works. Haworth has 10 gallons of water distributed per head per day. The cost for works was about 15s. per head, and the charge is 6½d. per thousand gallons. There are two small towns—Denholme and Wilsden—which have independent supplies, but no public works.

All the towns on the Aire, and within its sub-drainage area, below the point we have now reached are supplied by either Bradford or Leeds, with the exception of a small number which we will here refer to, leaving the supply of those great manufacturing centres and the towns dependent upon them for another article.

Baildon receives water from springs, collected into reservoirs. No measurement of quantity is made, and the distributing works are not complete. The cost of works is at the rate of 50s. per head, but the charge is not estimated. Assuming the supply to be at the rate of 20 gallons per head per day, which is sufficient, the rate would be 4½d. per thousand gallons. Yeadon is supplied by a Company allowing 50 gallons per head per day, but only about one-fourth of the population take advantage of the Company's works. The water is pumped into reservoirs, and the cost of works was very heavy, approaching £12 per head of population. The charge is nearly 10d. per thousand gallons. Horsforth is supplied from a catchment, the water being collected into a reservoir. The quantity is 15 gallons per head per day. The cost of works is mentioned, but the figures given are probably erroneous. The charge is 7½d. per thousand gallons. Castleford is one of the few towns in this part of the country supplied from wells. The wells are said not to be artesian, but their yield is described as very large. About 12½ gallons per head per day are supplied. The cost of works was nearly 50s. per head, and the charge is about 7d. per thousand gallons. Featherstone is another rather large town at present served from private wells, but works are in progress for a systematic supply.

Communicated Article.

THE CORROSION OF IRON.

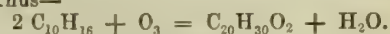
By Mr. WILLIAM FOSTER, M.A. (Cantab.), F.C.S., &c.,
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SIXTH ARTICLE.

I have taken linseed oil as an example of the second class of varnishes because of its great importance. It is the only example which concerns us. Linseed oil is a member of a small group of fatty substances having a property in common—that is, of absorbing oxygen and becoming resinous. These fatty bodies consist of an organic acid radical combined with an organic base, the whole presenting a close resemblance in chemical constitution to an ordinary metallic salt. For instance, ferrous sulphate (FeSO₄) consists of a base, iron (Fe), combined with an acid radical (SO₄), such radical being characteristic of sulphates. Now, upwards of 90 per cent. of ordinary linseed oil consists of a compound (linolein), the base of which is glyceryl (C₃H₅), and the acid radical associated with it is that of linoleic acid. Free linoleic acid has the formula HC₁₈H₃₃O₂. The formula of linolein is C₅₇H₁₀₂O₆ (C₁₈H₃₃O₂)₃ = C₅₁H₈₆O₆. It is also usual to speak of those compounds containing glyceryl as glycerides. In addition to the glyceride linolein, linseed oil contains small quantities of glycerides of the organic acids, elaidic, myristic, and palmitic. These compounds are known as elain, myristin, and palmitin. When linseed oil (in the main linolein) is exposed to the air, oxygen is absorbed, with the formation of new products. Two of these have been studied. The linoleic acid radical is converted into that of oxylinoleic acid (HC₁₈H₃₁O₅), and this, in turn, suffers further oxidation, giving rise to a neutral, amorphous, and elastic substance resembling caoutchouc named linoxyn (C₃₂H₅₁O₁₁). It is to the formation of these two substances, and particularly the latter, that linseed oil owes its value as a varnish. This tendency on the part of linseed oil to absorb oxygen and pass into new forms is much increased by heating the oil with oxide of lead (litharge). In this process a lead salt of linoleic acid is formed, but the exact nature of the change by virtue of which the "boiled oil" more readily resinifies—that is, passes into a mixture of oxylinoleic acid and linoxyn—is not understood. When linseed oil,

either in the natural state or "boiled," is applied as a protective varnish, it is obvious, from the nature of the changes necessary to form a hard skin, that time is an element which has to be considered; and further, that as the outer surface resinifies first, ready access of oxygen to the underlying layers of oil is prevented. The perfect adhesion of the varnish being dependent on the thorough hardening of the underlying layers, everything which retards this result diminishes the usefulness of the oil as a varnish. As a matter of experience, it is known that when linseed oil is applied to the surface of wood and of metal (say iron), the oil more readily hardens in the first case than the second. It would appear from this circumstance that some product or products are formed in the oxidation of the oil, in addition to the two I have considered, and that these are influenced (probably removed) by the absorbent character of the wooden surface. For instance, I have not considered the fate of the radical glyceryl (C₃H₅), when its acid radical is oxidized and converted into the neutral substance linoxyn. All evidence on this point is wanting in the researches to which I have referred. There are also the other three glycerides, constituting more than 10 per cent. of the original linseed oil. The practical aspect of the whole question is, that although linseed oil forms an excellent varnish for wood, it is much less useful for iron. That its desirable qualities are those of forming a hard elastic coating, which mainly consists of a neutral principle, such substance being incapable of forming definite chemical compounds with most of the numerous bodies usually employed as a basis for a mineral paint.

Varnishes of the third class, though extensively employed, are never used alone for coating ironwork. The members exhibit the characters of those belonging to the two classes we have already considered. In the first place, they contain a solid basis dissolved in some spirituous solvent, such basis being left unchanged on evaporation of the liquid; and, in the second place, one or more of the compounds present gives rise to a solid substance by atmospheric oxidation. The only instance of a varnish of this class which I shall consider is afforded by a mixture of linseed oil and commercial turpentine. Such a mixture is the one generally used in conjunction with metallic oxides for the purpose of preparing a paint. The behaviour of linseed oil in this instance is not different from that when exposed alone. The use of the turpentine is chiefly for the purpose of rendering the mixture more fluid, so that it can be more readily applied; and as the turpentine is in some measure volatile, the varnish (or paint) dries rapidly, in consequence of loss through evaporation of a portion of this component. Commercial oil of turpentine is a solution of solid resinous substances in a limpid volatile oil. When submitted to distillation, the resinous substance (colophony) remains behind in the retort, whilst the limpid volatile oil passes over. The latter constitutes rectified turpentine, and when pure has the formula C₁₀H₁₆. Its property of easily dissolving resinous substances is well known, and particularly fits it for use as a solvent of such compounds in varnish-making. Turpentine is capable of directly uniting with water, forming a crystalline compound. On free exposure to air it partially evaporates, whilst a portion undergoes oxidation, furnishing resinous and other products. The resinous substances chiefly concern us. They are kept in solution in ordinary cases by virtue of the solvent action exercised by the unaltered turpentine. They are known as acid resins, and are identical in chemical character with common rosin, or colophony. In fact, the latter is believed to be formed by the oxidation of the volatile oil C₁₀H₁₆ in the woody tissue of those trees which yield commercial turpentine. Thus—



Rosin, or colophony, is therefore not only present in commercial turpentine, but is also produced from the latter by oxidation of its volatile oil. It is a brittle glass-like solid, exhibiting different shades of colour according to the temperature employed in its manufacture. Its colour ranges from pale yellow to deep brown. The older writers regard it as a mixture of three isomeric acids—namely, pinic, sylvic, and colopholic acids, each of which has the formula C₂₀H₃₀O₂. A recent writer on the subject considers rosin to be chiefly abietic anhydride (C₄₄H₆₈O₄), which, when combined with a molecule of water, furnishes abietic acid (C₄₄H₆₄O₃). Rosin is readily reduced to a powder, is insoluble in water, and combines directly with caustic alkalis to form soluble salts. One of the chief commercial uses of rosin depends on the latter circumstance. Rosin and caustic soda, heated together, form a soluble salt, which is largely produced in the manufacture of ordinary yellow soap. Though rosin is insoluble in water, the two are capable of combining together, forming a hydrate when they remain in contact for a length of time. This circumstance interferes with the use of turpentine when employed in preparing paints intended for immersion in water.

Having considered the behaviour of linseed oil and of turpentine when exposed to atmospheric oxidation, and some of the characters of the products formed, we are in a position to deal with the subject of mineral paints. These consist of mineral substances usually ground up with linseed oil and turpentine. Lead compounds, ferric oxide, oxide of antimony, sulphide of zinc, silica, and barium sulphate (heavy spar), are common instances of the substances employed in paint-making. Such compounds, when they are ground up with oil, are merely suspended in it without entering into chemical combination during the process of mixing, or afterwards when the paint is used in the ordinary way. When the paint is dry the particles of the mineral substance are rendered adherent to each other and the painted surface by being imbedded in the solid oxidation products of the oil and turpentine. Though lead oxide, when boiled with linseed oil, does form a lead compound with some of the components of the oil, there is little reason for believing that a similar result is obtained by mixing the two substances and exposing them at ordinary tem-

peratures. Lead paints furnish the worst examples of mineral paints for the protection of iron gasholders. The ordinary compounds of lead used in paints are so sensitive to the action of sulphuretted hydrogen, that even small quantities of the gas betray their presence in consequence of producing the black sulphide of lead. When the lead compound is the oxycarbonate (white lead), this change gives the surface an unsightly appearance. Further, the conversion of the carbonate of lead into sulphide brings about a disintegration of the paint to such an extent that it is found, as the result of careful experiments, that a lead paint "perishes" more rapidly than any other when used on iron, and exposed to the joint influence of water and air containing even traces of sulphuretted hydrogen.

Ferric oxide (Fe_2O_3) is a substance which has found much favour as a basis for a mineral paint. In the condition of a hydrate ($\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$) ferric oxide exhibits the property, in a marked degree, of combining with sulphuretted hydrogen. In fact, the object of the gas engineer is especially to obtain ferric oxide presenting the degree of hydration shown by the above formula when he requires it for the purpose of gas purification. When used as a basis for paint, it is necessary to obtain it in an anhydrous condition. In the latter state, and particularly after having been strongly heated, it is very hard, and not readily affected by sulphuretted hydrogen, or even by mineral acids. It is, therefore, well fitted for a paint when its colour is not an objectionable feature. The oxidation products of linseed oil and turpentine do not in the least affect such ferric oxide. They merely act mechanically in binding the particles of the oxide together.

The employment of the other mineral substances I have named calls for little comment. Each is usually preferred for some advantage it possesses over the rest in colour. Where a white colour is needed, either barium sulphate (heavy spar), zinc sulphide, or silica may be used as a basis. I am not aware that barium sulphate is ground in oil and sold as a paint under its own name. However, it is very extensively employed as an adulterant in cheap lead paints and powders, some samples of dry red lead in the market containing as much as 60 per cent. of this adulterant.

The value of a paint for the protection of a gasholder is, therefore, almost entirely determined by the character of the medium used in mixing with the mineral substance. With reference to paints generally, Mr. Douglas, in the paper I referred to in a former article, says "their lives will be bounded by that of the vehicles by which they are attached, and this rule is true of all paints, whatever be their colour or description."

The question naturally arises—What are the best methods of applying varnishes and paints for the preservation of iron gasholders? I have already considered the advantages of coal tar, when applied to the iron surface in a hot condition. As a preservative varnish it stands at the head of the list, and should be used first. To counteract the viscous character of the pitch, mineral paints, with the exception of lead paints, may then be used with advantage. A choice of colour, more than anything else, determines the kind to be used. When the paint hardens on the properly-tarred surface, a skin is formed, which gives support to the underlying pitch, and the compound layer thus formed is a fairly efficient preservative of the iron. The paint is, of course, prone to give rise to oxidation and hydration products when subjected to the action of air and water, and, after a certain period, will cease to afford the underlying pitch its needed support; but still the mischief for some time will be purely of a superficial character.

I have said nothing about the electrical influences which are claimed for certain mineral substances when ground up as a paint. The arguments in such cases are extremely unsatisfactory. We have seen that the particles are imbedded in a hard resinous layer which in itself is a non-conductor of electricity. Therefore, whatever may be the deportment of iron and a given metallic oxide in a given solution, one cannot argue from such a circumstance that anything like the same action would obtain when the particles are imbedded in, and insulated by a resinous layer. The case entirely differs from that of preserving iron at the expense of metallic zinc by coupling the two together, the principle of which was originally discovered by Sir Humphry Davy.

(To be continued.)

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

METER-RENTS.

SIR,—In your issue of Feb. 17 you request your readers to express, through the medium of the JOURNAL, their views on the subject of meter-rents. The charging of meter-rents by gas companies is, by some consumers, considered to be a great grievance; but from the suggestion that it is a substantial grievance which requires redressing, I decidedly dissent.

Every person must allow that meters represent capital, and therefore should contribute their proportion to a gas company's revenue. Whether they should pay direct interest, in the form of rent, upon the amount invested, or whether that interest should be derived indirectly by charging more for the gas consumed, is the question at issue. We are often told by tradesmen who are consumers of gas, that when they sell a pint of beer or a pound of sugar, they do not charge anything for the use of the pint pot or the scales; and from this they argue that gas companies should not charge for the use of meters. They might with as much show of reason assert that they do not charge us for the privilege of using their premises. Certainly, they do not make a direct charge for these things; but they must be recompensed indirectly, by placing upon the article they sell a price sufficient to cover all charges, and leave a margin for

profit. But we cannot justly compare pint pots and scales with gas-meters—the cases are not parallel. In the one instance the articles are obtained for a few pence, or at most a few shillings, often last for generations without any expense for repairs, and are not specially reserved for the use of one customer, but are compelled to serve all and sundry; whereas, in the other case, gas companies are obliged to supply to every customer, for his use and his alone, an expensive and delicate machine costing pounds.

Another grievance is that owing to the heavy rent on small meters as compared with the larger sizes, the small consumer is compelled to pay more in the aggregate for his light, in proportion to the gas consumed, than an individual who is a larger consumer. But it is a recognized commercial principle that large purchasers should have an advantage over those who do not invest to the same extent—there is always a reduction allowed on taking a large quantity. The reasons why this principle should be recognized and acted upon by gas companies are particularly strong. The small consumer occasions the same labour in inspection, reading index, and general supervision, as the largest consumer in the district. But let us suppose the custom of charging meter-rents was abolished. Imagine a person who made a request to be supplied with gas, being furnished with a meter for which he was to pay in proportion to the amount of gas consumed. He may have a large house. He may, therefore, require to be supplied with a meter in proportion to the size of his residence—say one capable of supplying 20 lights—and yet he may not consume more than 500 or 1000 feet per quarter. This would be a direct loss to the gas company, and unfair to the other consumers, who would, of course, have to pay more than their share, owing to the existence of such a system. For this person's gas supply, all the inspection would be required that is necessary for the largest consumer, and there would be the same risk of leakage at his service-pipe; yet to compensate for all this risk and labour, as well as depreciation, he only pays a few shillings per quarter. This may be an exaggerated instance, and one which would rarely occur in practice; but such a thing is possible.

For these reasons I am a supporter of the system of meter-rents, believing it to be fairer to both consumer and company than that of charging indirectly upon the gas consumed.

Feb. 27, 1880.

T. O. M.

THE GAS REFEREES SULPHUR TEST.

SIR,—In his account of the accident that occurred to him whilst using the Gas Referees sulphur test, Mr. Greville stated his belief "that the variations in the amount of liquor produced by different apparatuses, and even in some cases by the same apparatus, are in great part explained by the fact" he there points out. In his reply to my letter, I am glad to see a modification in his belief, for he there adds that he does not wish his communication to convey the impression that the source of error alluded to exists to any large extent.

I must beg to differ from Mr. Greville on one little point—namely, as to its being an accident exceedingly likely to pass undetected. For my part, I should say it was exceedingly unlikely to pass undetected—the appearances of liquor running over the trumpet tube being strongly marked. Liquor does not run down the sides of the trumpet without leaving a trace of its passage. Even the few drops that collect in the trumpet round the burner when the test is first put to work evaporate and leave a very obvious residue; but supposing that the liquor should run over whilst the test is at work, and be unnoticed (a highly improbable supposition in a gas-works, where there is always some one about), yet I contend that it would be impossible for me to pick up the trumpet tube and wash it out without noticing what had taken place.

It is a custom with many persons to keep a record of the amounts of liquor obtained from their sulphur tests; and I hope they will not too hastily attribute the inevitable variations to loss of liquor by leakage, but seek a little consolation from Mr. Greville's most recent assurance that he does not want to make us believe that the error exists to a large extent.

I trust Mr. Greville will excuse me for having taken his words literally, and believe that I have written only in honest defence of the sulphur apparatus used by the Gas Referees.

ANOTHER F.C.S.

FROZEN LAMP SERVICES.

SIR,—In several recent numbers of the JOURNAL I have found different remedies suggested for frozen lamp services; but what I have sought in vain is some means of preventing them freezing at all. And yet, judging from an experiment I made this winter, I suppose such a means exists. For certain reasons unconnected with this subject, I was obliged to fit up some of my lamp-columns with lead instead of iron pipes, and I observed that these lamps were not affected by frost during winter, notwithstanding that they were exposed to the wind in all directions, while the other lamps, in a less unfavourable position, were very often frozen. I may add that the lead pipes used were of the strong kind usually employed for water services— $\frac{1}{2}$ -inch diameter and $\frac{1}{8}$ -inch thick. The prevention of the freezing of these lamp services I ascribed to the fact of the lead being, compared with iron, a bad conductor of heat.

Another means of preventing lamp services freezing would, in my opinion, be to fill the space between the iron pipe and the lamp-column with some material which is a bad conductor of heat—for example, tar and sawdust.

Rotterdam, Feb. 20, 1880.

C. T. SALOMONS.

We have received from Mr. J. O. N. Rutter, of the Brighton Old Gas-Works, a copy of "D. B. Friend's Almanac, Diary, and Local Guide to Brighton for 1880." What we would call attention to, and commend to others in the gas profession as worth imitating, is a chapter entitled "Advice to Consumers of Gas." In this Mr. Rutter has conveyed a mass of practical information on the management of gas by householders—as to the reading of a meter, attending to burners, fittings, &c., stopping escapes, and regulating pressure, &c. There is nothing particularly new in what is said; but the means of getting the information right home to the users of gas, and that in a form in which it will be readily referred to, at all events for a twelvemonth, is worth consideration by others.

Parliamentary Intelligence.

PRIVATE BILLS RELATING TO GAS, WATER, ETC.

SESSION 1880.

PROGRESS MADE TO SATURDAY, FEB. 28.

Title of Bill.		Petition for Bill Presented.	Bill Read the First Time.	Bill Read a Second Time.	Bill Reported.	Bill Read the Third Time.	Bill Received Royal Assent.
Ackworth, Featherstone, Purston, and Sharlston Gas Bill	Lords	Feb. 9	Feb. 10	..	..	..	..
Birkenhead Borough Bill	Commons	..	..	..	..	..	..
British Gaslight Company, Limited (Staffordshire Potteries), Bill	Lords	Feb. 10	Feb. 10	Feb. 23	..	..	..
Burton-upon-Trent Corporation Bill	Commons	..	..	..	..	..	..
Cardiff Water Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Chester Gas Bill	Commons	Feb. 10	Feb. 10	Feb. 20	..	..	..
Cork Gas Bill	Lords	..	..	..	..	..	..
Cork Improvement Bill	Commons	Feb. 9	Feb. 10	Feb. 24	..	..	..
Dagenham and District Farmers (Optional) Sewage Utili- zation Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Dartford Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 17	..	..	..
Dearne Valley Water Bill	Lords	Feb. 9	Feb. 10	..	..	..	..
Denton and Haughton Gas Bill	Commons	Feb. 10	Feb. 10	Feb. 16	..	..	..
Doncaster Corporation Water Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Eastbourne Gas Bill	Commons	Feb. 10	Feb. 10	Feb. 16	..	..	..
Edinburgh and District Water Bill	Lords	..	..	..	..	..	..
Exmouth and District Water Bill	Commons	Feb. 9	Feb. 10	Feb. 23	..	..	..
Gaslight and Coke, Commercial Gas, and South Metropolitan Gaslight and Coke Companies Bill	Lords	Feb. 9	Feb. 10	Feb. 17	..	..	..
Great Yarmouth Water Bill	Commons	Feb. 9	Feb. 10	..	..	..	..
Hinkley Local Board Gas Bill	Lords	Feb. 9	Feb. 10	..	..	..	..
Huddersfield Tramways and Improvement Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
Hull Lighting Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Hyde Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
King's Lynn Corporation Bill	Lords	Feb. 9	Feb. 10	Feb. 23	..	..	..
Lancashire County Justices Bill	Commons	Feb. 9	Feb. 10	Feb. 23	..	..	..
Lancaster Corporation Bill	Lords	Feb. 10	Feb. 10	Feb. 16	..	..	..
Lincoln Gas Bill	Commons	..	..	..	..	..	..
Liverpool Corporation Water Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Liverpool United Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 24	..	..	..
London Gaslight Company Bill	Lords	Feb. 9	Feb. 10	Feb. 24	..	..	..
Maidstone Gas Bill	Commons	Feb. 9	Feb. 10	..	..	..	..
Malton Gas Bill	Lords	Feb. 9	Feb. 10	Feb. 23	..	..	..
Oldham Improvement Bill	Commons	Feb. 9	Feb. 10	..	..	..	..
Phoenix Gaslight and Coke Company Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Portmadoc Water Bill	Commons	..	..	..	..	..	..
Prescot Gas Bill	Lords	Feb. 10	Feb. 10	Feb. 16	..	..	..
Preston Improvement Bill	Commons	..	..	..	..	..	..
Rathmines and Rathgar Township (Vartry Water Supply) Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Rathmines and Rathgar Township Water Bill	Commons	Feb. 16	Feb. 16	..	..	..	..
Reading Gas Bill	Lords	Feb. 10	Feb. 10	Feb. 16	..	..	..
Rochester Corporation Bill	Commons	..	..	..	..	..	..
Sea Water Supply to London Bill	Lords	Feb. 9	Feb. 10	..	..	..	..
Sligo Borough Water Bill	Commons	Feb. 10	Feb. 10	Feb. 16	..	..	..
South Metropolitan Gas Company Bill	Lords	..	..	..	..	..	..
Southwark and Vauxhall Water Bill	Commons	Feb. 9	Feb. 10	..	..	..	..
Stafford Borough Bill	Lords	Feb. 9	Feb. 10	Feb. 23	..	..	..
Wakefield Corporation Water Bill	Commons	Feb. 9	Feb. 10	Feb. 23	..	..	..
Wandsworth and Putney Gas Bill	Lords	Feb. 10	Feb. 10	Feb. 16	..	..	..
Wigan Improvement Bill	Commons	..	..	..	..	..	..
Wrexham Water Bill	Lords	Feb. 9	Feb. 10	..	..	..	..
Yeadon and Guiseley Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 17	..	..	..
"	Lords	Feb. 9	Feb. 10	..	..	..	..
"	Commons	Feb. 9	Feb. 10	..	..	..	..

HOUSE OF LORDS.

MONDAY, FEB. 23.

Petitions against the following Bills were presented:—
Cardiff Water Bill, from Corporation of Cardiff.

Lancashire County Justices (Water, &c.) Bill, from Corporation of Manchester.

Portmadoc Water Bill, from William Edward Oakeley.

Rathmines and Rathgar Township Water Bill, from (1) Owners, &c., of mills and manufactories; (2) Grand Canal Company; (3) Corporation of Dublin; (4) Millowners, &c. (J. B. Johnston and others); (5) Rate-payers and owners, &c., of property in the township of Rathmines and Rathgar and others, in public meeting assembled.

Sea Water Supply to London Bill, from (1) Metropolitan Board of Works; (2) Corporation of Kingston-upon-Thames; (3) Wandsworth and Putney Gaslight and Coke Company; (4) London and North-Western Railway Company; (5) London and South-Western Railway Company; (6) Grand Junction Water-Works Company; (7) Chelsea Water-Works Company.

Sligo Borough Water Bill, from Midland Great Western Railway of Ireland Company.

Wakefield Corporation Water Bill, from (1) London and North-Western Railway Company; (2) Liversedge Local Board; (3) Justices of the Peace of the West Riding of the county of York; (4) Sir George Armytage, Bart.; (5) James Akroyd and Son, Limited, and others; (6) Great Northern Railway Company.

THURSDAY, FEB. 26.

The Lancashire County Justices (Water, &c.) Bill and the Sea Water Supply to London Bill were referred to a Select Committee consisting of the Duke of Bedford (Chairman), Earl Bathurst, Lord Saltersford, Lord Gifford, and Lord Skene; to meet on Monday, March 1.

HOUSE OF COMMONS.

MONDAY, FEB. 23.

A petition in favour of the Hull Lighting Bill was presented from the Committee of the Hull Guardians Society.

THE GOVERNMENT AND THE METROPOLITAN WATER SUPPLY.

Mr. FAWCETT asked the Home Secretary when the Bill relating to the Water Supply of London would be introduced.

Mr. CROSS: I was in hopes that I could have given a definite answer to-day, but the arrangements are not quite complete, and what they may be is still uncertain. I propose to ask the Chancellor of the Exchequer to give me a day to bring in the Bill.

Mr. FAWCETT: May I ask the Home Secretary whether, considering the great pecuniary interests involved in this subject, and the risk of speculation in shares, he will arrange, in order to prevent some people obtaining information before others, that the Bill shall be ready for circulation immediately after being introduced?

Mr. CROSS: I have already taken steps that when the Chancellor of the Exchequer gives a day to bring in the Bill, the print of the Bill shall be in the hands of members the next morning, or as early as possible.

NATIONAL WATER SUPPLY.

Mr. MONK, in the absence of Mr. Rowley Hill, who had given notice of the question, asked the President of the Local Government Board whether, in view of applications from various districts to take water for their own purposes from watersheds with which they have no natural connection, the Government are prepared, in anticipation of legislation upon the subject, to initiate an inquiry into the whole question of water supply.

Mr. SCLATER-BOOTH said this question had been several times under the attention of the Government. At the present time he thought there was not any occasion to institute a special inquiry upon the subject, seeing that ample information was at their disposal should the Government think fit to deal with it.

TUESDAY, FEB. 24.

Petitions in favour of the Liverpool Corporation Water Bill were presented from Owners, &c., on the banks of the River Severn—(1) Frances Cotton Baker and others; (2) F. Strickland and others; (3) H. Fowler and others.

A petition against the Wigan Improvement Bill was presented from Henry Park.

LIVERPOOL CORPORATION WATER BILL.

On the order for the second reading of this Bill,

Mr. HILL moved that it be read a second time this day six months. He said he did so not altogether on account of the individuals connected with the Severn Valley whose interests would be seriously affected if the Bill became law, for this would be more the subject of inquiry by a Select Committee than consideration by the House on the second reading. He simply wished to call attention to the principle of the Bill, which would empower the Corporation of Liverpool to supply themselves with water from a district beyond their own watershed, out of their own geographical limits, and take a supply which hitherto, from time immemorial, had been the source of supply to the districts in the Severn Valley, through which the River Vyrnwy flows. The taking away of the head waters of the river would be a great injury to the population of the valley, inasmuch as these were the only uncontaminated waters flowing into the Severn, the other waters being contaminated more or less according to the nature of the districts through which they ran. On principle, he contended, it ought not to be allowed for one district, however important, to come into another watershed and take away the water possessed by that district, without very much stronger reasons than could be alleged on behalf of the Liverpool Corporation. It should, he said, be remembered that it was not simply taking away a certain quantity of water from the river, but the whole of the waters of the Vyrnwy, except, indeed, a small quantity of 8 million gallons to be guaranteed for the Severn Valley district. But it was not proposed to enforce this guarantee in the event of the scheme sanctioned by the Bill being carried out. There was no provision made for the supply of the district. The Bill simply said "it shall be provided." The Corporation would take the whole of the rest of the water flowing from the Vyrnwy for the benefit of the town of Liverpool, not merely for sanitary but for commercial purposes. The quantity of water they would require for sanitary purposes would be very small indeed, but there were, of course, in Liverpool some large manufacturers requiring a considerable supply of water; for instance, there was a large sugar factory which paid the Corporation about £4000 per annum. So it would be really taking the water of the Vyrnwy from the sanitary uses to which it was at present entirely devoted in the Severn Valley district, in order to enrich the Corporation of Liverpool by the addition of a large revenue, which would follow the supply of the water for manufacturing purposes. The average flow of the Vyrnwy, taking it at the lowest price of 6d. per 1000 gallons, would yield an immense revenue—it would be a mine of wealth. Then, again, the smaller towns on the Severn would be subjected to a heavy expense in defending their natural rights against this invasion by the Liverpool Corporation. It would be almost ruinous to the small

towns in the Severn Valley, while, of course, the wealthy Corporation of Liverpool had large resources which they would not hesitate to use to acquire a source of wealth which must considerably relieve their ratepayers. The Royal Commission on Water Supply, which sat some ten years ago, under the presidency of the Duke of Richmond, considered this very question, and reported against power being granted by Parliament for one authority to take a water supply from another district with which they had nothing in common. For these reasons he asked the House to reject the Bill.

Mr. MONK, in seconding the motion, said this was no ordinary case, but one of the greatest importance, and one which very nearly touched the supply of water not only to Liverpool, but to all the large towns and cities in the country. Last year the Thirlmere scheme of the Manchester Corporation was passed, and by the Act sanctioning it power was reserved to the Corporation of Liverpool and other large towns to avail themselves of the scheme for a supply of water. Not only by availing themselves of the Thirlmere scheme would the Corporation of Liverpool be saved a very considerable expense, but they would have the most ready supply, and a supply of which they could avail themselves much sooner than if they went to the Severn watershed. The water-pipes in connection with the Thirlmere scheme were to be laid within three miles of the Liverpool district, and the expense of taking a sufficient supply from Thirlmere would be very much less than by the scheme now before the House. This was a matter of great moment, and the President of the Local Government Board, in replying the previous day to a question he (Mr. Monk) addressed to him, said that the Government were possessed of sufficient information with regard to the water throughout the country to render it unnecessary for any further evidence to be obtained on the subject. It was a matter not only for the Government but for the House seriously to consider whether they would allow this Bill to be read a second time, at all events unless the Corporation of Liverpool could make out a very strong case. At the present moment they had not made out any case whatever; not one word had been spoken in support of the Bill. There could be no doubt it was not only a Bill for the supply of water to Liverpool, but it was a commercial undertaking on the part of the Corporation of Liverpool, who meant to repay themselves for the scheme by selling to towns in Lancashire the water from the Severn district. He had much pleasure, therefore, in seconding the motion of the honourable member for Worcester.

Mr. HIBBERT thought that if the motion just made should be carried, it would be dealing in a very hard manner with the proposal before the House. The honourable gentleman who had last spoken told the House that Liverpool might go to Thirlmere for a supply of water; but he remembered that the report of the Committee on the Thirlmere scheme did not hold out any probability of any towns sharing the supply, beyond those in the immediate neighbourhood of Manchester. Then it was allowed that the Thirlmere scheme could not be completed within a period of ten years. In the face of these facts, Liverpool was compelled to look elsewhere for a water supply. The present supply would only be sufficient in a short time, considering the increase in the population, for nine-tenths of the inhabitants; and then what was Liverpool to do? If the Corporation went to any district, there would be the same objections raised as there were against the Severn source. They could not take water from the new red sandstone wells, because it was found impregnated with sewage, and unfit for consumption. He could not think the House would do well to throw out the Bill on the second reading, without giving the promoters a chance of being heard before a Committee of the House. Whether that Committee should be a Hybrid Committee or the usual Select Committee, was a question for the House to consider. He was of opinion that the ordinary Committee would be sufficient, and he should vote in favour of the Bill.

Mr. REGINALD YORKE said he wished to answer some of the remarks made by the honourable gentleman who moved the rejection of the Bill, inasmuch as he implied there was a great deal of widespread dread in the Severn district as to the effects of the measure. He had received and lodged three petitions from his own constituents, and he found that no less than 105 of the largest owners and occupiers in the district of Tewkesbury and Gloucester, representing the riparian tenantry of the district, were very anxious that the Bill should pass into law. They believed that their property would be much benefited by the construction of the works proposed by the Bill, inasmuch as they would tend to regulate the supply of water, diminishing the floods by which so much damage was now done, and increasing the supply of water in the summer time. This showed that, so far from being afraid of the effects of the Bill, some riparian owners and occupiers welcomed the proposal. In dealing with the motion, he trusted the House would bear in mind that in the neighbourhood of Gloucester there was nothing like a unanimous feeling against the Bill.

Sir BALDWIN LEIGHTON, whose notice of motion in reference to the Bill appeared in last issue, said he desired to appeal to the impartial judgment of the House, and especially to those honourable gentlemen who had given attention to such subjects as the present. This was a proposal on the part of Liverpool to come 70 miles into another watershed for a supply of water, and to make an artificial lake of 1000 acres in extent, submerging a village and a church. But it was not the magnitude of the engineering undertaking so much as the importance of the principle involved that he desired to call attention to. There were in England (excluding the Highlands and Dartmoor) only two great gathering-grounds for water supply on a large scale—the one was the Cumberland Lakes, and the other North Wales. Last year the former was taken by Manchester, and this session it was proposed to take the other for Liverpool. He was ready to admit the urgent necessity of water supply to the great towns of England; but vested interests must be regarded. They could not sacrifice the water supply, navigation, fisheries, and the sanitary requirements of a whole district even to supply another great population. The proper principle, he apprehended, was that no town should appropriate the water supply belonging to another district, unless special circumstances could be shown to justify it. The people of the district must be first served. But Liverpool had said, "We have no alternative." Was that so? He was informed that the Rivington mains only required proper cleaning to supply an additional 4 million gallons a day, and he held in his hand reports to the Liverpool Corporation as to the supply of water from the Cumberland Lakes and from other places. It was not true, therefore, that Liverpool had no alternative. As regarded precedents and principles laid down by the House, they had the report of the Duke of Richmond's Commission and the Rivers Pollution Commission, and there was also the Rivers Conservancy Bill of last year. He found, too, that in 1863 the Bill introduced by Gloucester and Cheltenham, to obtain a supply of water from the Thames Valley, was thrown out on the second reading by a majority of 30, on the ground that the watershed proposed to be taken belonged to the valley. Then they had the Thirlmere Bill, a year or two ago, which was referred to a Hybrid Committee. He would observe that the cases were not quite similar, because in the case of Thirlmere there were no populations affected by the withdrawal of the water, and it was practically a case within the watershed of the town of Manchester. The present Bill ought only, therefore, to be read a second time on the understanding that it be referred to a Hybrid Committee,

with instructions such as those of which he had given notice. As he saw that the President of the Local Government Board had put on the paper a motion substantially the same as his own, and that, in fact, he had adopted his (Sir B. Leighton's) proposal, he ventured to ask his honourable friend the member for Worcester to withdraw his motion.

Mr. SOLATER-BOOTH said the Bill was one of a very peculiar character, and there was no wonder that its provisions had attracted the notice of the persons dwelling in the Valley of the Severn. It was not for him to become the advocate of the Bill, but he might venture to say, from the position he held, that he was aware that Liverpool was in great need of an important and extensive water supply. They had no doubt very good reasons to show for the selection they had made in the plans now submitted to the House. Whether the selection would prove to be a good one, and whether it was one which the House would ultimately sanction, was another matter; but, at any rate, the Corporation who had the interest of such an enormous number of people at heart had a right to expect that the scheme would receive careful attention by the House. He regarded the Thirlmere scheme and the present one as analogous, and in his opinion the present proposal should be referred to a tribunal capable of taking a wider view of the matter than an ordinary Select Committee. It seemed to him that the interests of the people of the Valley of the Severn, in trade, navigation, water supply, fisheries, and so forth, ought to be secured and maintained; for they had a *prima facie* right to—he would not say a monopoly of the water supply. He had taken it upon himself to place on the paper a notice of motion that the Bill be read a second time and referred to a Hybrid Committee with certain instructions, which he trusted would satisfy the honourable member for Worcester and his friends who had opposed the second reading. He moved that this course be followed.

Sir E. LECHMERE said he opposed the scheme, not simply because it was for supplying Liverpool with water, which was absolutely required for the Severn Valley; but because he believed that a large quantity of the water would be used, not merely for sanitary, but for trade purposes, and because the effect would be to obstruct the navigation of the Severn by lowering the depth of its water-way. The river was now navigated for 42 miles, and had a daily traffic of 1000 tons, bringing a yearly revenue of £8000. It was a great artery of commerce in the Midland shires, and as a Commissioner of the Severn he knew that the effect of allowing Liverpool to take such an enormous quantity of water would be to diminish the water necessary for this traffic. He had not heard how the compensation clause was to be carried out, or how far it was adequate to meet the requirements of towns such as Bridgnorth, Worcester, Tewkesbury, and other towns which derived their supply from the Severn.

Dr. PLAYFAIR thought the House would do well to adopt the course proposed by Mr. Solater-Booth. If a Hybrid Committee were now appointed, having on either side as little local interest as possible, the subject would be fairly examined on its merits. Undoubtedly, a town like Liverpool had great need of water, and a proposal from the Corporation must receive attention, and there was every probability that a Hybrid Committee would do justice to the case. On general grounds, he believed that to refer the Bill to such a Committee was the proper course to adopt.

Mr. RAIKES, referring to what occurred with the Thirlmere scheme, said he hoped the Committee would be careful so to shape the amendments as not to risk the fate which befell the Manchester Corporation Bill in the House of Lords in 1878. He would say nothing on the merits of the Bill before the House, but supported the proposal to submit it to an examination by a Hybrid Committee. It was desirable that the Committee should be assisted by evidence from the Local Government Board, which would relieve the parties from some expense in calling many witnesses, and such evidence was always more valuable than professional evidence on either side, which was open to the suspicion that they supplied their information to order.

The motion for the rejection of the Bill was then withdrawn, and the Bill read a second time and referred to a Select Committee of nine members, five to be nominated by the House and four by the Committee of Selection. It was also ordered: "That it be an instruction to the Committee, that they have power to inquire into and report upon the present and prospective sufficiency of the water supply of the district which the Corporation of Liverpool are authorized to supply, and into the existence of any other available source of supply; and whether, having regard to the various interests affected by the scheme, and to the present and prospective requirements of the population in the Severn Valley—as to water supply, fishing, navigation, and the scouring effect of floods—compulsory powers should be given to take water from the River Vyrnwy and its tributaries; and, if so, to what extent, and under what conditions as to compensation water, or otherwise; and also what provisions are requisite for enforcing and securing such conditions."

THURSDAY, FEB. 26.

Petitions in favour of the following Bills were presented:—

- Great Yarmouth Water Bill, from (1) Corporation of Great Yarmouth; (2) Owners, &c., of Southtown and other places; (3) Board of Guardians of East and West Flegg.
- Liverpool Corporation Water Bill, from Householders and freeholders in the parish of Llanwddyn and other parishes in which the proposed works are to be situated.

BARNESLEY GAS COMPANY.—The annual meeting of this Company was held on Monday, the 16th ult., when the Directors report stated that they felt justified in recommending the payment of the full dividends authorized by the Company's Acts; although there would remain a balance of only £573 7s. 10d. to carry to the reserve-fund. This was less by £461 6s. 3d. than the balance carried to the reserve-fund at the end of the year 1878; but was more than accounted for in four ways—first, that the revenue from gas, for the first time during a long period, had not increased in the accustomed ratio, but, on the contrary, had yielded somewhat less for the year 1879 than for the year 1878; secondly, the fall in the price of coke; thirdly, by the increase in the amount (over £400) expended under the head of "repairs and renewals," the Directors having determined to keep up the works to the most efficient state; and, fourthly, the increase in the amount payable for dividends. The Directors hoped to have been able to advise a further reduction in the price of gas to the consumers; but, having regard to the diminution in the Company's income, and to the fact that the amount standing to the credit of the reserve-fund was still very largely below that fixed by statute, and having regard also to the serious loss the Company sustained annually by leakages caused by the winning of the coal underlying Barnsley and the neighbourhood, they felt the question must be postponed for the present. From the accounts it appears the capital of the Company is £90,000, of which £4000 only is loan capital. The expenditure comes to within £887 of the sum raised, £1572 having been laid out last year. The total receipts for the twelve months were £19,933, the net profit on which was £7569. The report and accounts were received and adopted by the meeting, much satisfaction being expressed at the state of the Company's business.

Legal Intelligence.

HIGH COURT OF JUSTICE—EXCHEQUER DIVISION.

MONDAY, FEB. 23.

(Sittings in Banco, before the LORD CHIEF BARON and Baron POLLOCK.)
TATTON v. THE STAFFORDSHIRE POTTERIES WATER-WORKS COMPANY.

This case, which had stood over in order that the parties might agree to the terms of a suggestion thrown out by the Court at the last hearing, on Dec. 11, 1879 [see JOURNAL, Vol. XXXIV., p. 936], that the damages should be reduced from £1400 to £400, came on again to-day.

Mr. BOSANQUET, who appeared for the plaintiff, said that the parties had agreed to accept the £400 (the action being for injuries done to the plaintiff's dyeing-works at Leek by the defendants reservoir at Tiddesworth), but there was some difficulty as to drawing up the order as to costs. He wished to know the direction of the Court as to them.

Mr. JELF, for the defendants, said they had practically succeeded on the argument of the rule, and had even added the £25 paid into court; he therefore thought it would meet the justice of the case if the parties paid their own costs.

The LORD CHIEF BARON said it ought not to be forgotten that the plaintiff had been practically ruined by the rendering of the water muddy by the defendants works, and by the subsequent litigation, and he thought the defendants ought to make up the damages to £450.

Mr. JELF, however, said his clients did not feel justified, having regard to the interests of their Shareholders, in offering any more.

His LORDSHIP then said an application must be made to Justice Stephen, who with himself had heard the rule argued, to give what direction he thought proper as to costs.

SWINDON POLICE COURT.—THURSDAY, FEB. 26.

(Before Messrs. H. CALLEY, Chairman, E. HANBURY, and W. W. COBBINGTON.)

CHARGE OF FORGERY, EMBEZZLEMENT, AND FRAUD BY A GAS-WORKS MANAGER.

William Barrett Swain, alias William Barrett, late Manager of the Swindon Gas and Coke Company, was brought up in custody charged with forging, on Dec. 23 last, eight share certificates in the Company, of the value of £10 each, and also with obtaining from a Mrs. Ann Boniface the sum of £80, by false pretences, on such certificates. There was a further charge of obtaining a sum of £50 from Messrs. R. W. Wallace and Co., and a cheque for £25 from Messrs. J. and J. Blott and Co.; and also other charges of embezzling certain sums of money from various customers of the Gas Company.

Mr. BOODLE appeared to prosecute, and, having opened the case, Mr. J. E. G. Bradford, the Chairman of the Gas Company, was called, and said: The prisoner was engaged as Manager of the works on the 26th of April last year, entering into residence on the works on the 1st of May—succeeding Mr. H. Hunt, the present Manager of the Stroud Gas-Works. Prisoner produced most excellent testimonials, one of them being for fifteen years good service. There was a written agreement entered into and signed by the prisoner, who represented himself as the late Manager of the Bedford Gas-Works. The salary was to be £100 per annum, with house-rent, coal, gas, rates and taxes, &c., free. The agreement put in was the one signed. It gave prisoner power to sell coke, but not tar, and provided that all moneys received should be at once paid into the bank. Witness found the prisoner addicted to drink, and his conduct generally very unbecoming. At the December meeting of the Board he was so disorderly that the Directors asked him when it would be convenient for him to leave their service. He mentioned the 30th of January, and this time was accepted, prisoner leaving on the 2nd of February. At one of the meetings prisoner remarked that he could get a much better price for the tar than they were receiving. In the autumn he was asked what was being done with the tar, and made some evasive answer, saying it would be accounted for. The prisoner was irregular with his payments, and when asked by any member of the Board how it was no coke money was paid in, he made some evasive answer. Prisoner was never instructed to deal with the tar, and he (witness) had never heard of Messrs. J. and J. Blott and Co. The tar had been always sent to Messrs. Butler and Co., at Bristol, and they forwarded a cheque direct to the Company for it, the transaction being entered on the minutes. There was no mention of any tar sales from when the prisoner became Manager until he left. Witness knew some tar was sold by prisoner last summer, but he did not know to whom, nor had it been accounted for. In January, 1879, it was reported that 20 shares had been transferred from the executors of the late J. H. Sheppard to Mr. W. H. Tucker, of Chester. He produced eight of these certificates. The eight shares handed in were all forgeries; the signatures—Thomas Strange, John Chandler, John Godwin, and himself—were all forgeries. Some of the shares bore numbers which showed them to have been taken from the share book used by the Company when it was first formed, although they professed to be countersigned by Henry Hunt, who was recently Manager of the Company. The forged scrip showed the date of the Company's proprietary deed to be 1877 instead of 1841. The previous afternoon witness received a letter from the prisoner at the police station, offering to make a clean breast of the whole affair if he would see him. He went to him, and prisoner then said he should plead guilty to everything, except as to some money he was charged with taking from a Mr. Holt. When asked how he obtained the share certificates, he said he took the original plate from the chest, and sent it to London for use in printing them.

In reply to the prisoner, witness said: I remember you bringing me a telegram about the tar last year, but I forget now what it was about, as I told you I could not do business out of the board-room.

Mrs. Ann Boniface, a widow, said she knew prisoner as the manager of the gas works. On Nov. 23 last year he called on her and said he had bought some gas shares, but had not sufficient money to pay for them; would she take two of them? She told him she could not, but she knew some one who would. She asked Miss Eagles, her assistant, if she would have them, and she consenting, she told prisoner. He asked for £12 on account, promising to settle on the following Monday, and she let him have the money. On Monday prisoner brought the books, to settle. She told him that she thought the matter had to be settled at the office, to which prisoner replied that it did not matter, for he had brought the books to save trouble. Miss Eagles then signed the book, and she gave him the other £8. From something she heard from Mr. Ashton, a former Manager of the works, she saw the prisoner again, and told him she had not a transfer paper. He said it was all right, he would let her have one. Prisoner asked her if she could not get a transfer paper from Mr. Froom, a relative, as he had lost his, and she did so, and prisoner drew up one for her like it. The next day prisoner called again and asked if she would take some more shares, as he found he could not do with all he had. She said she did not mind taking three, and gave him £10 on account. The day after he brought her four shares, asking if she would object to taking that number. She told him she would do so, and paid him the £70 balance. On that day she drew his attention to the stamp on the transfer paper, and he told her she had better send it to London to get it properly stamped, and she did so. A few days after this prisoner again called and

said he was thoroughly hard up, and was sorry to say he should have to part with the other two shares he had. She bought these of him, and he brought her the book produced [the original proprietary deed of the Company] to sign. The books of the Company were lying at her house some weeks, and she saw a number of signatures in them of persons who held shares.

Mr. W. B. Wearing, Manager of the County of Gloucester Bank at Swindon, said the bank acted as treasurers for the Gas Company. He put in the pass-book, showing the sums paid in, and whether by the prisoner or by the collector Sheppard. The signatures "Thomas Strange" on the forged shares produced he could swear were not Mr. Strange's, nor anything like it.

Mr. J. Chandler, one of the Directors of the Company, and one of the Committee of Management last year, denied that the signatures "John Chandler" were his.

Mr. J. Godwin, another Director of the Company, gave similar evidence with respect to his signatures on the forged certificates. He had never authorized any one to make use of his signature.

Mr. Henry Hunt, the present Manager of the Cainscross Gas-Works, Strood, prisoner's predecessor in the management of the Swindon Gas-Works, said there were two register-books of Shareholders in the office when he left. No. 1 contained the register of shares from No. 1 to No. 400, the other of later issues. The scrip produced bore the name of "Henry Hunt." He had never made the signature, nor authorized any one else to make it. The shares would be entered in the No. 1 register-book. He sold the tar, whilst acting as Manager of the Company, to Messrs. Butler and Co., and they always settled by cheque, which he paid directly into the bank. He never had authority to sell to any one else, except small quantities called for at the works.

In support of the charge of attempting to obtain £25 from Messrs. J. and J. Blott and Co., of the Eagle Chemical Works, Poplar,

Mr. J. Blott, of Chadwell Heath, Essex, was called, and said that on the 4th of February he received a telegram from the prisoner, asking where he could see him. He replied, and met the prisoner at his brokers in Mincing Lane. Prisoner there told him the Swindon Gas Company were anxious to sell 10,000 gallons of tar, and he had been instructed to sell it to a good firm, as the Directors had had some trouble with the firm they had previously been doing business with. He agreed to purchase the tar at 1d. per gallon, put into his firm's boats at Swindon. On the 6th of February he received a letter from Swindon, on the printed paper of the Company, and bearing the Company's stamp, asking where prisoner could see him on the next day to sign the agreement, and adding that as the last cheque the Company had received was dishonoured, the Directors would insist upon the deposit of £25 in cash, this part being heavily underlined.

Mr. BOODLE: I think you have another letter, in which prisoner describes the Directors as being "as mad as March hares"?

Witness: Yes.

Mr. BOODLE: Kindly hand it in. It will be no doubt edifying for Mr. Bradford.

Examination continued: On the 8th of February witness wrote to the prisoner, telling him he had sent a cheque for £25, which could be paid into the bank and honoured long before his firm had the tar. To this prisoner replied that he had just left the Directors meeting, and they were all mad; he must have cash, as they would trust no one. The cheque produced by Sergeant Strong was the one he signed and sent to the prisoner. It was crossed, and marked "Not negotiable."

Mr. BOODLE: That business precaution saved you £25, I believe?

Witness: No; saved the Gas Company.

Mr. BOODLE: No; the prisoner at that time was not their servant, he having left on Feb. 1.

In the case of embezzlement from Messrs. R. W. Wallace and Co., of Mark Lane, London,

Mr. C. Lamb, the firm's Manager, said on the 15th of May last year he heard from prisoner, and saw him at their offices in London. Witness agreed to purchase all the tar the Company made during a twelvemonth. Prisoner asked for a deposit of £20, and a crossed cheque for the amount was given to him. Prisoner said he did not know if his Directors would accept a crossed cheque, but took it away. The next morning the firm received a letter from prisoner from Swindon, stating that the Chairman was not satisfied with the cheque, and he had returned it, adding that the next day he would run up and explain. He accordingly came, but witness could not meet him, leaving a note stating that the cash should be paid before the firm had the tar. On the back of this note the prisoner wrote that as his terms had not been complied with he cancelled the whole transaction. On the 17th of May witness sent prisoner a Bank of England note for £20 in a registered letter. The first tar they had was at the end of July last, when they received 216 casks. On the 22nd of August a crossed cheque for £22 1s. 6d. to pay the balance due for this lot was given to prisoner in London. He returned the cheque, saying a crossed cheque would not do, the Directors being mad; and then an open cheque was given to him. The firm sent 300 barrels to the gas-works to be filled. In September they received 48 of them full, and an invoice for £13 13s. Prisoner called at the office for this money, and waited there whilst they sent to the bank for the cash. On Jan. 20 this year 50 more barrels were sent, and an invoice for £9, for which prisoner was paid by cheque. He next saw prisoner on the 9th of February, after many letters had been sent him complaining of the non-delivery of the tar at the firm's office in London. Whilst in the office a telegram was handed in to prisoner, from his wife, telling him that Drewitt, the foreman, had just sent off 100 casks of tar for Messrs. Wallace, which telegram the prisoner handed to witness, saying, "There you are; you see the tar is all right." Witness then showed prisoner a statement which he had just received from the Company, showing

that his firm owed £39 0s. 6d. for the very tar for which he had paid prisoner cash. Prisoner said this was a mistake, and at once wrote across the statement that it was "all a mistake." Prisoner then stated that he was about to leave the Company's employ, and, wishing to clear up everything before he left, would witness let him have a cheque for the 100 barrels then on the way up. Witness gave him a cheque as requested, and also for 50 casks which prisoner said he had been obliged to purchase in the town to put the tar in. The tar had never arrived.

Mr. Bradford, recalled, said he visited the works on Jan. 30 last. He inquired for the prisoner, and found he had gone to London. There was not then at the works any tar waiting to be sent away.

By the CHAIRMAN: The £64 18s. paid by Messrs. Wallace to the prisoner had never been credited to the Company, nor was there any trace of it in their books.

The CHAIRMAN: That being so, and as the money received for tar came in regularly before prisoner was employed, how was it the Directors did not make inquiries?

Witness said they did several times, and prisoner put them off by promises that he would make it all right in due time. He added that he had complained to prisoner of his frequent absence in London, and asked the cause, to which prisoner replied that it was a private matter.

Mr. S. Hunt, an accountant, said he had been through the books of the Company with the prisoner, whom he used to assist with the accounts. When the item £39 0s. 6d. for tar to Messrs. Wallace and Co. was reached, he believed prisoner led him to understand it had not been paid. If he had not done so the entry would appear on the cash side.

Police-sergeant Strong proved apprehending prisoner at Great Grimsby. He found in his box a pass-book, showing the Gas Company's account up to the 16th of February last. He also found in a purse in his house the cheque for £25 given by Messrs. Blott and Co. to prisoner. He confirmed Mr. Bradford as to what took place in the police-station on the previous day.

Prisoner, who had nothing to say, was then remanded for a week to complete the depositions, previous to being committed for trial.

Miscellaneous News.

ON THE QUANTITY AND QUALITY OF THE WATER SUPPLIED TO LONDON DURING 1879,

BEING THE ANNUAL REPORT SUBMITTED TO THE SOCIETY OF MEDICAL OFFICERS OF HEALTH.

By CHARLES MEYMOTT TIDY, M.B., M.R.C.S., F.C.S., &c.

To the President, Council, and Members of the Society of Medical Officers of Health,

Gentlemen,—An average of 32·7 gallons of water per head has been daily supplied during 1879, to upwards of 4 millions of people, by the eight London Water Companies. This quantity is, in my opinion, at least one-third in excess of what is necessary or even advisable. The vast population within the districts of the Companies reside in 573,792 houses, of which about a quarter (138,624) are on the constant service (December).

All the water (except about 1-19th of the total quantity—viz., that supplied by the Kent Water Company) is filtered before delivery, and no less than 82 acres of ground are covered by filter-beds for the efficient filtration of the water.

In Table I., I have stated for your information the quantities supplied monthly by the eight London Water Companies, the number of houses so supplied, and the quantity (including waste) per head of the population. One-half of the water, in round numbers, was taken from the River Thames, and the remainder from the Lea, the New River, and from chalk wells.

TABLE I.

Average Daily Supply to the Metropolis during 1879.

(Estimated Population supplied by the Eight Companies, June, 1879, 4,101,200.)

1879.	Average Daily Supply in Gallons.	Number of Houses Supplied.	Quantity supplied Daily, in Gallons, per Head of the Population.
January	137,099,205	552,657	33·2
February	129,941,893	554,227	31·6
March	129,561,672	556,767	31·5
April	128,493,940	557,660	31·3
May	132,584,711	562,058	32·5
June	134,725,591	563,000	32·8
July	135,981,121	565,798	33·1
August	140,308,815	566,755	34·2
September	139,492,704	568,773	34·0
October	134,868,826	571,608	32·8
November	131,877,956	572,505	32·1
December	138,810,978	573,792	33·8
Average	134,178,951	563,800	32·7

Note.—It is believed that these quantities are given upon the gross capacities of the pumps, and that they are consequently subject to a deduction of about 10 per cent. to arrive at the net quantities.

In Table II., I have, as usual, given the average composition of the water of the London Companies during 1879, the detailed analysis of the several samples having been month by month duly submitted to you.

TABLE II.

Average Composition and Quality of the Metropolitan Water during the Year 1879.

[The quantities of the several constituents are calculated in grains per Imperial gallon—70,000 grains.]

	Ammonia.		Nitrogen as Nitrates, &c.	Oxygen required to oxidize Organic Matter, &c.	Total Solids.	Lime.	Magnesia.	Chlorine.	Sulphuric Anhydride	Hardness on Clark's Scale.	
	Saline.	Organic.								Before Boiling.	After Boiling.
Thames Water Companies—	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Degrees.	Degrees.
Grand Junction	0·000	0·008	0·148	0·091	21·12	7·865	0·583	1·092	1·452	14·3	4·1
West Middlesex	0·000	0·009	0·137	0·083	21·03	7·960	0·576	1·078	1·437	14·2	3·9
Southwark and Vauxhall	0·000	0·008	0·124	0·089	20·34	7·521	0·548	1·074	1·482	13·8	3·8
Chelsea	0·000	0·008	0·135	0·065	20·32	7·650	0·520	1·122	1·557	13·9	3·8
Lambeth	0·000	0·008	0·134	0·078	21·09	7·550	0·592	1·116	1·519	14·1	3·9
Other Companies—											
Kent	0·000	0·003	0·392	0·011	28·84	9·580	0·823	1·709	2·550	18·7	6·3
New River	0·000	0·005	0·145	0·045	20·84	7·753	0·535	1·092	1·395	14·1	3·6
East London	0·000	0·008	0·139	0·058	22·21	7·990	0·603	1·193	1·549	14·8	4·1

Note.—The amount of oxygen required to oxidize the organic matter, nitrates, &c., is determined by a standard solution of permanganate of potash acting for three hours.

Grand Junction.—The total solid matter obtained by evaporation to dryness ranged from 19.70 grains per gallon in April, to 22.50 grains in December; the nitrogen, as nitrates, from 0.050 grain in November, to 0.165 grain in June. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon was in April, 0.026 grain, and the maximum in June, 0.165 grain. The samples collected in January and June contained a slight trace of suspended matter. In the other months the water was clear.

West Middlesex.—The total solid matter ranged from 20 grains per gallon in January, to 22 grains in February and December; the nitrogen, as nitrates, from 0.095 grain in July, to 0.210 grain in December. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon was in April, 0.015 grain, and the maximum in September, 0.159 grain. None of the samples contained any matters in suspension.

Southwark and Vauxhall.—The total solid matter ranged from 18.20 grains per gallon in January, to 23.70 grains in December; the nitrogen, as nitrates, from 0.102 grain in June, to 0.180 grain in December. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon was in February, 0.036 grain, and the maximum in September, 0.155 grain. The sample collected in January contained a trace of suspended matter. In the other months the water was clear.

Chelsea.—The total solid matter ranged from 19 grains in July, to 22.20 grains in February; the nitrogen, as nitrates, from 0.090 grain in August, to 0.210 grain in January. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon was in June, 0.033 grain, and the maximum in July, 0.105 grain. The samples collected in January and November contained a trace of suspended matter. All the other samples were clear.

Lambeth.—The total solid matter ranged from 20.20 grains per gallon in June, to 22.10 grains in December; the nitrogen, as nitrates, from 0.094 grain in July, to 0.180 grain in December. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon was in May, 0.036 grain, and the maximum in September, 0.148 grain. The sample collected in January contained a trace of suspended matter. In the other months the water was clear.

Kent.—The total solid matter ranged from 26.70 grains per gallon in September, to 31.10 grains in December; the nitrogen, as nitrates, from 0.300 grain in July, to 0.450 grain in November and December. The amount of oxygen needed to oxidize the organic and other matters per gallon ranged from 0.001 grain in July, to 0.039 grain in November. The samples collected were uniformly bright and clear.

New River.—The total solid matter ranged from 19.40 grains per gallon in March, to 22.40 grains in February; the nitrogen, as nitrates, from 0.120 grain in June and August, to 0.200 grain in December. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon was in November, 0.014 grain, and the maximum in August, 0.107 grain. The samples collected from the mains were, without exception, bright and clear.

East London.—The total solid matter ranged from 20 grains per gallon in October, to 26 grains in February; the nitrogen, as nitrates, from 0.105 grain in May and July, to 0.195 grain in December. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon was in April, 0.028 grain, and the maximum in October, 0.086 grain. The samples, as collected from the Company's mains, were, without exception, perfectly bright, and free from suspended matter.

I would remark here that the year through which we have passed has been an exceptionally trying one for the Water Companies—indeed, far more trying than any of which I have had experience. The excessive rainfall has rendered the Thames more frequently than usual thick and turbid. It was to have been expected that the analyses would show a larger average amount of organic matter than in previous years, and the only thing which need surprise us is that it is not greater than results prove it to be. And yet, notwithstanding this—and I specially direct your attention to the fact—the death-rate of London for 1879 is the lowest on record.

When I write my next report it is not unlikely that the water supply will have passed out of the hands of the Companies, and the management be vested in some other body. I will not venture to predict the future of the London Water Supply, but I again repeat what I have said more than once before, that in my opinion no better sources of water can be found for the Metropolis, considering all the facts of the case, than the rivers Thames and Lea. I trust, when the Companies have passed into the hands of Government, that the general management of the several works will be as good as now, and that the change the public have clamoured for, and the more efficient working that the public expect, will be seen, not merely in lessened taxation, but in the improved health of the people and in a lower death-rate.

(Signed) C. MEYMOTT TIDY.

THE LIVERPOOL CORPORATION (VYRNWY) WATER SCHEME.

On Monday last week a meeting of owners and ratepayers of Shrewsbury was held, to consider whether steps should be taken to oppose the Liverpool Corporation Water Bill now before Parliament. After a long discussion, a resolution was passed authorizing the Town Council to oppose the Bill, and also to raise a rate not exceeding 1½d. in the pound to pay the expenses incurred. The rate is estimated to produce £600.

A special meeting of the Cheltenham Town Council was also held to consider the same subject. The interest in the Severn claimed for Cheltenham is the right the Corporation have acquired, by the purchase of the works of the late Cheltenham Water-Works Company, to abstract 3½ million gallons of water from the river daily, which right is only at present exercised to the extent needed for the supply of Tewkesbury. The Chairman of the Water Committee moved a resolution authorizing the expenditure of £500 upon the prosecution of the petition in opposition to the Bill, but an amendment was carried by 11 votes to 7, to the effect that no opposition should be offered to the Bill, on the ground that it did not affect the interests of Cheltenham, and that it would, therefore, be unjust to tax the town for the purpose. Notice was then given of a motion to rescind the resolution already passed to lodge a petition against the Bill.

At a special meeting of the Bewdley Town Council, Mr. Gabb, referring to the scheme, said he thought it would prove a blessing rather than otherwise to the towns on the banks of the Severn. They would have a more regular supply of water in the Severn, and if they could get 8 million gallons of water emptied into the river in dry seasons they would not be able to walk over dryshod. Then they would have less flooding, because the Liverpool Corporation would be compelled to store the water during the flood season. After some discussion, a resolution was proposed that the Liverpool Corporation Water Bill be opposed by the Council, the cost of opposition being limited to a sum equal to a rate of 3d. in the pound. Only 7 members voted in favour of the motion, 4 remaining neutral, and, as the resolution did not receive the support of a necessary majority, the whole matter has fallen through.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

The Fortieth Quarterly and Tenth Annual Meeting of this Institution was held at the Mitre Hotel, Manchester, on Saturday, the 28th ult. The attendance of members was very large. Visitors from kindred Associations were present, including Mr. Mitchell, the President of the West of Scotland Association of Gas Managers.

The minutes of the previous meeting and the report of the Committee for the past year were read.

The election of new members and the other preliminary business having been completed, the retiring President, Mr. T. Newbigging, introduced Mr. William Carr, of Halifax, the President for the ensuing year, who thereupon took the chair. Mr. J. Chew, of Blackpool, was elected Vice-President; and Messrs. Barrett, Manchester; Coles, Todmorden; and Veevers, Dukinfield, Members of Committee in place of those retiring. Mr. Robert Hunter, the Honorary Secretary, was re-elected, as were also Messrs. Lord and Smedley, the Auditors.

The President then proceeded to deliver his Inaugural Address, dealing with many important matters, and it was listened to by an appreciative audience.

Papers were afterwards read by Mr. Hawkins, of Wigan, "On Gas Purification;" and by Mr. Chew, jun., of Blackpool, "On Three Months Experience of the Working of the Electric Light."

The following articles were on exhibition during the meeting:—A Siemens electric lamp; a section cut from a pipe socket, showing Painter's hydrostatic joint; a sample of Spence's new metal for pipe-joints; and a model of Tangye Brothers and Holman's anti-dip pipe and valve.

We shall publish the proceedings *in extenso* in future numbers of the JOURNAL.

WAKEFIELD GAS COMPANY.

The Half-Yearly Meeting of this Company was held on Monday, the 16th ult.—Mr. W. STATTER, J.P., in the chair.

The SECRETARY and MANAGER (Mr. J. W. Whitaker) having read the notice of meeting, the report of the Directors for the past six months was presented. It stated that the amount divisible amongst the Proprietors was £5523 19s. 1d., out of which the Directors recommended the payment of dividends for the half year at the rate of 11 per cent. on the original shares, 8½ per cent. on the B 5th shares, and at the rate of £7 14s. per cent. per annum on the new £10 shares, all clear of income-tax. It was further stated that the extensions to the purifying plant had been thoroughly completed and in use during the past half year, and that the works generally were in good order.

Dr. Revenue Account, for the Half Year ended Dec. 31, 1879.		Cr.	
Manufacture of gas—		Sale of gas—	
Coals, including dues, &c.	£2,995 16 5	Common gas	£8,107 4 3
Purifying materials	212 16 8	Public lighting and under contracts	756 15 0
Salaries of Engineer, &c.	100 0 0	Rental of meters	353 9 9
Wages and gratuities	797 10 6	Residual products—	
Repair and maintenance of works and plant	802 17 3	Coke, less labour and cartage	1,136 15 4
Distribution of gas—		Tar, " "	1,000 13 3
Salaries of Inspectors, &c.	137 14 3	Ammoniacal liquor	1,318 19 1
Repair, &c., of mains and services	147 12 3	Rents	53 3 0
Repairing, renewing, and refixing meters	63 18 4	Transfer fees	2 2 6
Repairing public lamps	53 16 3	Fitting and service-laying account	42 1 8
Rates and taxes	640 10 4	Interest allowed on banking account	10 3 5
Management—		Law charges recovered	1 7 0
Directors' allowances	200 0 0		
Salaries of Secretary and Clerks	79 2 0		
Collectors' salaries	117 10 0		
Stationery and printing	35 9 6		
General charges and incidentals	19 1 3		
Auditors' fees	25 0 0		
Bad debts	100 0 0		
Superannuation allowance	100 0 0		
Deficiency of gas exhibition	17 11 3		
Total expenditure	£6,677 6 6		
Balance	6,105 7 9		
	£12,782 14 3		£12,782 14 3

The CHAIRMAN moved the adoption of the report and accounts. He said he might supplement what was stated in the report by saying that the Company's works were not only in good order, but had been very efficiently worked. The increase in the quantity of gas made was something considerable. During the last half year 77,371,000 cubic feet of gas had been made, being an increase of 5,458,000 feet over the corresponding half year of 1878. The increase in the first half of 1879 was about 6,500,000 feet, or for the whole year 12,137,000 feet, which amounted together to an increase of 9 per cent. This increase in the quantity of gas made compelled the Directors to consider the propriety of increasing their storage room. At present they had room for 800,000 feet, and he believed it was an axiom that if they could store one day's supply they could store enough; but during the past winter they had exceeded 800,000 feet a day on thirteen occasions, and one day they supplied as much as 850,000 feet. The Directors were, therefore, making preparations for the erection of another gas-holder, and in the course of a month the contracts would be let. The proposed new holder would involve an addition to capital of £10,000 or £12,000; so that the Shareholders might expect another call to be made upon them before very long. The illuminating power of the gas had been maintained at 17½ candles, and he believed there had been no complaint either as to the quality or the quantity of the supply. After paying the dividends as recommended in the report, there would be a surplus of £1258 to add to the reserve-fund, which would then amount to £6515.

Mr. BRIGGS seconded the motion, and it was adopted.

The CHAIRMAN then proposed the payment of the dividends, and the motion was seconded by Alderman HOWDEN. After which,

On the motion of Mr. B. WATSON, seconded by Alderman MOORHOUSE, a vote of thanks was given to the Directors, and the meeting ended.

ALDERSHOT GAS AND WATER COMPANY.—The half-yearly meeting of this Company was held on Wednesday last, when the Directors report recommended that a dividend of 3 per cent.—being at the rate of 6 per cent. per annum—be declared, free of income-tax, on the ordinary shares. In reference to the gas-works, the report stated: "The increase in the consumption of gas is very fair. During the half year the duplicate 8-inch main from the gas-works has been carried into the centre of the town, and some further extensions into the new roads have been lately laid out." In regard to the water supply, it was stated: "There is also a moderate increase in the sale of water. About a mile of new mains have been laid, and contracts have been made for a duplicate pumping-engine, and for another tube well to the chalk, the first one having been only a test, and not being sufficiently large to supply the amount required." The new capital to pay for the work being carried out has been raised by the issue of 6 per cent. preference shares of £10 each, at the price of £12.

SOUTH SHIELDS GAS COMPANY.

The Ordinary Meeting of this Company was held on Thursday last—Dr. R. WALLIS, J.P., in the chair.

The SECRETARY (Mr. J. H. Penney) read the notice convening the meeting, after which the following report was submitted:—

The Directors beg to submit to the Proprietors the accounts for the half year ending Dec. 31 last.

The balance of the profit and loss (net revenue) account amounts to £4196 5s. 9d., out of which the Directors recommend the payment of a dividend for the half year ending Dec. 31 last at the rate of 7 per cent. per annum.

The gas consumption for the past half year was 75,187,700 cubic feet, which shows an increase over the corresponding period of last year of 6,707,800 cubic feet.

The Jarrow new works have been in operation since the last meeting. The Engineer's patent stoking machine has been at work during the same period, and has given great satisfaction.

Your Directors have effected a great saving by completing the contracts for a new gasholder and retort-house roof, before the rise in the price of iron.

The Directors beg to recommend a reduction of 3d. per 1000 feet in the price of gas, to take effect from the beginning of the present year. This will make the prices within the boroughs of South Shields and Jarrow, after deducting the usual discounts, about 2s. 9d., 2s. 8d., 2s. 6½d., and 2s. 5d. per 1000 feet respectively.

The retiring Auditor is Mr. John Ridley, who, being eligible, offers himself for re-election. The Directors retire from office and seek re-election.

Dr.—Capital Account, for the Half Year ended Dec. 31, 1879.

	Expenditure to June 30, 1879.	Expended this Half Year.	Total to Dec. 31, 1879.
To Expenditure to June 30, 1879 . . .	£111,904 10 0	—	£111,904 10 0
Since that date—			
New buildings, manufacturing plant, machines, storage works, &c. . .	..	£8,928 12 11	
New mains and service-pipes (not being in place of old ones) . . .	..	191 8 10	
New meters (not in place of old ones) including fixing . . .	..	151 7 5	
Costs of promoting special Act . . .	..	1,909 0 9	
			11,180 9 11
			£123,084 19 11

Cr.—Capital Account.

	Certified Receipts to June 30, 1879.	Receipts during this Half Year.	Total Receipts to Dec. 31, 1879.
By £80,000 9 per cent. stock and share capital, now converted into South Shields Gas Consolidated Stock, at 7 per cent.	£91,500 0 0	..	£91,500 0 0
New stock	£5080 0 0	..	
Less calls unpaid	530 2 0	..	
Premiums on issue of new stock . . .	..	£7,549 13 0	7,549 13 0
Loans on mortgage	19,800 0 0	2,107 17 6	2,107 17 6
			19,800 0 0
			£120,957 15 6
Balance . . . . .	..	..	2,127 4 5
			£123,084 19 11

Dr. Revenue Account, for the Half Year ended Dec. 31, 1879.

	Cr.
Manufacture of gas—	
Coals, including dues, &c.	£3,548 4 11
Purifying materials, &c.	214 14 4
Salaries of Engineer and Officers at works	543 4 3
Wages and gratuities	1,053 3 10
Repair and maintenance of works and plant	2,693 12 6
Distribution of gas—	
Salaries of Inspector, &c.	166 6 8
Repair, maintenance, and renewal of mains and of service-pipes	210 15 11
Repairing, renewing, and re-fixing meters	320 4 1
Lighting and repairing public lamps	458 0 1
Rents	159 18 0
Rates and taxes	406 7 1
Management—	
Directors allowances	140 11 0
Salaries of Secretary, Accountant, Clerks, &c.	287 15 0
Collectors commission	122 2 0
Stationery and printing	60 11 7
General charges and incidents	129 14 11
Auditors	21 0 0
Law charges	18 16 7
Bad debts	12 18 11
Total expenditure	£10,597 5 4
Balance	4,886 11 10
	£15,483 17 2

The CHAIRMAN said since the Shareholders last met the Company had obtained the Royal Assent to the Bill they promoted in Parliament last session. They had secured extended powers under the Act, and by it they were placed in a different position in regard to gas legislation. They would all have received a copy of the report and balance-sheet, and from it they would perceive that the accounts were presented in a more comprehensive manner than formerly. This, of course, entailed considerable extra work on their Secretary and other officials. As they were aware, under the new Act of Parliament the old Shareholders of the Company were not now in a position to divide any new capital that might be required *pro rata* according to their interest in the Company, and the result was that the shares had to be offered for sale by public auction. They had already had one sale of shares, and the shares met with a very ready sale, realizing good prices. This he considered was one of the surest signs that the Company were in a sound and prosperous position. They had recently passed through times of great depression in a commercial point of view, but the Company had been enabled to maintain their position amongst other mercantile concerns in the country. This depression they had reason to believe had passed away, and there was seen a silver lining in the dark cloud, so that they might look forward to a new state of matters in regard to the development of the national industries of this country. They, in fact, saw on all hands a great revival of trade, and he was glad to observe that the receipts of the River Tyne Commissioners for dues had gone up 12 per cent. The iron and coal trades were also giving indications of being once more prosperous. With regard to the coal trade, he might say that the Directors had secured contracts, on most favourable terms, for the ensuing year—in fact, he might say that since they signed their contract coal had advanced from 1s. to 1s. 6d. per ton. These were all signs of the times, and he was proud to say the Company were keeping pace with them. Comparing the corresponding half

of the previous year with that of last year, they were in a most favourable position. Respecting the sale of gas, in comparing the half year of 1878 with that just closed, he found they had sold 7 millions of cubic feet of gas more than in the corresponding half of the previous year, and in money value the increase was £994. These were all just sources of congratulation. Respecting the recent sale of new stock, he must say that the regulations of the Legislature were very strict, although at the same time fair and just. Instead of dividing the stock among themselves at par, the shares were sold at a premium. The Shareholders, however, did not altogether lose the benefit, seeing that the premiums realized went to increase the capital without bearing interest, and thus tended towards the reduction of the mortgage debt. As to the insurance of the works, under the new Act they had an insurance-fund to which they could devote surplus money equal to one-twentieth part of the paid-up capital. The reserve-fund was at its maximum, and, therefore, the regulations of the Act did not affect it. According to the terms of this Act, the Shareholders became entitled to 6s. for every 1d. per 1000 feet reduction in the price of gas; and they would see that the Directors had in their wisdom reduced the price of gas 3d. per 1000 feet, so that the Shareholders would in the next half year receive 15s. per cent. additional dividend. They had some difficulty in coming to this conclusion, but considering that they now had £994 to carry over to the next half year, and that they might fairly expect there would be an increased consumption of gas owing to the revival of trade, they saw their way to make the reduction. He then referred to the Jarrow works, and the successful working of Mr. Warner's patent stoking apparatus, and said he had no doubt that when the retort-house was in full operation, Mr. Warner's estimate of the saving that would be effected was rather under than over stated. They would, he felt sure, save in the retort-house at least £1000 a year by the use of the machine. He concluded by moving the adoption of the report.

Mr. HENDERSON said he had great pleasure in seconding the motion. It must be indeed gratifying to the Shareholders to have such works as they had at Jarrow, which were second to none in the kingdom. He thought that they might congratulate themselves upon their success.

Mr. SMITH said he was very much gratified at witnessing the patent stoking machine at work at Jarrow a few days ago. He considered that the machine was quite a success, and it must have cost Mr. Warner a great amount of labour to bring it to such perfection.

Mr. BOWMAN said he thought the Directors ought to be congratulated upon the step they had taken in reducing the price of gas. The reduction would be most acceptable to both large and small consumers.

The motion having been adopted, Mr. HALL proposed that a dividend on the consolidated stock of the Company be declared at the rate of 7 per cent. He referred to the consideration which the Directors had given respecting the reduction in the price of gas, and alluded to the charges made by other Companies.

Mr. RIDLEY seconded the proposition, which was carried.

Mr. NELSON moved that the fees of the Auditors be increased from £42 to £50 per annum. The Auditors, he said, under the new Act of Parliament, had increased duties, and it was only right that they should have additional remuneration.

Mr. BOWMAN seconded the motion, which was also carried, and Mr. RIDLEY returned thanks on behalf of himself and Mr. Chapman.

Mr. MOORE then proposed a cordial vote of thanks to the Directors for their services during the past half year. The proposition, he said, needed no commendation, as the result of their labours had been so satisfactory. The Directors of the Company were gentlemen who had a very large and comprehensive understanding of the duties entrusted to them. For his own part he looked upon the Company as the trustees for the public, as from what he had seen he believed the Directors themselves considered they had a duty to perform to the public. He had to congratulate them upon the recent reduction in the price of the gas. Gas was now one of the essentials of life, and therefore it was only right it should be supplied at the lowest rate. According to the Company's new Act of Parliament, the larger the dividend which the Shareholders were entitled to receive, the greater was the reduction in the price of gas the public were entitled to.

Mr. DUNCAN seconded the motion, and said the Directors had undoubtedly given great care and anxiety to the interests of the Shareholders in promoting the welfare of the Company. It was indeed most gratifying to hear from Mr. Henderson that the Directors were satisfied with what they had done.

The vote of thanks was carried, and Mr. HENDERSON responded; after which the Directors were re-elected for the ensuing half year, and the proceedings terminated with a vote of thanks to the Chairman.

PETERBOROUGH GAS COMPANY.

The Half-Yearly Meeting of this Company was held on Tuesday, Feb. 17—Mr. W. HARRIS in the chair—when the Directors reported that during the past half year the consumption of gas had been somewhat less than in the corresponding period of 1878, and this, together with the reduction in price effected from the 1st of July last, had prevented so large a profit resulting from the six months working as during the previous period. The receipts for the last half year amounted to £6434 4s. 1d., of which £5054 5s. 10d. was from the sale of gas. The manufacturing charges were £2433 9s. 9d.; repairs and maintenance, £405 16s. 11d.; other miscellaneous expenses, £1110 16s. 10d.; so that, after making allowance for interest on mortgages, bad debts, and stocks in hand, there remained a sum of £2444 16s. 3d. to be carried to profit and loss account. This added to £62 10s. 3d., brought forward from the previous half year, made a total of £2507 6s. 6d.; from which, after providing for the payment of the preferential dividend on the 5 per cent. new preference A shares, the Directors recommended the payment of the maximum dividend for the half year on the remaining share capital of the Company, and a back dividend at the rate of 1 per cent. per annum, or 2s. per share on the ordinary shares of the Company, for the year ending Sept. 30, 1879, free of income-tax. The Company's capital consists of £59,150 of shares, and £6446 10s. of mortgages; the expenditure on capital account to date being £622 less than the receipts.

The CHAIRMAN, in moving the adoption of the report and accounts, said that, notwithstanding the very great commercial depression which had prevailed all over England, and indeed all over Europe, the prosperity of the Company had not been greatly hindered. The difference in the amount of gas-rental between the half years ending Dec. 31, 1878, and Dec. 31, 1879, was £354 17s. 9d. in favour of the former period, which was altogether an exceptional half year—the winter set in very early, and it was of remarkable severity, so that the consumption of gas was much larger than usual. It must also be remembered that during last half year the reduction in the price of gas had taken effect to the amount of £246 10s., being the third reduction within three years. When the Company commenced the manufacture of sulphate of ammonia, the enterprise was regarded with some degree of doubt by several of their friends, whose opinions were entitled to respectful consideration on their part. The Directors thought, however, the result would be held to justify their

action, for the first year's working under their Engineer and Manager (Mr. G. E. Stevenson) showed a net profit of £491 13s. 8d., whilst previously one year's sale of ammoniacal liquor realized only about £150.

Mr. E. VERGETTE seconded the motion, which was agreed to.

The CHAIRMAN proposed that the dividends for the half year, as recommended in the report, be declared.

This proposal was seconded by Mr. T. W. HOLDICH, and carried.

Mr. REDHEAD proposed, and Mr. T. W. HOLDICH seconded, that the salary of the Secretary (Mr. J. Graves) be increased.

This was agreed to; and a vote of thanks was passed to the Chairman, who responded, and the meeting terminated.

NEWPORT (MON.) GAS COMPANY.

The Half-Yearly Meeting of this Company was held on Monday last week—Mr. T. GRATREX in the chair.

The SECRETARY (Mr. E. F. Marfleet) read the notice convening the meeting, and the Directors report was taken as read. It recommended the payment of the usual dividends for the last half year; and stated: "The Directors have determined to commence a depreciation-fund for the works on leasehold land. A new purifying-house has been erected, and the new purifiers, referred to in former reports, have been carried out, and, with the other works of the Company, are in full working order. A new and enlarged station-meter has been erected, and is now in use. The Directors do not intend erecting any additional works on the present site. The purchase of the additional freehold land is progressing, and the capital produced from the recent call will pay the remainder of the purchase-money."

The Company's receipts during the past six months amounted to £9484; and the expenditure to £6928; leaving a profit of £2556 to carry to next revenue account, to the credit of which there was already a sum of £2869 of unappropriated profits of previous half years. The capital of the Company is £61,250 in shares, and £10,750 of borrowed money, while the expenditure to date of account exceeded these sums by £1808. The reserve-fund amounts to £4000; and the depreciation-fund, which is just commenced, to £200.

The CHAIRMAN having moved, and Mr. JACKSON seconded, the adoption of the report,

Mr. CHRISTOPHERS asked, in regard to the depreciation-fund, why it had not been commenced before.

The SECRETARY said they were not able to do so till their Act of 1875.

The motion was then agreed to.

The CHAIRMAN next moved the following resolution—"That dividends at the rate of 5 per cent. on class A stock, 3½ on class B stock, and 3½ on class C shares, for the half year ending Dec. 31, 1879, be declared."

Mr. E. J. PHILLIPS, who seconded the motion, said that the accounts for the last half year were not so satisfactory as those of the three previous half years; yet, in the various departments, there had been a saving. In the item of coal there had been a saving of more than £400; in purifying materials, about £120. There had also been a saving in the salaries of officers, maintenance of the works and plant, and in almost every other department. In spite of these facts, the balance only showed an amount of £2556 3s. 11d. In the half year ending June, 1878, it was £3613; at December, 1878, £2606; while at June, 1879, it was £2680. One reason why the balance was not so good was the fact that the rates and taxes charged were very high. There had been a dispute between the Company and the Assessment Committee of the Guardians, but he believed the matter would be amicably settled. The gas supplied during the half year had been of good quality, as tested by the officer of the Corporation. The illuminating power had been kept up to 15½ candles, and there was no trace of sulphuretted hydrogen.

Mr. WILLIAMS asked whether the depressed times had had any effect as to the collection of the gas-rates.

The CHAIRMAN: Yes, certainly; but we have much to be thankful for.

The resolution was then carried, and this was all the business of the meeting.

SUNDERLAND AND SOUTH SHIELDS WATER COMPANY.

The Annual General Meeting of this Company was held on Tuesday, the 24th ult.—Mr. R. VINT in the chair.

The SECRETARY (Mr. J. W. Sutherland) having read the notice convening the meeting, the following report was presented:—

The new pumping-station at Dalton is now completed, with the exception of the removal of the temporary plant from the ground, which is being proceeded with as quickly as possible. The engines are in full working order, and the supply of water obtained has been highly satisfactory and of excellent quality.

Your Directors recommend that a dividend of 5 per cent. on the ordinary and preference stocks of the Company, for the half year ending Dec. 31, 1879, clear of income-tax, be declared, making, with the interim dividend paid on the 1st of September last, 10 per cent. for the year; also that interest at the rate of 5 per cent. per annum be paid on the amount called up on shares allotted, Sept. 3, 1875.

The retiring Directors are Messrs. Vint, Stokoe, Richardson, and Hall, and the retiring Auditor is Mr. H. G. Armstrong; all of whom are eligible for re-election.

Revenue Account, for the Year ending Dec. 31, 1879.		Cr.	
Dr.			
Wages	£3,911 12 11	Balance from 1878	£27,170 2 10
Coals, including carriage	2,350 16 9	Less dividend declared at last annual meeting	16,379 16 1
Rates and taxes	4,175 19 0		
Salaries and Auditors	2,182 10 0		
Directors	500 0 0		
Repairs	1,948 5 0	Water-rents, interest, &c.	£10,790 6 9
Oil, tallow, &c.	251 6 8		47,169 7 11
Printing, stationery, &c.	185 12 2		
Incide. tals.	404 0 0		
Interest on bonds	162 1 8		
	£16,072 4 2		
Interim dividend	16,563 17 2		
Balance	25,324 13 4		
	£57,959 14 8		£57,959 14 8

The CHAIRMAN, in moving the adoption of the report, said the Shareholders would observe from the accounts that £3911 had been paid for wages last year, which was a decrease of £214 on the previous year. The item of coals, cartage, and carriage amounted to £2350, which was also a decrease of about £130. On oil and tallow there was a decrease of upwards of £50, and for repairs £1948 had been paid, being less than the previous year by £1632. The other items were about the same as last year. The total working expenses for the year just passed were £16,072, being about £1800 less than in the previous year. Of course, as they would observe, the chief difference was in the item of repairs. With regard to the work that had been done during the year, at Dalton a third large cooling-pond had been made, and a lot of heavy work completed, and the engines put into proper working order; and the Directors were very happy to find that the results were likely to prove satisfactory. However, as their Engineer was present, he (the Chairman) should leave it to him to refer more particularly to that point. During the past year they had laid new mains to the extent of 3540 yards, and put in 778 new service-pipes, which generally meant so many new customers. They had also taken in the new district

of Washington and Usworth, which they supplied from their new reservoir on the top of Humbleton Hill. He believed the supply of water obtained from the Company would be a great boon to the district. They had raised during the year 1556 million gallons of water, and delivered it to their customers at the rate of more than 4,250,000 gallons per day. The Shareholders would be aware that during the last three or four years the district, in common with the kingdom generally, had been labouring under an extraordinary depression of trade. The consequence was that in the last year the Company, for the first time since its commencement, had a small decrease in the annual revenue. On the other hand, he had the cheering information to give the Shareholders that they had received on account of domestic supply more than in any previous year, and in the last quarter for meter-rentals, from chemical and other works on the Tyne and elsewhere, they had an increase of income over the corresponding quarter of the previous year of £442, so that this year they had reason to believe they would be able to show a very considerable increase under this head. The Company were now in a position to supply any demand that could possibly arise for many years to come. It was also satisfactory to find that the water was everything that could be wished. There was a balance available for dividend of £25,324, and they would be able to carry forward about £9000.

Alderman GLOVER, in seconding the motion, said he thought the Company would compare favourably with any company in the kingdom. He regarded the satisfactory increase in the revenue from meter-rents during the past quarter as the surest test of the increasing prosperity of the Company.

Mr. T. HAWKSLEY, C.E. (the Company's Engineer) said he did not know that he had so much to communicate to the Shareholders as he had been able to tell to them on many previous occasions. There was one thing they would perhaps be pleased to hear, and this was that his labours in the outlay of their money had very nearly, if not entirely, come to a conclusion. But perhaps this was not a matter to be altogether rejoiced at, because when the Engineer ceased to spend the Shareholders' money, it showed that they had no further means of investing it. As a Shareholder, he should be very glad to hear that they had it in view to spend a good deal more money, because he knew very well that their revenue would very largely increase as soon as trade revived, and they would have the means of making much larger dividends—not in percentage, but in actual amount—if they had more means of investment. He would revert to one matter on which he had the greatest pleasure in making a statement, and that was the very admirable manner in which the undertaking was managed by the Directors and Officers. The Shareholders would see from the accounts that the expenditure on the working of their very large undertaking was only about 33 per cent. on the revenue. Now, there were very few similar concerns where the water was pumped from such a great depth, and a constant supply given, in which the expenditure was not at least 40 per cent. Here, by the exceedingly careful, and at the same time not illiberal management of their Board, the expenditure was practically some 6 or 7 per cent. less than in most places. That, of course, was only saying in other terms that they had good security for their investment, because with so low an annual charge, and with so good a prospect as they had at the present time of increasing their revenue by the extension of property in the district they occupied, and by the revival of trade, and in consequence of a very small future expenditure of capital being required, inasmuch as they were capable certainly of supplying 8 million gallons of water per day now, when only an average of 4½ million gallons was required—for all these reasons he said their property was perfectly well assured, and they and the public also had a very excellent future before them. He had during his lifetime been concerned in the construction of rather more than 100 water-works, and was connected at the present time with a very large number of undertakings similar to this in different parts of the kingdom; but he did not know one which had a better, a more assured future before it than this Company had.

The motion was carried unanimously, as was also one for the declaration of the dividends recommended in the report. The retiring Directors and Auditor were then re-elected, and the business closed with the usual vote of thanks to the Chairman.

CHATHAM AND ROCHESTER WATER-WORKS COMPANY.

The Half-Yearly Meeting of this Company was held on Tuesday, Feb. 17—Mr. J. BAIRD presiding.

The SECRETARY (Mr. S. M. Heckford) read the following report for the six months ending Dec. 31, 1879:—

The Directors have the gratification to report the continued progress and prosperity of the Company. Shortly after the last report, the new steam-pump therein referred to was obtained to assist in pumping out the water from the new well, &c., and after considerable trouble and expense this was ultimately accomplished, so that the workmen were able to get down and fix the sluices which shut off and control the water flowing from the new headings into the well where the new pumps are to be fixed. This well, which is 7 feet in diameter, has been carried down in brickwork to the depth of 150 feet, and a large chamber for the air-vessel has since been constructed and is now ready for the brick foundations to be put in, previously to fixing the air-vessel and iron girders for the pumps.

The Directors recommend that a dividend at the rate of 7 per cent. per annum (free of income-tax) be declared upon all shares fully paid up, or the calls due in respect of such shares prior to Dec. 31 last, in proportion to the length of time which such shares or calls have been paid respectively, and that the balance of the revenue account be carried forward to the next half year's account.

[The statement of accounts showed that £50,376 had been received on capital account, together with £9305 placed to capital as a reserve fund for contingencies. The revenue account showed that £5600 had been received as revenue during the past half year, against which the expenditure included £763 for salaries and wages; £349 for rent, rates, and taxes; £1137 for coal and oil; and £1231 for repairs and renewals; leaving, after the payment of miscellaneous charges, £1485 available as dividend for the past half year. The reserve-fund of the Company amounts to £9305.]

The CHAIRMAN moved the adoption of the report, and in doing so described the additional works which had been undertaken to meet the constantly increasing requirements of the Company.

The motion having been seconded by Mr. HODGES,

Mr. STIGANT criticized the statement of accounts, which he contended was misleading, for it showed that the Directors proposed to pay a dividend of 7 per cent. out of a profit of £1485, which would really pay a dividend of 5 per cent. only. He moved, as an amendment, a dividend at that rate only.

The CHAIRMAN said if Mr. Stigant had looked at the profit and loss account, he would have found that there was a balance carried forward at the end of the previous half year of £3111, thus making £4596 available to be appropriated as dividend.

Mr. PRALL (the Company's Solicitor) also pointed out the fallacy of Mr. Stigant's argument as to the amount for disposal as dividend, saying he appeared to have overlooked the large amount brought forward from the previous half year.

Mr. WARNE said he was quite sure the Shareholders would not adopt the timid suggestion made by Mr. Stigant, who appeared to have altogether missed the point in his statements.

The amendment was not seconded, and the report and balance-sheet were adopted.

The three retiring Directors—Alderman Tribe and Messrs. Brock and Hutchison—were re-elected, as was also Mr. G. Bolton, one of the Auditors, a further sum of five guineas each being awarded to the Auditors for their additional services.

A vote of thanks to the Directors, Secretary, Auditors, and other Officials of the Company, brought the proceedings to a close.

COLNE VALLEY WATER COMPANY.

The Twelfth Half-Yearly General Meeting of this Company was held at the Charing Cross Hotel on Monday, the 23rd ult.—J. R. HOLLOND, Esq., in the chair.

The CLERK (Mr. W. Verini) read the notice convening the meeting, and the following report of the Directors was presented :—

The Directors beg to present their half-yearly report and statement of accounts to the Shareholders.

During the half year the water-rental amounted to £1443 11s. 6d., being an increase of £196 8s. 6d. as compared with the corresponding period of 1878. Water has now been laid on to other houses and cottages, representing an additional water-rental of £90 19s. 6d. per annum.

The long-continued bad weather rendered it impossible to execute all the orders that were on hand for supply to houses, or the receipts would have been considerably increased. The consequence was that the expenditure for the half year slightly exceeded the income.

The Directors regret to have to announce the loss they have sustained in the death of their late Secretary, Mr. Philip Verini, who by his untiring energy and zeal rendered invaluable service to the Company.

John F. Bateman, Esq., Stephen P. Kennard, Esq., and Alexander Sim, Esq., retire from the directorate, but offer themselves for re-election.

B. D. Kershaw, Esq., retires from the auditorship, but offers himself for re-election.

Dr.	Capital Account on Dec. 31, 1879.	Cr.
Capital—		
10,000 shares, at £10 per share paid up	£100,000 0 0	
44 new shares, at £10 per share paid up	440 0 0	
Debentures	25,000 0 0	
	£125,440 0 0	
		Expenditure as per last account
		£121,496 3 1
		Expenditure for half year ending Dec. 31, 1879
		514 0 10
		£122,010 3 11
		Balance carried to general balance
		3,429 16 1
		£125,440 0 0

Revenue Account, for the Half Year ending Dec. 31, 1879.

Engine working expenses—		Water-rates	£1,443 11 6
Fuel	£131 5 1	Rent of water-meters	43 5 3
Oil	8 0 0	Transfer fees	2 7 6
Tallow	6 19 4	Sale of gravel and refuse lime	46 8 7
Waste	2 3 10	Balance	51 8 6
Sundries	0 7 10		
Wages	205 2 8		
Pipe system expenses and repairs	45 14 7		
Lime	49 4 4		
General working expenses and repairs	78 18 1		
Insurance of boilers, &c.	31 0 0		
Stable expenses	26 0 2		
Meter repairs	2 4 11		
Salaries to Secretary and other officials	173 18 0		
Rent, &c.	34 2 4		
Stamps, stationery, and printing	29 10 4		
Sundries and petty expenses	12 14 11		
Advertising and incidental expenses	5 19 9		
Law expenses	3 8 10		
House services, &c.	15 5 5		
Commission to Collector	34 5 3		
Rates and taxes	26 2 7		
Interest on debentures, &c.	664 13 1		
	£1,587 1 4		£1,587 1 4

The CHAIRMAN, in moving the adoption of the report, said it was satisfactory that the Directors could chronicle some progress. The increase in the water-rates for the last half year, as compared with the corresponding half of the previous year, amounted to about £196, but this did not show sufficiently what an increase there was as compared with the previous year. If they took the whole year of 1878, and compared it with the whole year of 1879, they would find that the increase in the water-rates amounted to about £544. Of course they could wish that the progress of the Company was rather more rapid, but it had been delayed by a variety of causes, the chief of which might be attributed to the weather. When the Directors presented their report made up to the previous half year, they had to exercise the Englishman's privilege of complaining of the weather, and he thought they might say that since June 30, 1879, the weather had not improved, and that in the latter half of the year it was as bad as it had been before, and consequently there was not the same inducement for their *clientèle* to take the water. He thought that if they had a thoroughly dry summer, as in former years, the Shareholders would find there would be a very rapid increase in the applications for water. As a matter of fact, the Directors found on looking into the subject, that not nearly half the houses in their district were as yet supplied with water. On the other side of the accounts it would be seen that the Directors had effected several economies. Last November they gave up their London offices, which saved £60 a year, and they had now established their office at Bushey. There had, besides this, been a certain saving in the salaries paid. The result of all this was that they hoped next half year to be able to show a balance on the right side. As it was, they had hitherto had nothing but balances on the wrong side, and though the amount shown on the present occasion was considerably less than in the previous half year, it was still on the wrong side. He was glad to say that the character of their water remained as good as ever. In the various reports issued by Dr. Frankland, they found that the Colne Valley water stood first for purity. This was the case in July and August; in September, however, it stood second, but in the following two months it stood first again, so that in the majority of the months of the year the Colne Valley Water Company stood at the head of the list. He then referred to the very great loss sustained by the Company by the death of Mr. Philip Verini, their late Secretary, whose services to them he warmly eulogized, remarking that the Board regarded Mr. Verini's death as a personal loss. They had not thought it necessary to appoint a successor, but their late Secretary's son, Mr. William Verini, now acted as Clerk to the Company. The Directors believed that Mr. W. Verini possessed considerable knowledge of the affairs of the Company, having assisted his father a great deal, almost from the formation of the Company, and they thought they could not have confided to better hands the post of Clerk.

Mr. BENSKIN thought that the price paid for fuel was high. The oil bill, too, was very heavy.

The CHAIRMAN said they had a list of the prices paid last half year. Coal in July was 16s. 7d. per ton; in August, 18s. 3d.; in September, October, and November, 17s. 8d.; and in December, 18s. 6d. It was also

17s. 8d. in January. In July and August coke cost them 16s. 8d. per ton; in September and October, 14s. 8d.; and in November and December, 14s. 2d. The oil was 4s. per gallon. He saw that in the half year ending Dec. 31, 1878, they paid £7 11s. 4d. for it, and in the past half year £8, so that did not seem to be a very large increase; and the prices he had mentioned included the cost of cartage and the City dues. The Company used the Ebbw Vale steam coal, mixed with coke. The Directors had tried to contract for coal by the year, but the contractors had declined. Mr. A. SIM seconded the motion, and it was carried unanimously.

The retiring Directors and Auditor were then severally re-elected, and the proceedings terminated.

THE GAS SUPPLY OF CORK.

From the report presented to the Corporation of Cork, at their last meeting, by the Accountant appointed by them to examine into the accounts of the Cork Gas Consumers Company, it appears that the nominal capital of the Company is £150,000—£146,205 being registered; and of this amount £135,413 has been paid up. The debentures outstanding during the past six months amounted to £10,988 11s. 3d., and the sums borrowed from other sources to £10,332 5s. 11d., making a total working capital of £156,733 17s. 2d.

The total receipts from revenue for the last six months amounted to £24,480 10s. 7d., or an increase of £949 4s. 4d. over the corresponding period of the previous year. The working expenditure for the same time amounted to £15,701 18s. 11d., or an increase of £464 17s. 2d., and the net revenue to £8778 11s. 8d., or an increase of £484 7s. 2d. over the corresponding period of the previous year. The increase in revenue consisted of £605 6s. 5d. rentals, and £343 11s. 11d. residuals. The renewal of retorts and the re-construction of a gasholder caused the increased expenditure.

The quantity of gas manufactured during the six months was 98,253,000 cubic feet, of which 71,401,100 cubic feet were sold to consumers within the borough at 4s. 6d. per 1000 feet, and 3,231,500 cubic feet at 5s. per 1000 feet to consumers outside the borough. The quantity for public lighting was 9,203,400 cubic feet at 4s. 6d. per 1000 feet. This makes a total of 83,836,000 cubic feet consumed, against 98,382,000 cubic feet supplied, showing a loss by leakage of 14,546,000 cubic feet, which is equal to 1478 per cent. on the supply, being 6 per cent. less than the previous half year.

The quantity of coal used during the six months was 11,015 tons, comprising 7754 tons of Newcastle, 3187 tons of Welsh small, and 74 tons of cannel, at an average price of 12s. 11½d. per ton. This shows a production of 8919'895 cubic feet of gas per ton of coal carbonized. The cost of production per 1000 feet, including all charges and dividends on paid-up share capital, was 39'816d., or 3s. 3½d.

The quality of the Company's gas, according to the testing apparatus at the works, was equal in intensity to 16 sperm candles, the required parliamentary standard being 14 sperm candles.

The outlay on permanent investment for the six months was £1703 19s. 11d., which account now stands at £150,812 2s. 4d.

The reserve-fund, which on Dec. 31, 1878, amounted to £9105 4s. 7d., was further augmented by £1715 19s. 11d. It now stands at £10,821 4s. 6d.

After paying £233 10s. 10d. interest on debentures; £227 1s. 11d. interest on bank overdraft and other loans; £5416 10s. 4d. as dividend, at 8 per cent., on paid-up share capital; £306 13s. 4d. for charges and insurance; £438 4s. written off the suspense account; £700 added to the depreciation-fund; and reserving £348 16s. 6d. to meet contingency of bad debts; the surplus net profits amounted to £1107 14s. 9d.

The accumulated surplus assets—that is, assets over and above all the liabilities—amounted to £15,970 16s. 8d., of which £10,800 was invested in debentures of local companies.

The progress of the Company is well illustrated by the following tabular comparison, for three years ending Dec. 31:—

	1877.	1878.	1879.
Net revenue	£16,367	£15,642	£16,603
Reserve-fund	7,103	9,105	10,821
Depreciation-fund	558	1,462	1,991
Insurance-fund	1,290	1,400	1,800
Permanent investment	146,806	148,475	150,812

[The half-yearly meeting of the Company was held on Monday last week; and a report of the proceedings will appear in next issue.]

NEWBURY TOWN COUNCIL GAS SUPPLY.

A Special Meeting of the Newbury Town Council was held on Friday, Feb. 20, in reference to the alterations and extensions proposed to be made at the gas-works—a subject which has agitated the Council at most of their recent meetings.

The Gas Committee reported that they met on Feb. 13, when Mr. Silverthorne's plans and report, Mr. O'Farrell's remarks thereon, and Mr. Silverthorne's observations and replies thereto, were considered. After some discussion, Mr. Lucas moved—"That no immediate steps be taken for removing the works from their present site." This proposal was seconded by Mr. J. C. Fidler, and supported by Mr. Ravenor. Alderman Adey thereupon moved—"That, taking into consideration the probability of the electric light being the light of the future, or that gas may be superseded by some other light, no steps be taken in reference to the removal of the present works, or to the carrying out of Mr. Silverthorne's scheme, but that a sum not exceeding £1000 be expended on the present works, to meet the requirements of the town for the next two or three years." This motion was seconded by Mr. Money, and Mr. Lucas having withdrawn his motion, was carried by 8 votes to 3, two members abstaining from voting. On the motion of Mr. Slocock, seconded by Mr. Knight, it was also resolved—"That Mr. O'Farrell be requested to consider and report to the Council at their next meeting as to the probable cost of giving effect to Alderman Adey's proposal.

Mr. O'Farrell's report was consequently presented to the Council at this meeting. He stated that he had had much difficulty in keeping within the prescribed limits of expenditure; but entered into details of the works which he considered came within that limitation. He, however, said that when done the works would only meet the wants of the gas consumers and the public for two or three years. No extra storage for gas was provided for. Mr. O'Farrell concluded his report by stating that he had thus far complied with the terms of the resolution of the Committee, but having done so, he felt bound to inform the Council that the works would only be of a temporary nature, and that the outlay caused thereby would be partially lost, little of the material being available should the Council at the end of a year or two, under the pressure of circumstances and the additional requirements of the borough, be compelled to remove the works. The estimate amounted to £999 9s., but Mr. O'Farrell reported that a further expenditure of £783 would be, in his opinion, necessary in order to render the work efficient and economical.

Mr. DOLTON moved the adoption of the report.

Mr. MONEY objected to Mr. O'Farrell's plan for the improvement of the works on the present site at such an outlay, which would only tide them over two or three years.

Mr. O'FARRELL, in reply to a question, stated that about £600 worth of the material estimated for in his report could be utilized on a new site.

Mr. C. LUCAS asked what was the present producing power of the works, and what increase would result by the improvements suggested in the Committee's report.

Mr. O'FARRELL said they could now only manufacture 87,000 feet of gas in 24 hours, and the improvements would allow them to make an increase of 46,000 feet; but as the public could at present take 25 per cent. more gas than the works could supply, the increase in two years would only be 25 per cent. more.

Mr. HOPSON seconded the adoption of the report.

Mr. B. SMITH said he thought Mr. O'Farrell thoroughly understood his work, and that his plans should be accepted. He proposed—"That land having been purchased, and plans prepared by the Engineer to the Board (Mr. O'Farrell), under the direction and approval of the Corporation, for erecting new works, the Council do now instruct Mr. O'Farrell to prepare full specifications, with detailed quantities, &c."

Mr. M. PALMER seconded this proposition.

Alderman ADEY objected to the removal of the works to the new site. The heavy expenditure for the sewerage would be upon them immediately, and he considered that as the Council were so divided upon the matter, and the public also, they should hold over such a heavy expenditure.

Several members having spoken in favour of the proposal to remove the works,

Alderman LUCAS moved as a further amendment—"That Mr. Silverthorne's plan be adopted, subject to any alteration or modification which may be suggested by the Gas Committee, and that he be requested to meet the Gas Committee for that purpose."

Mr. J. C. FIDLER seconded this amendment, which, on being put, was lost by 14 votes to 5.

The amendment proposed by Mr. Smith was next submitted, and carried by 14 votes to 5. The result, therefore, is, that enlarged works are to be erected on the new site near the Great Western Railway, at Greenham, as originally proposed by the Gas Committee.

THE PROPOSED ACQUISITION OF THE ABERSYCHAN AND PONTPOOL GAS AND WATER WORKS BY THE LOCAL AUTHORITIES.

At the last meetings of the various Local Boards in the districts supplied by the Abersychan and Pontpool Gas and Water Companies, the proposed purchase of the gas and water works supplying the places was discussed at some length; the general conclusion being that, in the absence of specific information as to the cost to be incurred, no action could yet be taken in the matter.

The meeting of the Abersychan Local Board was held on Tuesday, the 17th ult., when Mr. Hambleton said that the deputation appointed to wait on the Gas Company had done so; but nothing was settled as to the terms of purchase. The Directors said they were willing to sell at a fair and reasonable price. The Chairman (Mr. R. Greenway) suggested that the matter be left in abeyance at present, until it was known whether the other Boards would join in the purchase. Mr. Williams, who was described by the Chairman as "one of the largest ratepayers," thought the scheme would never be carried through, and it was waste of time to further discuss it. He would strenuously oppose the purchase; and he knew three or four of the other large ratepayers who would also oppose. Eventually the following motion was carried unanimously:—

That in anticipation of the event of the various Local Boards agreeing to purchase the Abersychan Gas-Works and the Pontpool Gas and Water Works, on such fair and reasonable terms as have been contemplated, the Abersychan Local Board finds itself quite unable to consider the matter with a due regard to the interests of the ratepayers without further information. The Board therefore request that the two Companies be asked to furnish, for the private information of the various Boards, a copy of the annual statement and balance-sheets of the two Companies for the last seven years, and the Board also desires it to be stated what further capital (if any) is needed to complete the reservoir and the requisite arrangements for putting the two gas and water works in repair.

A meeting of the Panteg Local Board was held the same day, when the above resolution was submitted for approval, and agreed to *nem. con.*

On the following day the Pontpool Local Board met, and the Chairman (Mr. E. H. Davies) reported that the Committee appointed for the purpose had waited upon the Directors of the Abersychan Gas Company to ascertain if they would consent to dispose of their works. They said they did not wish to part with them, as they paid very well; but they expressed their readiness to sell the undertaking, at a reasonable rate, for the benefit of the district. They had invited Panteg, Llanvrechva, and Abersychan to join in the scheme, and Abersychan had expressed its readiness to do so, but there had not yet been received any reply from the other two Boards. Upon the resolution (as above) adopted by the Abersychan Local Board having been read by the Clerk, Mr. Lewis moved, and Mr. Wilton seconded, that the idea be abandoned; the former gentleman saying it would be a most complicated business, which the public did not require them to undertake. An amendment—"That the Committee continue their labours and report the result of their inquiries," was, however, carried by a majority of 2; though, during the discussion, much opposition was expressed to the purchase by a large section of the Board.

COMPLETION OF THE EXTENSIONS AT THE MACCLESFIELD CORPORATION GAS-WORKS.

The alterations at the Macclesfield Corporation Gas-Works, in the Commercial Road, having been completed, on Monday of last week an official inspection by the Mayor and Corporation took place, and much satisfaction was expressed at the improvements effected. Mr. T. Moore (the Engineer and Manager), under whose superintendence the work has been carried out, prepared a report as to what had been done, and it has been ordered to be placed on the minutes of the Gas Committee. It is as follows:—

To the Worshipful the Mayor (Chairman) and the Members of the Gas Committee of the Corporation of Macclesfield.

Gentlemen,—I beg to report that Messrs. Braddock and Matthews, of Stockport, Messrs. Westwood and Wrights, of London, and Messrs. Dempster and Sons, of Elland, have executed their respective contracts. The different buildings thus completed will provide for a very important extension to the manufacturing plant of your gas-works. The necessity for this has been felt for a long time, and the Committee, availing themselves of the experience of their predecessors, carefully considered the matter in detail, the result being placed before the Council in a series of resolutions in February last year. The figures and circumstances upon which those resolutions were based, show the Committee did not undertake the extensions one moment too soon, as, with an exceptionally bad state of trade, 11 out of your 12 beds of retorts have been at work from the beginning of December to the end of January this winter—a very dangerous and most expensive way of working indeed. You will now gradually get into a much better position. The old retort-house was capable of producing 500,000 cubic feet of gas per day. You have now room for fully 40 per cent. increased carbonizing power; to be added, of course, as occasion may require. You have hitherto had no proper storage for tar and ammoniacal liquor, necessitating their

immediate removal in the winter, and "together" (which depreciates their value), besides the labour of taking them up to the canal in carts. You have now four new storage tanks, holding 60,000 gallons, equal to two months winter stock. You have also a convenient pump-room, and will soon have proper separating arrangements, and be able to pump the tar and liquor into covered trucks on the railway; thus, while adding to their value, save the nuisance and the expense of carting them through the streets to the canal. The room at the south end of the retort-house will, when it is completed, contain the engine, exhausters, governor, and the gauges; and the whole of this delicate machinery will be under the eye of the foreman in charge at a glance. This room, which is 54 feet long by 25 feet wide, has a flat roof, carried by strong wrought-iron girders. Upon this roof the condensers will be placed, and so clear the yard for the coke ground. Above the pump-room, and forming its roof, is placed the tank for the supply of the works with water. It contains upwards of 5800 gallons, and receives the rainfall from the large roof of the retort-house; thus utilizing water which before was wasted. Space for an additional stock of not less than 800 tons of coal and cannel has also been provided. Before, it had to lie out in the open yard, its value for gas-making purposes being thereby greatly reduced. The site and foundations for improved scrubbers have also been bought up and prepared, so that when it is deemed necessary to fix these, there will be no pulling down or turning back. The building known as the manager's house will provide the photometer and experiment room, an office, workshops, and what you have long required—convenient stores. You have done this work at a time when prices have been lower than they have been known for a number of years. The cost of the buildings, comprising the tar and liquor tanks, coal store, scrubber, foundations, pump, engine, exhausters, and governor-rooms, together with new retort-house, 97 feet long by 64 feet wide and 26 feet to wall plate, with wrought-iron slated roof and ventilating towers, will amount to £5000. The taking down of the foundation on such a restricted site through "made ground" and across "filled-up" tanks, and the erection of the new retort-house over the old one, the process of gas manufacture going on underneath all the time, have presented difficulties not ordinarily met with. No injury has, however, accrued to your plant, nor have your consumers suffered the slightest inconvenience. It is but just to remind you, you have had no architect's fees or clerk of the works to pay, the whole being the design of your own Engineer, who also prepared the plans and specifications, and has carried out the works in accordance with your instructions, and, I trust, to your satisfaction.

(Signed)

THOS. MOORE, Engineer and Manager.

THE GAS SUPPLY OF STONE.

LOCAL GOVERNMENT BOARD INQUIRY.

On Tuesday, the 17th ult., an inquiry was opened in the Town Hall, Stone, by Captain HILDEYARD, one of the Local Government Board Inspectors, respecting an application made to the Board by the Stone Local Board, for a Provisional Order to empower them to construct gas-works within their district and the townships of Stone and Meaford, and to manufacture and supply gas within the district and the townships of Aston, Darlaston, Meaford, Oulton, and Walton.

Mr. H. C. SANDERS and Mr. J. UNDERHILL attended on behalf of the Stone Local Board; and Mr. A. YOUNG appeared for the Stone Gaslight and Coke Company, who opposed the application.

Mr. SANDERS, in opening the case for the applicants, gave a sketch of the origin of the Stone Gas Company, which, he said, was formed in 1853 under the Joint-Stock Companies Act. He also explained the constitution of the Local Board, their functions and powers, and their design with regard to the provision of new gas-works. The present Gas Company had no statutory powers, and he thought preference would be shown to an undertaking which should possess such powers as were sought by the Provisional Order now applied for. In 1854 the original Company obtained sanction to borrow £2000, with power to borrow an additional £1000. In 1855 the gas undertaking was transferred to the present Company, the purchase price being fixed at £2000. All that had been paid into the Company by way of capital was about £1000, and there were some 30 Shareholders. The present value of the concern was said to have been made out of profits. It was provided that after securing the payment of 10 per cent. dividends, further profits should be appropriated in the reduction of the price of gas charged to consumers. With respect to the proceedings of the Local Board, he quoted from the first section of the Public Health Act, 1875, to show that the Urban Sanitary Authority of any place might contract with the gas company for the supply of gas, or might themselves make such provision in case there was no existing company to give the supply, or from other considerations. He then stated that the Stone Local Board had considered the question of the gas supply to the town, and were favourable to becoming purchasers of the gas-works and managing the business themselves. Eventually, on Sept. 29 last, a resolution was carried by the Board that it was desirable negotiations should be opened with the Gas Company with a view to the acquisition of the gas-works by the Board. That resolution was forwarded the following day, with a request that the matter should be brought before the Company at the earliest opportunity. Several letters passed, and at length, on the 21st of October, a letter was received by the Board to the effect that the Directors of the Company were prepared to sell their works to the Local Board for £20,000. As might be expected, the Local Board did not feel disposed to become purchasers of the works at such a price as that; and, as the Company did not intimate that they would take less, the Board felt compelled to put themselves in a position for going to the Local Government Board and asking for a Provisional Order to enable them to provide gas-works of their own. However, ample time was allowed to intervene before definite action was taken. The Board intimated, in effect, that they did not want to take steps to obtain a Provisional Order, but were determined not to purchase the gas-works at the price asked. At length the notices were issued. In the drafted Order it was explained what the character of the proposed new gas-works would be—as to their capacity for well supplying the town with gas, and as to the storage, &c., and the maximum charge was suggested to be fixed at 4s. per 1000 cubic feet. With respect to the present Company being a non-parliamentary one, and not having, therefore, any statutory obligation, the consumers had no security as to the prices which the Company might choose to charge for gas; they could charge 5s., 6s., 7s., or any other price. Neither was there any stipulation as to the quality of the gas. Adverting, then, to the opposition of the Gas Company to the application of the Local Board, he (Mr. Sanders) remarked that the Company had stated they had, since they purchased the gas undertaking, spent a considerable portion of the profits in improving the works, £9300 being the sum so expended. This, he thought, showed that the Company must have been making profit to the extent of from 20 to 30 per cent. The Company maintained that the quality of the gas was good, and that no complaints were made, but he should be able to show that complaints had been made from time to time. When the present Company bought the old works, the price charged for gas was 7s. 6d. per 1000 feet, and it was afterwards reduced to 5s.; but although

coal had become cheaper, the price of gas had been kept up, and of course the profits must have been greater than they were when coal was dear. The Company represented that the works were of an efficient character, that they stood upon extensive ground, were in first-class working order, and were well capable of supplying the whole of Stone with gas. As to their capacity for supply, he might say that he understood the Company really had no means of knowing how much gas they were making. The Company also alleged that prior to the formation of the Local Board at Stone, the road surveyors did not make any complaint as to damage done to the roads by the Gas Company. He should be able to show, however, that complaints were made of the condition in which the roads were left after they had been broken up. Under the Act applying to such cases, provision was made as to the way roads were to be opened for gas extension purposes. About the end of October last the Gas Company made an application to the Local Board for permission to open a road. To that, however, the Clerk to the Board replied, stating that they could not give such permission, as it was illegal; it being a fact that a local board could not give authority to a non-parliamentary gas company to open a road. An intimation was, however, privately made to the Company that if the road were opened no action would be taken. No other communication had been made since then, he understood; and, in fact, the Company were useless and powerless as to extending their mains to supply new consumers. The Company also stated that they had recently made improvements which would enable them to give the town a better supply of gas. With respect to the question of the price charged for gas, he quoted, by way of comparison, the prices paid in some neighbouring towns, stating that in most of the Potteries towns the price was 3s. 6d. per 1000 feet, while at Uttoxeter, a somewhat similar town to Stone, it was 4s. 2d., with discount allowance if paid in a given time, which brought the charge down to 3s. 9d. As to the price asked for the works, the Local Board complained that no variation from the high figure first named was made; not a word was said as to the price being fixed by an arbitration award. It was only natural, therefore, that the Local Board and the gas consumers should desire that the gas-works should be obtained upon a fair valuation, if obtained at all; or that they should be able to provide gas-works for themselves. He believed this movement received general favour in the town. He then read some certificates relating to the gas-works, and to their estimated value. In one case it was said that the town was well supplied with gas. The Engineer of the Loughton Gas-Works (Mr. J. M. Darwin) estimated the value of the plant at £20,000. The Engineer of the Stafford Corporation Gas-Works (Mr. J. Storer) estimated the works, as a "commercial undertaking," as worth from £20,000 to £25,000. The mistake made in these cases, he (Mr. Sanders) said, was that the profits realized by the Company at present were made the basis of the estimation, which, he submitted, was fallacious. Alluding to the question of nuisances caused by the gas-works, both in the neighbourhood and in the river, he said that the Gas Company would not themselves apply for an Act of Parliament, because they knew that if they did there would be such stringent terms imposed upon them as would materially reduce their profits.

Dr. E. Fernie, the Chairman of the Stone Local Board, was then called, and, in answer to Mr. UNDERHILL, stated that the price of gas was 5s. per 1000 feet, subject to reduction if payment was made in a specified period. The house in which he lived was near the gas-works, and they experienced a great nuisance from the process of purification by the use of lime, instead of oxide of iron, which, he thought, would be better. He remembered being at a meeting of the Local Board, in October, 1878, when a memorial was presented, signed by a number of the inhabitants, calling the attention of the Board to the nuisance caused by the gas-works. It was represented therein that there was such an offensive smell from the works as at times to render houses in the locality uninhabitable, and the memorialists stated that they were informed that if the oxide of iron process were to be substituted for the lime process in the purification of the gas the nuisance would be obviated to a great extent. Witness then testified to the correctness of the correspondence which had been carried on between the official representatives of the Local Board and the Gas Company, on the question of the proposed purchase of the works. At a meeting of the Board on the 29th of September last, a resolution was carried to the effect that it was desirable negotiations should be opened with the Gas Company with a view to the acquisition of the works by the Local Board. This was transmitted the following day, with a request that the matter should be brought before the Directors. The progress of the ensuing correspondence was stated up to the time when the Directors of the Gas Company intimated that they were willing to dispose of the works to the Local Board for £20,000. The Board met and considered the offer, their conclusion being that the amount was exorbitant, and it was resolved to suspend all further negotiation with the Company until a Provisional Order could be applied for. Witness then stated that no other offer had been made by the Company, nor any overtures as to the transfer of the gas-works to the Board, and hence the proceedings which had resulted in the present application to the Local Government Board for a Provisional Order. He was most decidedly of opinion that it would be for the benefit of the town to have the supply of gas in their own hands.

In answer to Mr. YOUNG, witness said he did not think Stone could support two gas companies. There had not been any meeting of the inhabitants for the purpose of considering this question, the present proceedings being based entirely upon the resolutions of the Local Board. He did not know he had stated that the Board would be able to supply gas at 2s. 6d. per 1000 feet; but he had said that they could supply it at a much cheaper rate than the Gas Company. He was aware that in the Provisional Order the maximum price of gas was put down at 4s. per 1000 feet; but he was not responsible for that. He thought the Local Board, and the gas consumers too, would be able to make a profit out of the gas-works, though they had not formed any estimate as to what that profit might be. It was not till recently that the Board were aware that the Gas Company had no statutory powers. [Mr. Young produced a copy of a communication from the Local Board to the Gas Company, dated July 22, 1879, in which it was said that the Lighting Committee agreed to the Company's charge of 3s. 9d. per 1000 cubic feet for gas supplied to the public lamps, and considered the price satisfactory, comparing favourably with the price paid in other towns.] Witness said the first part was right, but he did not remember the final clause. He did not think gas could be made without creating a nuisance; but if oxide of iron were used in the process of purification, he thought the nuisance would not be so great. His house was about 80 yards from the gas-works, and his health had not been injured. His property had certainly increased in value since he went there 15 years ago, but not in the same ratio as property in other parts of the town. In the interest of the roads he should say it was preferable that the present Company should open the streets where necessary, rather than that a new gas company should do it. It was true that the first time the Local Board declined to allow the Company to open the streets was on the same date as when notice for the Provisional Order was given, but it was not because of giving such notice that the refusal was made. He had said that he thought the gas-works might be worth £13,500. The Board had not made any offer as to going to arbitration. They considered that if they had the gas-works, with the profits made, they would be able

to reduce the price of gas to the consumers, and that there would also be a proportion to go to the Board for the reduction of the rates.

Mr. YOUNG: By that, the ratepayers who do not consume gas would derive benefit at the expense of the gas consumers?

Witness: It would depend upon the apportionment of profits.

Mr. YOUNG: Now, have you any serious intention of carrying out what you propose in reference to a gas-works undertaking, and is not all this done for the purpose of compelling the Gas Company to come to terms?

Witness: I have said I thought it was unreasonable that the Gas Company wanted so much for the works. I thought they would have parted with them upon just and fair terms; and we had the impression the Company would have offered some other terms than those first stated.

In reply to Mr. SANDERS, witness said that the members of the Stone Local Board, excepting those who were gas shareholders, were favourable to the present proposal. Before there could be any apportionment of the profits, the price of gas must be reduced to 8s. per 1000 feet; so that the consumers would be the first to reap profits. The Board could well undertake the duties connected with the management of gas-works.

Mr. Thompson, a member of the Local Board, and partner in the firm of Messrs. Joule and Sons, brewers, stated that he had occasion some time previously to complain of the price charged for gas supplied to their works, and the figure was subsequently lowered from 4s. 2d. to 3s. 9d. The price of gas to the public was 5s., with 10d. off for cash in a month.

Cross-examined by Mr. YOUNG, witness said he believed that if the Local Board obtained the management of the gas supply, the price would eventually be reduced to 2s. 6d. per 1000 feet.

Mr. Arthur Hatfield, shoe manufacturer, and a member of the Local Board, said at the present time three out of every four of the working-class consumers in Stone had to pay 5s. per 1000 feet for their gas. He considered it would be to the advantage of the town if the Local Board had the management of the gas supply, and that was the opinion of the class among which he moved.

Mr. J. J. Chapman, Surveyor and Sanitary Inspector to the Local Board, said there had been a great deal of breaking up of the roads by the Gas Company in various parts of the district, and he had from time to time complained to the Company of the manner in which this was done. He had no doubt it would be to the advantage of the town if the Local Board had the opening of the streets for their own purposes.

Mr. Welch, an accountant, of Liverpool, said he had examined the Company's accounts, and found that the Company had paid a dividend of 5 per cent. in the earlier years, subsequently increased to 7½, and afterwards to 10 per cent. The amount available for dividend in a period of 24 years, with the bonus shares, showed a total of £10,935, or an average dividend of about 19 per cent. per annum. Taking the last 14 years, the profits, he calculated, would be 25 per cent. per annum.

Mr. YOUNG cross-examined this witness at some length, with the view of showing that the amounts appropriated to the increase of capital were not so large as had been represented. The cross-examination was ultimately postponed, the Gas Company undertaking to supply a financial statement for the use of both sides in the inquiry.

Some other unimportant evidence having been given, the inquiry was adjourned.

FRIDAY, FEB. 20.

Mr. SANDERS said his clients had been very much taken by surprise at the cross-examination of Dr. Fernie, with reference to the letter of the 21st [of October] from Mr. Gundry, the Secretary of the Gas Company, stating that the Company were prepared to recommend their Shareholders to sell their works as they stood for £20,000, and he might add that it would be useless to offer them a less sum. From that time until their meeting three days ago he regarded this letter as an ultimatum on the part of the Gas Company that they would not take less than £20,000, and under the circumstances the Local Board had no option whatever but to take the course they had in reference to a Provisional Order. The Local Board were quite willing to refer the matter to arbitration, if the Company consented to this, but such a course would not interfere with the present proceedings.

Mr. WYNNE, the Chairman of the Stone Gas Company, said the sum of £20,000 was mentioned to prevent any haggling. If at that time the Local Board had offered to arbitrate, the Directors would have accepted it; but in their present position they could not do so. He might say that personally his desire had long been that the town should have possession of the works when there was a properly-constituted body to conduct the undertaking in the interest of the town.

Mr. J. Snape, of the firm of Chapman and Snape, architects and surveyors, Newcastle, produced plans which he had prepared of the proposed new gas-works. He entered into a calculation with the view of showing that gas might be made at 3s. 6d. per 1000 feet, interest and sinking-fund being provided for, and leave a profit beyond. If the price were lowered, the consumption would, no doubt, be greater.

In cross-examination by Mr. YOUNG, witness said if the Provisional Order now applied for were granted, and it led to the closing of the Gas Company's works, Walton, Oulton, and Meaford would be shut out from a supply of gas, unless an illegal act were committed.

Mr. Robert Paulson Spice, C.E., said he had read the correspondence which had taken place with respect to the proposed acquisition of the Gas Company's undertaking, and had made himself acquainted with the history of the case. By the courtesy of the Chairman and the Directors he had also inspected the works. His opinion was that it was desirable to transfer the undertaking from the Gas Company to the Local Board. The arrangement of the works was unsystematical and unsatisfactory, and not in accordance with the modern practice. A large amount had been taken out of the pockets of the consumers, which, under a statutory company, would have gone towards the reduction of the price of gas. He agreed with Mr. Snape that 3s. 6d. per 1000 feet for the gas which was consumed would be sufficient to allow of a profit.

In cross-examination, witness said he assumed that if the Local Board established gas-works, one of the works would probably come to the ground; but he could not conceive that the existing Company would be such idiots as to resist all efforts at settlement. The fitter of the two in this case would be the present works, if the Company could sell gas cheaper than the Local Board. He did not know of any place of the same area and population where the gas was cheaper than at Stone, and he did not know any other place where £6000 had been added out of profit to £3000 of capital. But these averages of population and area all went for nothing.

This was the case on behalf of the Local Board.

Mr. YOUNG, in opening the case for the Gas Company, said the Local Board had been established for the purpose of carrying out a system of drainage which every one admitted to be necessary. A supply of water was also required. These were matters of paramount importance, which the Local Board ought to have endeavoured to carry out. But the Local Board seemed to have been animated by a feeling of jealousy against the Gas Company, acting under the belief that the Company received profits which ought to be used for the benefit of the public at large. It was clear that two gas companies could not co-exist in Stone, and that if works

were provided by two bodies, one of them must be a failure. He contended that no serious attempt had been made at bringing about an amicable settlement; and without imputing any deliberate injustice to the Local Board, he said that the Board had stolen a march upon the Gas Company, who intended applying to Parliament for statutory powers. It was the settled intention of the Gas Company to go to Parliament, and the ratepayers were not groaning under such a state of injustice as to render it unreasonable or unfair to allow them to remain as they were till the Company had done so, and placed themselves in such a position as to render them unassailable by the Local Board. The promoters of this Provisional Order had not taken any decided steps to ascertain the general feeling of the ratepayers; and, indeed, the resolution in favour of the Provisional Order by the Local Board appeared to have been passed in a crude manner, the promoters not having at the time any correct data to act upon. He then argued that even if the Local Board obtained their Order, the plans of Mr. Snape were impracticable for gas-works, and the site selected was unfit for the purpose. If the Local Board had not assumed the position of being at arm's length with the Gas Company, the probability was that they would not have been there holding the present inquiry. He commented upon the evidence of the witnesses called on behalf of the Local Board, and urged that it merely went to show the impolicy of erecting works in opposition to those already in existence. He also indicated the nature of the evidence he intended to call, observing that amongst other facts it would be shown that the testimony given by the Local Board as to the profits made on the gas-works had been much exaggerated.

Mr. Martin Smith, General Manager of the North Staffordshire Railway, said he had resided in Stone about four years, but was in no way connected with the Gas Company. He and the Railway Company were gas consumers and large ratepayers. He considered the price charged for gas fair, having paid higher prices in similar places for a worse article. Two gas companies could not exist in Stone. He was strongly against the Local Board having the gas-works, for the rateable value of Stone was only £12,000, and no sewerage works had yet been carried out. It would take a rate of 4s. in the pound to begin with, and there was a doubt whether the Local Board could carry on gas-works satisfactorily. There were 1300 ratepayers in Stone, and he did not think they ought to take upon themselves the responsibility of managing the gas-works for the consumers, who only numbered 380.

Mr. F. Wynne said he had been Chairman of the Gas Company for more than 20 years. The average cost of management, commencing at £15 and now being £100 a year, had been £48. To this economy he attributed the present state of the Company. He had seen a portion of the site of the proposed new gas-works flooded to a depth of 4 feet.

Cross-examined: In addition to the amount paid to the Manager (£100 a year), the wages account was £353 a year. With regard to the nuisance caused by the works, he said that if two gas engineers would say it would be better to use oxide of iron than lime for purifying, the Directors would adopt that system; but they were not going to accept the *ipse dixit* of Dr. Fernie as to which was the better plan of the two. He (witness) had always been an advocate for reducing the price of gas as soon as the Company were in a position to do so. There was not time, after receiving notice from the Board, for the Directors to apply for a Provisional Order or go to Parliament for a Bill.

Re-examined: If there had been time, the Directors would have gone to Parliament on receiving notice from the Local Board.

SATURDAY, FEB. 21.

Mr. G. W. Stevenson, C.E., said he had had nearly 30 years experience in town improvements, and had been for a considerable length of time engineering adviser to the Metropolitan Board of Works. He had watched carefully the course of legislation with respect to gas undertakings during the last 20 years. He had visited the existing gas-works at Stone, and had formed the opinion that they were large enough to supply the consumers. He admitted that there were a few defects in connection with the works, but they would not interfere with the supply of good gas in abundant quantity. He held the opinion that whatever shortcomings there were in the present works could readily be redressed and rectified at a small outlay. Good 18-candle gas was being supplied, and the price was so low that he did not know of any town, where the population was the same, in which the price of the gas was equally low, and he knew the prices all over the kingdom. He advocated the Company, for their own sakes, placing themselves under parliamentary control, as at present their capital and property were insecure.

Mr. Young: Are you aware what the price charged for gas is at Newport, a small town near here? Are you not aware that it is cheaper than it is here?

Witness: I am certainly not aware of the price charged in that town, but coal may be cheaper and more easy of access there than here.

Mr. Alfred Penny, C.E., gave evidence in effect similar to that of the last witness. He stated that for a very small outlay the present Gas Company's works could be made, in efficiency and convenience, second to none in Staffordshire.

Mr. J. Slocombe, a member of the firm of Messrs. Howard, Smith, and Slocombe, accountants, of Birmingham, said he had had great experience in dealing with gas companies accounts. He had made a statement of the capital account of the Stone Gas Company, which consisted of a paid-up capital of £2000, and he had ascertained what the Company had from time to time appropriated for extensions, from the years 1856 to 1879. He had also made out a tabulated statement and schedule showing the progressive capital, expenditure, and dividends payable thereon, calculated at 10 per cent. on the outlay and bonus shares distributed to Shareholders from 1856 to 1879. Without going through the account in detail, the statement, he said, showed in result the amount, including bonus shares of £6000, the dividends and bonus shares actually distributed being considerably less than the total progressive outlay.

Mr. SANDERS: Then the result of this is, that even crediting 10 per cent. on original outlay, and 10 per cent. on expenditure for the year immediately it is incurred, the amount divided and bonus shares come to within £800 of the calculated amount of dividends?

Witness: Yes; that is so, and the works now stand at something like £10,000 in the books.

So that, according to your statement, there is only £3000 which can be credited to capital?—At 10 per cent. it would be so; but as a matter of fact the Company are only paying 5 per cent. Since 1878 they have only taken 5 per cent. on £8000.

Mr. Young said he hoped he had already been able to impress the Company's legitimate arguments sufficiently upon the Inspector, and, therefore, he would not trouble him with any further observations.

It having been previously intimated by the Inspector that he should be glad to listen to any observations from any of the principal ratepayers of the town,

Mr. M. SMITH, General Manager of the North Staffordshire Railway, remarked that a good deal of what he should have addressed to the Inspector had been rendered unnecessary by the course pursued by Mr.

Young. The last two witnesses had given it as their opinion that the granting of a Provisional Order would be injurious to the town of Stone, and he had particularly noticed that Mr. Sanders did not venture to cross-examine them on that point. He (Mr. Smith) should not have come before the Inspector as a ratepayer, if the ratepayers had been properly appealed to for their opinion in regard to this matter. In reference to the subject of a gas undertaking, no meeting had been called. When the Local Board was formed there was considerable discussion in the town on the subject of drainage, but not one word was said on the subject of gas. He could bring forward evidence to prove that drainage was now as necessary as ever; but although it was so sadly wanted, the Local Board were rushing headlong at the gas question. Let the Local Board turn their attention to supply better and more efficient drainage, among the things which were more necessary than gas. He did not believe in the Local Board undertaking this business, and, if they did undertake it, he believed that in the end they would burn their fingers. There was only one precedent—that of the town of Maryport—of two gas companies being supported; but the rates of that town were completely saddled by the burden of two works, which had cost the town £30,000. In this case the two works ran neck and neck for a time, but, as a natural result, one had to succumb, as the town could not possibly support two, which was, he believed, the identical position of the town of Stone. In conclusion, he reminded the Inspector that he represented the unfortunate class who had to pay, and he entreated him to remember that there was a third party to this argument, which was the despised and most unfortunate ratepayers.

Mr. SANDERS then addressed the Inspector in support of the application of the Local Board. Adverting to the speech to which they had just listened, he said the Board had been charged with neglecting the drainage of the town, but he could say that the sewerage scheme was now under the consideration of the Board, who had already expended some money in commencing operations. He then reviewed the evidence on both sides, and asked the Inspector if the Local Board could have pursued any other course; and also whether the course taken by the Gas Company might not have been very different, and whether the Board's action had not been forced upon them by the Gas Company, who were their only opponents in the case. The nuisance caused by the gas-works had been proved. Local boards and corporations were undoubtedly the right people to have control of a town's gas, and there were several cases where the system worked well. He endeavoured to show that it would be to the benefit of the ratepayers and the town for the Stone Local Board to have the control of the gas undertaking, though he agreed that the town could not support two gas-works. He submitted, in conclusion, that the Gas Company were fully able, considering the enormous profits they made, to supply gas at a much cheaper rate.

The INSPECTOR said: I think a Provisional Order for the setting up of gas-works would not be for the good of Stone. Supposing the Order were granted by the Local Government Board, it would then have to go to Parliament, where you might not have their decision your way. My own view of the matter is that you would have never-ending litigation and expense, because your case is an unusual one. It is stated for the Board that their object is not to press the Company to part with their works, and that if the Provisional Order be now obtained by the Board the works will be constructed. Both sides have agreed that the town cannot support two gas-works, and, consequently, there would be a great hardship entailed on somebody, and I should imagine that very probably the ratepayers would suffer as well as other people; so that I cannot think it would be for the good of the town. We have now a distinct undertaking from Mr. Wynne that the Gas Company will apply for parliamentary powers, though it was the offer of the Local Board two months ago; and had the Company agreed to do then what they have offered to do now, I have no doubt both sides would have been saved a great deal of trouble and expense. I wish the Company were in a more official form; but I hope Mr. Wynne's undertaking will receive the approval of, and be borne out by the body of the Shareholders.

Mr. WYNNE: There is no doubt at all, Sir, that the Shareholders will carry out what the Directors recommend.

The INSPECTOR: A few months ago that offer would have satisfied the Local Board. I think now that it is only putting it off another year, and their hardships—and they are very small—will only last during the year. That the price of the gas might be lowered I have no doubt, if the undertaking were in the hands of the Local Board, as they could get money on cheaper terms. As to the question of acquiring the works from the Company, this is a matter—supposing the Company are willing to part with them—between the ratepayers and the Local Board. I understand there has been already considerable pressure put on the Local Board to carry out works of sewerage. Now, it is customary with the Local Government Board, when there is pressure on matters of this kind, to refuse a loan for carrying out other works. The Board have full power of enforcing the proper arrangement of sanitary matters, and when they have a case of this sort before them, they say, "You must give us an assurance that these works are in a way to be carried out." I think, on the whole, both sides have acted in a premature way. The Gas Company first sent a conclusive answer in strong terms to the Local Board; then the Board retaliated by acts. They go and ask for a Provisional Order, but if they had waited a little longer they might perhaps have saved themselves a great deal of expense. I hope, however, they will come to terms with the Gas Company.

The inquiry then terminated.

SPENCE'S METALLIC COMPOUND AND ITS USE FOR PIPE JOINTS.

In reference to the paper read before the Society of Arts on the 11th ult., on "A New Metallic Compound, and its Application to Industrial and Artistic Purposes," and the discussion thereon [see *ante*, p. 250.], Mr. Robert Morton, of the London Gaslight Company, writes to the Society to say that while the compound is very easily manipulated, it is also excessively brittle—a fact altogether ignored or overlooked in the paper and discussion. With regard to its use in jointing socket-pipes, Mr. Morton says that, having had his expectations raised in this direction, he is reluctantly compelled, in the interests of his professional brethren and any one contemplating its use, to state that, contrary to Mr. Livesey's experience, he has, as yet, been unable to get a sound joint by its use. At his works they have tried a considerable number on 4-inch pipes, about half of which were made under the immediate supervision of Mr. Spence's representative, and not one of them has stood the test, the major portion leaking under a pressure of from 3 inches to 5 inches of water.

Mr. W. Faija, of Westminster, also writes on the same subject. In the course of his letter he says: "That there are many uses to which the metal can be put, there is no doubt; and it seems to have given satisfaction both to Mr. Livesey and to Dr. Cole, in the work for which they have each used it; but I think they are in error in saying that it expands in setting. It has a very limited range of temperature at which it is in a liquid state; and, consequently, when poured into a mould, cools or chills quickly on

the outside, and thus draws the still molten metal in the centre towards the sides. The result is, that it is most difficult to obtain a sound casting of any thickness. The outside will be smooth and perfect, and will fill the mould well, and may thus lead to the supposition of its expansion. If the metal is thin, the casting will no doubt be generally sound, but if any thickness of metal is required, some special means of casting will have to be adopted, or there will, undoubtedly, be a cavity in the centre. Mr. Livesey seems to have got over the difficulty of its getting afloat, which it does very easily while it is being melted; and if he has broken any of the pipe-joints he has made, it would be interesting to know the result of his examination. I should not be disposed, with my present knowledge of the material, to endorse the opinion as to its elasticity. It has not the ductility of lead, and hence gives different results; but I should consider that the continuity of the pipes experimented with was maintained more by its hardness and unyielding properties than by its elasticity. I may say the experiments I made were to determine the tensile strength of the metal, which proved to be about 600 lbs. per square inch of section."

RECENT SALES OF GAS AND WATER STOCK.

BRITISH GASLIGHT COMPANY.—On Tuesday, the 17th ult., two sales by auction of a number of shares in this Company took place in Norwich, when an average of £35 per share was realized.

CROYDON COMMERCIAL GAS COMPANY.—On Wednesday last, Messrs. Blake, Son, and Haddock offered for sale 370 fully-paid £5 shares in the above Company. They consisted of 70 original, or first capital shares, the last dividend paid on which was at the rate of 11½ per cent. per annum; 121 second capital shares, bearing a similar dividend; 122 third capital shares, bearing a dividend of 8½ per cent.; 14 A shares, bearing 11½ per cent. dividend; and 43 B shares, on which the last dividend paid was at the rate of 8½ per cent. per annum. The prices realized were as follows:—Original shares: 20 at £11 10s., £230; 50 at £11 5s., £552 10s.—total, £782 10s. Second capital shares: 71 at £11 10s., £816 10s.; 50 at £11 5s., £552 10s.—total, £1379. Third capital shares: 60 at £8 10s., £510; 62 at £8 7s. 6d., £519 5s.—total, £1029 5s. A shares: 14 at £11 10s., £161. B shares: 5 at £8 7s. 6d., £41 17s. 6d.; 38 at £8 5s., £313 10s.—total, £355 7s. 6d. The gross amount realized by the sale was £3717 2s. 6d., being a premium of £1857 2s. 6d. on the nominal value of the shares.

MAIDSTONE GAS COMPANY.—On Thursday last, Messrs. Tootell and Sons sold by auction four £25 A shares in this Company for £200, and one £25 new share for £41.

SHEFFIELD UNITED GAS COMPANY.—On Tuesday, the 24th ult., a number of shares in the above Company were sold by Mr. R. Lowe. £150 (£100 paid) class A stock was disposed of at £199 per cent; £175 16s. (£100 paid) class B stock being sold at the same rate; £90 class C stock sold at £198 per cent; and 12 new £10 shares (£4 paid) each realized a premium of £6 7s. 6d. Ten class E £8 10s. shares were knocked down at a premium of £3 12s. 6d. each.

SOUTHAMPTON GAS COMPANY.—On Friday, the 20th ult., 20 £25 shares in this Company were sold at a premium of £7 each.

SALE OF GAS AND WATER STOCK BY THE STOCK AND SHARE AUCTION COMPANY, LIMITED.—On Thursday last the above-named Company, which has just been started for facilitating the disposal of stock in gas, water, and miscellaneous companies, offered for sale by auction, at their Offices, Crown Buildings, Old Broad Street, E.C., a large number of shares in established undertakings, amongst them being the following gas and water stock:—100 £10 shares (£7 10s. paid, the balance of £2 10s. to be paid by the purchaser in April) in the North Middlesex Gas Company, and entitled to a dividend of 10 per cent.; £2000 worth of 6 per cent. debentures in the Beyrout Water-Works Company; a £300 first mortgage debenture in the Cadiz Water-Works; and 10 £100 6 per cent. second mortgage bonds in the People's Gaslight and Coke Company of Chicago. The North Middlesex gas shares realized a total of £1055, or an average of £10 11s. each; the Beyrout Water-Works Company's debentures sold at the rate of 65 per cent., the total being £1300; for the £300 debenture in the Cadiz Water-Works 100 guineas were bid, but the offer was declined; and the bonds in the Chicago Company were taken by one buyer at the rate of 75 per cent. Mr. E. H. Bousfield (of Messrs. Edwin Fox and Bousfield, the Auctioneers to the Stock and Share Auction Company) conducted the sale, which was largely attended.

ALARMING FIRE AT THE DUNFERMLINE GAS-WORKS.

About half-past seven o'clock on Friday morning a fire broke out in the Dunfermline Gas-Works, which at one time threatened to be of a very dangerous character. It occurred in the meter and governor house at the south-east angle of the works, and had been preceded by an explosion, owing, it was conjectured, to some gas having escaped from one of the governors, and ignited at a safety lantern placed at the top of the door. When the fire was first discovered, the flames were issuing from the roof, and a messenger was at once despatched to summon the fire brigade. Meanwhile a considerable number of willing workers tried to subdue the fire by throwing water upon it, there being an abundance at hand. The fire, however, had obtained such a firm hold of the woodwork of the roof of the building that, previous to the arrival of the fire brigade, it was feared it might spread to the purifying and retort houses. Fortunately, the gas in the holder nearest the burning building was nearly exhausted, though the others were full. Soon afterwards the fire brigade arrived on the scene, and, aided by the exertions of some of Messrs. Mathewson and Sons workers, who had turned out with their factory hose-pipe, eventually extinguished the flames, and allayed the fear that had been entertained for the safety of the adjoining premises and the gasholders. It was then seen that the explosion must have occurred in the governor regulating the supply of gas to the portion of the town lying south of the gas-works. The governor was quite out of gear, and the top was completely off. The other governor, which regulates the supply to the northern part of the town, was also much damaged; and the station-meter, which stood between the two governors, likewise suffered very considerably. The whole of the external fittings of the meter were demolished, while the front plate was fractured from top to bottom, owing to the combined influence of the intense heat and the water discharged into the meter-house to extinguish the fire. This meter, which had been placed in position at a cost of £900, was comparatively new, and was capable of registering 20,000 cubic feet of gas per hour.

Immediately after the explosion, Mr. W. Mackenzie, the Manager, took steps to ensure that the supply of gas to the public should not be interfered with, matters being so arranged as to send out the ordinary supply through the bye-pass pipes provided for such an emergency. Before nightfall matters had been so far arranged that no inconvenience was experienced from the mishap. The supply of gas to the town was continued at night, but the lighting was somewhat defective, owing to the want of a regulated pressure. It is estimated that the damage and loss of gas will amount to about £500.

THE LANCASHIRE COAL AND IRON TRADES

(FROM OUR OWN CORRESPONDENT.)

There is no improvement in the trade of this district so far as the demand for round classes of coal is concerned. Less time is being worked at the pits generally, and the tendency of prices continues downwards. The winter demand for house-fire coal is now practically over, and, as I anticipated in a previous report, at many of the collieries the bulk of the stocks is left on hand. Good furnace coal moves off moderately well, but the supplies of common round coal are much in excess of the requirements. For gas-making coals I do not yet hear of many inquiries, and I have nothing material to add to what I stated a few weeks back. The indications are all in the direction of low prices ruling during the ensuing season. Engine classes of fuel continue generally firm in price. The chief demand is upon slack, which largely takes the place of better classes of fuel, which a year or two back were more generally in use for mill purposes, and sellers are hardening in their prices. The average prices at the pit mouth are about as under:—Good Wigan Arley, 8s. to 8s. 6d.; common, 6s. to 6s. 6d.; Pemberton four-feet, 6s. 3d. to 6s. 9d.; common round coal, 5s. to 5s. 9d.; good burgy, 3s. to 3s. 6d.; and common, about 2s. 6d. per ton.

The shipping trade continues in a depressed condition. There are large quantities of coal at Liverpool, and orders are difficult to secure, notwithstanding the low prices which sellers are now willing to take.

For coke an active inquiry is reported, and makers are able to maintain without difficulty prices which are fully 2s. 6d. per ton above the lowest figures lately ruling in the market. The demand is chiefly for the better classes of cokes, and for these at the ovens prices range from 15s. to 17s. per ton, small cokes being quoted at from 11s. to 12s. per ton.

It is becoming evident that a large quantity of iron has been bought and held upon speculation, and as many of the holders are endeavouring to realize, a weaker tone has been imparted to the market. Second-hand lots of pig and manufactured iron, and even hematites, are now to be bought in some cases at considerably under late rates; but, so far as consumers in Lancashire are concerned, there is not much disposition to buy at present; requirements, as a rule, being already well covered. The weakness in the market has not yet had much effect upon makers, who are generally well sold, and not anxious for further orders just at present. Lancashire producers have even advanced their quotations, Lancashire pig iron delivered into the Manchester district being quoted at about 72s. 6d. per ton, less 2½. Manufactured iron is rather easier for prompt sales, and ordinary bars delivered into the Manchester district have been offered at from £8 5s. to £8 15s. per ton.

Founders are a little better off; but they are unable to secure orders at prices based on the present cost of the raw material.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The shipments of gas coals from the Tyne improved last week. More would have been exported coastwise and abroad had not a strong north-westerly gale blown three days. This prevented the ordinary gas-house steamers and sailing vessels from keeping their time, and it threw out somewhat the shipping business at the Tyne Dock. The demand for coals of most kinds, households excepted, is good; but the speculation with regard to a large increase in values is not realizable; 7s. per ton, less 2½, for best gas, and 10s. per ton best steam, are the ruling rates. They form a basis for most kinds of contracts. Last week 20,000 tons of steam were sold at this figure. There is no appearance that they will alter very materially—this side of September, at any rate.

The coasting shipping trade is as dull as ever. Scarcely a dozen sailing vessels were chartered last week to load coals for British ports. The gas coal trade continues to be done by regular steamers and by sailing vessels, which run all the year round.

The shipment of gas and steam coals to the Baltic has commenced. Pretty large contracts to supply Russia with gas coals have been made; but, as a rule, merchants who are in the habit of shipping gas coals to that country, are hanging off until the tendency of trade is fully indicated. That it will be large is pretty certain. The coke business continues to be very firm. Prices have steadily advanced, notwithstanding the recent considerable increase of production.

The chemical market showed an improvement of 2 per cent. upon previous rates. Lead was cheaper, and copper fully maintained its price. The timber trade is not quite so firm as it was. The foundry trade of the Tyne is very busy, except in the manufacture of water and gas pipes, in which department they are rather slack.

Gas and water companies shares maintain their full value here. The dividends of all the large companies in the North of England show very satisfactory results. Next half year there is likely to be a considerable increase in the consumption of water, through the chemical and iron works having got into very full work.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

A general meeting of the Gaslight Company, Limited, which was recently formed at Buckhaven, Fifeshire, was held on Saturday, the 21st ult., when it was arranged that the Directors should apply for a suitable site for the works, and obtain the necessary plans. It is therefore expected that ere long building operations will be commenced.

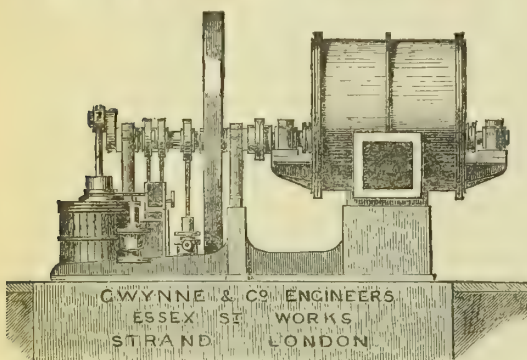
I understand that the experiments connected with the lighting of St. Enoch Station, Glasgow, last autumn, with the electric light, and the negotiations to which they gave rise, have now eventuated in something definite. Arrangements have been made with the British Electric Light Company to have the station regularly and systematically lighted up by the use of six lamps, over a period of twelve months, at a charge of so much per hour, the Railway Company providing the engine power to drive the dynamo-electric machines, and the Electric Light Company providing all the other apparatus, together with the experts to work the light. It is reported that Sir William Thomson was commissioned by the Directors of the Glasgow and South-Western Railway Company to devise a new form of reflector to suit the circumstances of the station, which is almost an exact repetition of the Midland Station at St. Pancras, but on a somewhat smaller scale. There is some talk of having the lights in operation within the next two or three weeks. So far as I am aware, the Glasgow station will be the first in the kingdom to which the electric light has been adapted.

While speaking of the electric light, I may mention that it is intended to use it on board a splendid Cape mail steamer of 3600 tons, which has just been launched on the Clyde, for the Union Steamship Company of Southampton. The saloon in which the light will be used is about 42 feet square, the height in the centre being about 18 feet.

A temporary gas-lamp has been put up in the middle of Bernard Street, Leith, the principal thoroughfare of the town, by the Lighting Committee of the Leith Town Council, for the purpose of testing the utility of Sugg's shadowless lantern. The lamp was used for the first time on Friday night, and gave an excellent light. The burner that is being used is a Sugg's "London" Argand, the consumption of which is 95 cubic feet per hour, giving a light equal to 220 standard candles, at a cost of 2d. per hour.

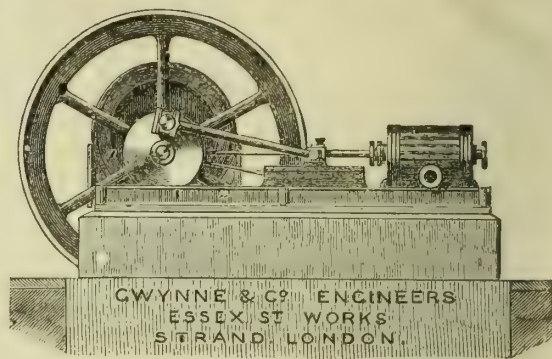
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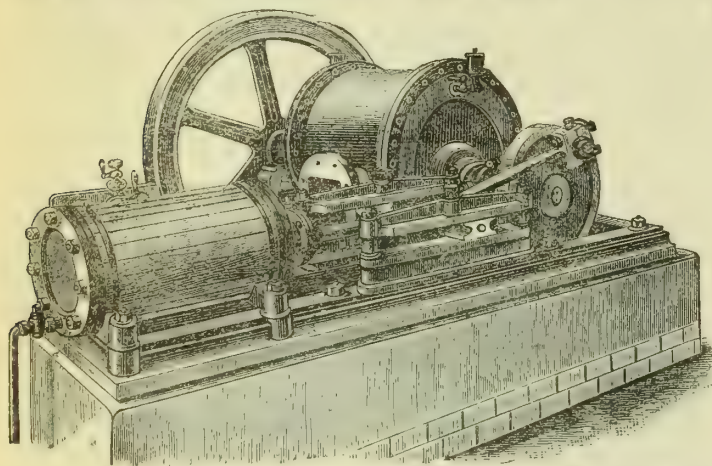
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[SEE ALSO ADVERTISEMENT, PAGE 342.]

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 9, 1880.

Circular to Gas Companies.

WE are still without official announcement of the approval by the Board of Trade of the scheme for the amalgamation of the Phoenix and South Metropolitan Gas Companies. We have no doubt that the statement we made last week, that the Board had practically sanctioned the scheme, with some slight alterations since it was first printed, is substantially correct; and, if the proper official of the Board could only be induced to exert sufficient energy to sign his name to the document, it might go on to the Privy Council, and the whole thing be settled. When another Privy Council will be held, not being in Cabinet secrets, we are, of course, unable to say; but one cannot long be deferred, and we do hope soon to have the pleasure of announcing that the South Metropolitan and Phoenix Companies are one. Then the legislation which is absolutely necessary can go quietly forward, and the South Metropolitan Company will, of course, obtain for the unified undertaking the powers sought by the Bills of the two Companies now before Parliament.

The Court of Common Council of the Corporation of the City of London have been bemoaning the cost they have been put to in opposition to, and in the promotion of Gas Bills. It seems that in all £13,000 was expended during the years 1875-77, and the Metropolitan Board of Works have paid away this amount. Now they call upon the Corporation to furnish half the sum as their contribution to the parliamentary expenses. This, we think, is rather hard; for, as the greater part of London has been benefited by the legislative changes, and as the area of the City is only one-eighth of the whole Metropolitan area, we think that to charge the Corporation with one-half of the expenses is too much. The Common Council, however, have agreed to pay, and there the matter ends; but perhaps it may be a lesson to them. They should hesitate before they initiate, or join again with the

Metropolitan Board of Works in any proceedings against the Gas Companies.

The question has once more arisen at Manchester as to the appropriation of gas profits. Some extensive improvements are projected, and it seems that the present contributions from the profits made by the gas undertaking must be continued, or an improvement rate be levied. Which of the two proceedings would be the more just to gas consumers we need not say. It is quite clear that so long as the Manchester gas-works are managed on the present system, reductions in price must be few and far between. If the works were in the hands of a Gas Company, the consumers in Manchester would not be charged much more than half the price they now pay, but they would doubtless have to contribute to an improvement rate.

The Corporation of Lincoln—or, at all events, some of the members of the Town Council—have an evident desire to acquire the undertaking of the Gas Company, but hardly know how to set about the work. A Committee has been appointed to make an inquiry into the affairs of the Company, in order to decide whether or not the undertaking is worth having. Some members of the Council suggest that the Company are not so prosperous as they are commonly reported to be. However, the Committee will sit and investigate, and as it is reported, or rather insinuated, that the Directors of the Company are not unwilling to part with their property, we may perhaps soon hear of the disappearance of another Gas Company; but we rather think a long price will be asked for the Lincoln gas undertaking, and the Corporation may possibly hesitate, with the "electric light looming in the distance," before they decide to effect the purchase.

There is hope for the British farmer, even though sunlight should not be vouchsafed to him, and assist in ripening his crops. It is asserted that the electric light is an admirable promoter of vegetable growth and development. We gather from a report of a discourse by Dr. Siemens, at the Royal Society, on Thursday last, that if a few strong electric lights were distributed over a field of carrots, their growth would be greatly promoted. Parsnips, it appears, would be equally benefited, and wheat made richer in starch and gluten. Steam is coming more and more into use in agricultural operations, and this additional impulse to its use in driving dynamo-electric machines in a field will more than ever astonish Hodge, who, with open mouth, will sit on a gate all through the night to see the carrots grow. We cannot boast that gas will work equal marvels, but as regards the promotion of vegetable growth we think that it has exercised a very beneficial effect.

One accident to which gas-lighted buoys are liable has just been experienced at Roseneath Patch, where the light went out in consequence of the exhaustion of the contents of the cylinder. This is a matter of little consequence just now, but when dark nights, fogs, and stormy seas prevail, it may not be easy to get a new cylinder into position so as to prevent any break in the lighting. This would be a very serious matter if the light were of any consequence to navigation at the place where it is situated.

The Corporation of Birmingham have failed, up to this time at all events, to upset the award of Sir H. Hunt in the case of the purchase of a portion of their gas undertaking by the West Bromwich Improvement Commissioners. Our readers will remember that the Birmingham Corporation Gas Act, 1875, enacted that if any of the outlying Local Authorities within the district of the former Birmingham and Staffordshire Gas Company gave notice, within two years, of their wish to purchase such portion of the undertaking as lay within their limits, the Corporation of Birmingham should transfer the part for a proportionate consideration. It was evidently understood that Parliament did not mean the Corporation to make any profit when they came, as we may say, to retail the undertaking. Guided by this principle, Sir Henry Hunt, the Umpire in the arbitration which took place on the matter, awarded that the West Bromwich Commissioners were to pay £70,750 for the portion of the gas undertaking within their limits. Against this decision the Corporation appealed last May to the Court of Queen's Bench, who upheld the decision of the Umpire, drawing from the Lord Chief Justice this remark, that, in his opinion, Corporations should not make any profit by gas undertakings. Since then the Corporation have carried the case to the Court of Appeal. It was argued in the course of the past week, and judgment was given once more upholding the decision of the Umpire. We do not suppose the Corporation will care to enter into further litigation, so we may take it as now decided that the letter of the Corporation Gas Act, 1875, will be maintained in every future case. It

has been understood all along that the decision in the case of West Bromwich—the most important of the outlying districts—shall be looked upon as settling the basis of the purchases, and that the price of any further purchases that may be made by Smethwick and other places shall be ruled by the same principle.

We are often dependent for information, as to what takes place at Local Board and public meetings in the provinces, on local papers, which are kindly forwarded by subscribers, and are not unfrequently misled. It happened so last week in the case of the report of the speeches made at a town's meeting at Hanley, to which we referred in last issue, at which one of the speakers informed his hearers that the British Company charged for their gas the amounts we then published—5s. per thousand feet, with a discount of 10d. for prompt payment, making the net price 4s. 2d. This statement, we find, is not true. The charge made by the Company in Hanley, Tunstall, and surrounding villages, has been 3s. 6d. per thousand feet since the year 1866, excepting a period from April 1, 1871, to October 1, 1872, when the maximum price was 3s. 2d., and the minimum 3s. We have often found how dangerous it is to accept the wild assertions of unscrupulous partisans when they oppose a Gas Company. The misstatements they make never benefit them or their cause. The advocates of the Town Council of Hanley would not dare to produce in a parliamentary committee-room the figures we quoted, as the falsity would be exposed in a moment.

The Gas Committee of the Corporation of Blackburn have issued the balance-sheet of their gas undertaking for the past year. The undertaking is very profitable, as it ought to be, considering the price charged for gas, notwithstanding the fact that the capital engaged in the concern amounts to £11 3s. 7½d. per ton of coal carbonized. The working details come out very well. On the average, 10,625 feet of nearly 17½-candle gas was obtained from each ton of coal used, and, beyond this, 11·84 gallons of tar, and 23¼ gallons of ammoniacal liquor. The unaccounted-for gas is rather high—namely, 10·4 per cent. Nevertheless the Corporation are doing extremely well, boasting that they have made a profit on the year's trading of £23,822. The inhabitants of Blackburn should, therefore, lose no time in agitating for a reduction of price. We should state that the Engineer and Manager of the gas-works (Mr. S. R. Ogden) has, as usual, prepared his able abstract of the accounts; and this will be found in another column.

In anticipation of the forthcoming half-yearly meeting of the Alliance and Dublin Consumers Gas Company, it has been unofficially announced that a reduction in the price of gas from 4s. 3d. to 3s. 11d. per thousand feet will be immediately made. The policy of this Company of late years has always been to make reductions in price as soon as circumstances warranted, and none but the carping critics of the Dublin press would hesitate to believe that the Company will go on in the course they have pursued with so much success for some years past. We know, of course, that gas will be made as cheap as possible in Dublin, and no one knows better the advantage of reducing the price than the Directors of the Company, who, working in their own interests, will naturally reduce the charge as often as they can, and to as low a point as possible. It is satisfactory to find that the calculations of the Manager and Directorate show that the reduction may be made without danger to the maximum dividend.

Gas Companies are everywhere alive to the importance of reducing prices, whatever their enemies may say to the contrary. Thus we find that the Wolverhampton Gas Company, having had a prosperous half year, and being able to look forward to continued prosperity, announce their intention of making a speedy reduction. Gas at the present time is cheap at Wolverhampton, the Company charging an uniform price of 2s. 6d. per thousand feet to all consumers, great and small. We must confess that we approve of the practice of the Company in charging no differential rates, as a small consumer is as much entitled to consideration as a large one. A comparison made by the Chairman at the recent half-yearly meeting of the Company of the cost of the manufacture of gas at Wolverhampton and Birmingham, seemed to show strongly in favour of the smaller undertaking, whereas it ought to be otherwise, seeing that the quantity of gas produced at Birmingham is eight times greater than that of Wolverhampton.

The half-yearly meeting of the Reading Gas Company was held on the 24th ult., at which, as a matter of course, maximum dividends on all classes of shares and stock were declared. We are happy to see it confirmed that the concessions made by the Company to the representations of the Town Council will avoid all opposition to the Bill the Com-

pany now have before Parliament. It is very essential that the Bill should pass, and as quickly as possible. There is an urgent necessity for the extension of the Company's works, and it appears they have only £54 of unexpended capital in hand. What power they may have to borrow we do not know; but it seems that they must be in great need of fresh capital. The Company are, we find, so prosperous, that we cannot help thinking that an early reduction in the price of gas will be announced in Reading.

The old Brighton Gaslight and Coke Company, it is hardly necessary to say, pay for the past half year full statutory dividends. The business of the Company is rapidly developing, and we can heartily congratulate the Directors on their increasing trade in Preston, the demand for gas in which is certain to increase.

The Redhill Gas Company are so favourably situated for the making of good profits, that no one will be astonished that the Company are enabled to pay full maximum dividends for the past year, and carry forward a respectable balance. Besides the dividend, which is paid out of the profits of the last twelve months, there is also paid a bonus of two per cent. in liquidation of arrears of dividend accrued before 1874.

That useful society, the Manchester District Institution of Gas Engineers, held, on the 28th ult., their tenth annual meeting, under the able presidency of Mr. W. Carr, of the Halifax Corporation Gas-Works. The Inaugural Address of the President was extremely interesting. He went carefully over nearly every subject which is of importance to Gas Managers in the conduct of their undertakings, and we think there are very few who will be disposed to contest the truth of the conclusions he arrived at. Mr. Carr discussed at some length the subject of "condensation," and candidly admitted that this is a matter upon which we have at present very little exact knowledge. It is one, however, which affords specially easy modes of investigation, and it is somewhat astonishing that doubts should have rested so long on points which would appear to be of easy demonstration. Unlike some other processes, such as the use of regenerator furnaces for heating retorts, a change of condensers, and the arrangements connected with them, is easily effected, and at small expense; and there would be no difficulty in instituting experiments which would at once and for all settle the many disputes as to the best modes of condensation. We know very well that it is no fault of Gas Managers that experiments are not more widely instituted; but it comes to this, that Directors and Gas Committees have only one object in view—viz., to obtain profits. Hence it is that the gas industry, in some respects, remains in much the same condition in which it was thirty or forty years ago. The subject of purification was but lightly touched upon by Mr. Carr. He has, as all have who wish for progress in this matter, a desire to see purification effected in closed vessels. We should have observed just now that greater attention might be paid to distillation, in so far as to determine the durations of the charges and the heats to be applied in carbonizing different qualities of coal. Here is a promising subject for members to work out. Mr. Carr's ideas of what is called "leakage" are, no doubt, perfectly correct, as it would be absurd to suppose that, unless under exceptional circumstances, in undermined districts, where pipes become broken in consequence of subsidence, the loss of gas arises from actual escapes. We quite agree with the President that a Manager should be partly paid by results. When that prodigy of scientific acquirements, "the Gas Manager of the Future," comes into office, he will, of course, expect to be highly paid, and we strongly suspect that Directors will continue to prefer the frugal stoker, who will make them ten per cent. Mr. Carr's address was extremely well received, but was in an unusual manner criticized by one of the members. It is, we believe, a standing rule in all scientific societies that a President's address should be received without comment. His position prevents him from replying to criticisms, and therefore the practice is to receive the address with the commendations it may be supposed to deserve. [We hope to conclude our report of the proceedings in next number.]

BIRKENHEAD CORPORATION GAS SUPPLY.—At the monthly meeting of the Birkenhead Town Council on Wednesday last, the Gas and Water Committee reported that they had taken into consideration a resolution of the Council, asking them to consider what reduction could be conveniently made in the present price of gas, and had come to the conclusion that no reduction was at present desirable. In arriving at this decision the Committee say they were influenced by the considerations that it will soon be necessary to extend the present retort-house and other apparatus; that it is intended to take immediate action for the purpose of increasing the supply of water; and, amongst others, that alterations, involving an additional cost of £1000 per annum, have lately been carried out for the purpose of increasing the illuminating power of the gas supplied.

Water and Sanitary Notes.

MR. CROSS redeemed his promise last Tuesday evening, and introduced in the House of Commons the Metropolitan Water-Works Purchase Bill. The measure is of a very comprehensive character, but its provisions may be summed up in a comparatively few words. The object of the Bill is to create first of all what is called a Water Trust, which here means a Chairman, to be paid £2000 a year, and to be nominated by the Secretary of State; two Vice-Chairmen, at £1800 a year each, the first appointments to be made by the Secretary of State, and afterwards by the Trust; four nominated members—one by the First Commissioner of Works, one by the Local Government Board, one by the Metropolitan Board of Works, and one by the Commissioners of Sewers of the City of London. The Lord Mayor and the Chairman of the Metropolitan Board of Works for the time being are to be *ex officio* members. There are then to be twelve elected members—ten to be returned by the Metropolitan parliamentary boroughs, and two to represent the “suburban” districts north and south of the Thames. As regards the paid offices, there will, of course, be no difficulty about filling them, and as much may be said about the nominated and proposed *ex officio* members; but who will be likely to canvass a Metropolitan parliamentary borough in search of a seat on the Water Trust? and who, forsooth, would ramble “from Dan to Beersheba” in search of a seat for a “suburban” district? We are convinced that these arrangements will not give satisfaction. The next thing we may notice is the price to be paid for the undertakings. No cash is to pass, but the Trust will be empowered to issue certificates of Metropolitan Consolidated Water Stock, to be substituted for shares and stock in the Water Companies. The amount of this stock to be issued immediately is, in round numbers, £22,000,000, which is to be offered in substitution for capital amounting to nearly £9,000,000. The interest at three and a half per cent. on the £22,097,700 comes to £773,419 10s., which will be paid to Shareholders in lieu of dividends. The present net revenue of the Water Companies is something less than three-quarters of a million a year, which shows that for a time the Trust is not likely to make much profit. The circumstances of the Water Companies are, however, improving daily, and in the bargain made with them it was necessary to take into consideration prospective profits. The value of these has been carefully calculated, and our readers will see, in the synopsis of the Bill published elsewhere, that another species of water stock is to be issued, the payment of interest on which will be deferred for a time. The longest delay in the complete payment will be in the case of the New River Company. When all the stock has been issued, the total charge upon the water undertakings will amount to £31,000,000, the interest on which at three and a half per cent. is £1,085,000. It will thus be seen that the Water Trust starts rather heavily handicapped, and that the Metropolitan ratepayer will have to wait a long time before he finds the charges for water reduced.

We may here notice that this much-suffering individual, the Metropolitan ratepayer, is almost left out of consideration in the Bill. He is not told how much he will have to pay in the future for water; he is told, however, that as soon as circumstances permit, he shall have a “constant” supply, which will compel him to set his house in order to receive it, and will involve him in some expense. Beyond this, he will have the privilege so dear to Britons, of voting—this time for a representative on the Trust. Who shall say the ratepayers ought not to be content? Yet loud symptoms of dissatisfaction with the bargain are making themselves heard, and they will, no doubt, grow stronger and stronger. Our Metropolitan Authorities have not as yet had any opportunity of expressing themselves, but when they do we expect to hear one universal condemnation of the Government scheme. It will, we fear, be considered that the price agreed to be paid is far too high, and this opinion will be held to be fully justified by the wild speculation which has been going on in the shares of the Water Companies since the scheme was published. Speculators must have seen how much greater the value of the shares would be under the guarantee of a Trust, than it now is under the somewhat uncertain workings of the several Companies in their own respective interests. We regard the present dividends of the Water Companies as perfectly safe, and look forward to their progressive advance to the statutory limits. Still, a *quasi* Government guarantee, such as would be conferred by the proposed Trust, necessarily carries with it a more substantial security. In what has gone before we have only had regard to the present position of the

undertakings, but when we see them passing away into the hands of a body which is brought into existence to “improve” the Metropolitan Water Supply, we cannot shut our eyes to the fact that a very large outlay of capital will be necessary—first of all to bring the machinery into order, and next for the construction of new works. The remodelling of the distributory plant of the several Companies, so as to bring them under one management, will necessarily involve very considerable outlay indeed. What new sources of supply will cost, we can only conjecture. We note that the Southwark and Vauxhall Company now take from the Thames 20 million gallons a day more water than they are allowed by their Act of Parliament, which seems to indicate that a further drain on the Thames will be scarcely possible. The Water Trust will then have to face one of two contingencies. They will be compelled either to go to a distant source for water, or they may tap the chalk strata all round London, and obtain the water which will eventually be needed for the ever-increasing population of the Metropolis and its suburbs. We regard, then, as very remote the prospect of the Trust being at all able to pay their way, unless rates are to be charged far in advance of those now levied by the Companies. It seems to us an appeal to the Metropolitan Authorities for aid in rates would be absolutely necessary; and, loud as the outcry is against the charges of the Companies, a louder uproar would be made against a public water-rate, to which the Metropolis has hitherto been a stranger.

Taking all things together, then, we confess we cannot see any hope for the Metropolitan ratepayer in the proposed change of proprietorship. He will continue, supposing the Bill should pass, to drink, for some time at all events, precisely similar water to that at present supplied. He will pay the same, and possibly higher rates; he will, perhaps, in the course of a few years, have the constant supply, if he chooses to put his fittings in order to receive it, and if he does not, the Trust will quickly compel him to do so; and by-and-by, if he should live long enough, he may see an entire reconstruction of the Metropolitan water-works, with advantages which we shall not here pretend to indicate. It will be gathered from this that in our opinion the ratepayer will not in the least benefit in the proposed change of proprietorship. For a time, we have little doubt, he will suffer; but his children's children will, perhaps, reap the benefit which may be derived under the provisions of Mr. Cross's Bill. But will the Bill pass? This, of course, mainly depends upon the Home Secretary, and the view taken of the matter by the Hybrid Committee, to whom the Bill will be referred. If the Committee report in favour of the Bill, its prospects of passing are good if the Government force the measure forward; but it must be remembered that an appeal may be made to the Lords, who upon several occasions within our experience have reversed the decisions that have been arrived at by Committees of the House of Commons.

To sum up, there cannot, we think, be a doubt that in the arrangements made by the Home Secretary, the holders of shares in the undertakings of the Metropolitan Water Companies largely profit. We shall leave others to appraise the benefit which is likely to arise to the Metropolitan water consumers under the arrangement. Our readers know the fixed opinion we hold and continually express, and that is that Companies can do as well for communities, whether large or small, as any public body; nay, we go farther, and say that, as a rule, they do better. It is not our business here to point out how much better it would have been to have brought in a new Regulation Bill, to settle the charges which could be made, than to have made all this disturbance about purchase. When the Bill comes on for second reading and is referred to a Committee, we shall have a great deal more to say about it. At present we can only recommend our readers to study carefully the abstract of the Bill which is given in the present number, and form their own opinion as to its merits.

The Lords have shown a spirit of self-abnegation in throwing out the Bill which proposed to bring a supply of sea water to the Metropolis west of Temple Bar. It was for them and such as they that the promoters of the scheme alone acted. The poor were, of course, not considered, because they would be unable to pay for a supply of sea water unless it was furnished to small tenements at a low rate. Many an anxious mother would be delighted to bathe her sickly child in sea water, ignorant of the fact that the benefits of sea water could only be felt in conjunction with the inspiration of sea air; however, the matter is settled. The Lords do not care for sea water for themselves, knowing that whenever they please they can go to the coast and enjoy as much of it as they want; and as regards the poor, the Metropolitan Board of Works do not see how that class could be benefited, con-

sidering that the streets would be oftener broken up than at present. The logic is not very good, but there is this practical fact to be noticed, that the decision of the Lords Committee perhaps saved a number of stupid people from losing their money.

A great agitation is at present going on in Sheffield against the charge made by the Water Company for baths in private houses. That a bath does not come within the legal definition of a domestic supply we must admit, and we can support our opinion by reference to numerous special Acts which fix a rate for baths and water-closets more than one, the latter of which may be regarded as a supply of a more purely domestic character. But there are differences in rates. As a rule, we believe, Water Companies charge from 10s. to 12s. per annum; but it would appear that the Sheffield Water Company are charging 30s., upon what authority, as we have not their Act before us, we cannot tell. The legality of the charge has been tested in a local court, and will be carried to a superior one; so we must refrain from comment.

THE GOVERNMENT WATER BILL.

THE Metropolis Water-Works Purchase Bill is creating a veritable uproar. The excitement has reference to finance, though it is clear that the Local Authorities have no great liking for the Water Trust *per se*. Mr. Samuel Morley has given notice that on the second reading of the Bill he will move a resolution to the effect that the compensation proposed to be given to the Companies is excessive, and would impose an unjust and unnecessary burden on the ratepayers. Mr. James Beal proposes to raise "a most powerful organisation" to protect the consumers and ratepayers as affected by the Bill. This veteran agitator in the Metropolitan field invokes an irresistible committee with two objects—to cut down the purchase money by a few millions, and to obtain various other modifications of the scheme, amounting in all to an entire transformation. One arrow in Mr. Beal's quiver consists of a competing scheme of supply, though what that is to be does not yet appear, and probably Mr. Beal himself is not quite clear on the point. The Committee, "sitting at 20, Regent Street," with Mr. Beal as the ruling spirit, have sent out a petition embodying these ideas, such petition to be signed by the Vestries and other Authorities, and addressed to the House of Commons. But despite all that may be said against it, Mr. Cross has evidently prepared his *projet de loi* with great care, and it seems a pity that it should run a risk of failure. The Bill deserves to be commended for one thing—namely, it distinctly requires that the Water Trust, to whom the undertakings of the Companies are to be transferred, shall apply all moneys received by them to the purposes of the Act, so that no profits will be applied to any other purposes than those connected with the water supply. It is stipulated by the Bill that the trustees shall, from time to time, after providing a reserve for contingencies, make such reduction in the price to be paid for water by consumers as may be found practicable and expedient. The principle is good, and the promise is pleasant; but, unfortunately, the sweetness of this provision will be lost if the balance falls on the wrong side of the account. Mr. Cross provides that the excess of profit shall be put to a good use; but we want to see the chance of such profit being won.

The Home Secretary, when introducing his Bill, called the attention of the House to the fact that according to the financial scheme which had been adopted in this measure, "the Imperial Exchequer would not be called upon, either by 'guarantee or loan, in any form or shape, to supply funds for 'the purchase.'" A guarantee would be wanted, and this was to be found first of all in the water-rates, and secondly in the local rates of the Metropolis. The guarantee, however, was, in the opinion of Mr. Cross, little more than a piece of financial etiquette. "I do not think," said the Home Secretary, "these rates will ever be called upon to contribute a single 'sixpence.'" It will be seen, nevertheless, that the Bill makes very clear provision upon this point. It is proposed that if the Water Trust at any time find that they cannot have at their immediate disposal, under their borrowing powers or otherwise, sufficient funds to provide for the punctual payment of the whole of the interest on the consolidated water stock, they shall forthwith seek a certificate from the Secretary of State, which, when issued, "shall be conclusive 'evidence of the amount required to be contributed by the 'Metropolitan Board and the Commissioners of Sewers respectively.'" The Secretary of State is to issue his precept to each of these bodies, requiring them to pay, within a specified time, the amount thus shown to be due; and if default is made by either of these bodies in regard to such payments,

the amount in default is to be deemed a debt due to the Crown, enforceable by *mandamus*.

Although Mr. Cross expects that this power of coming on the rates will remain dormant in the hands of the Trust, it may possibly prove otherwise. The Trust will know where to look for money, should they fail to make sufficient profit to pay all charges, and should their impecuniosity exceed the limit of their credit at the Bank of England, as well as their power of borrowing. From the latter two sources combined they may obtain a million. This is a decent sum, but a large portion of it will be required for working capital, and the power of falling back on the rates will enable the Trust to dip their hands into a second purse directly the first one begins to fail. That such a power will not be exercised is too much to say, and it is to be hoped that the ratepayers will clearly perceive what lies before them.

In order to estimate the possibility of the local rates being made to supplement the water-rates, we must look at the burden which the Water Trust will have to bear. The nine millions of deferred stock—speaking approximately—may be discounted at six and a half millions. To this we have to add the twenty-two millions to be paid at once. The total is thus, say, twenty-eight and a half millions. The payment is to be made in Water Stock, bearing interest at the rate of three and a half per cent. Accordingly, the Trust may be considered to be burdened with a first charge of very nearly a million a year, in the shape of interest. This, it must be remembered, is in addition to the interest to be paid on preference shares and debentures. The million pounds per annum to which we now refer is the mere equivalent of the ordinary share capital of the Companies. To this, accordingly, we must add the interest to be paid for the other description of capital, which additional sum amounted in 1878 to rather more than one hundred and forty thousand pounds. Allowing that the Water Trust may reduce the rate of interest, the annual sum to be paid under this head will be at least one hundred thousand pounds a year. Thus the Trust will have to raise eleven hundred thousand pounds per annum for interest of one kind and the other. The water rates received by the Companies in 1878 were not much more than two hundred thousand pounds in advance of this sum. If we put this now at a quarter of a million, we shall be stating rather more than the true surplus. How far will this quarter of a million go towards meeting the working expenses of the undertakings? In 1878 the expenditure of the Companies for maintenance of works and for pumping, with the addition of rates and taxes, made up a sum of more than three hundred thousand pounds. Where Mr. Cross is to get his saving in the first year of fifty thousand pounds is by no means clear, and the prospect cannot be said to improve as we look farther ahead, seeing that the issue of deferred stock will be going on year after year until the close of 1892.

We are not disposed to blame Mr. Cross for making very liberal terms with the Companies, but if the Metropolis is to bear this impost it seems strange that it should quarrel with the present financial régime. A rose with any other name will smell as sweet, and a pound taken out of a man's pocket is the same, whether abstracted by a Water Company or a Water Trust; while, in this case, the Trust threaten to take more than the Company. It might be said that the Companies are to blame for asking so much, but it should be observed that they were not obliged to name any price at all. They were asked if they would sell, and, of course, there was a price which would tempt them to part with their property, although they had no particular desire to get rid of it. When the buyer goes to the seller the price is naturally greater than if the seller goes to the buyer. Very much that is said against the bargain is superficial and unsound. Heavy as the terms are, they are by no means so absurdly extravagant as some writers and speakers represent. Two hundred and fifty pounds, at three and a half per cent., is no better than one hundred pounds at eight and three-quarters, except so far as the former may have a better guarantee than the latter. We are not quite sure that the speculators on the Stock Exchange have in all cases appreciated the difference. There has been violent excitement, and prices have been dashing up and down in a very extraordinary manner. The quotations in the share market have alarmed the press, and journalists have taken pen in hand to show that there must be something wrong, seeing that prices have advanced at such an amazing rate. There may be something wrong in people's heads, but we can hardly fancy Mr. Cross is such a dolt as to fall into a gross financial error. He may see reasons for his bargain which are not yet appreciated, but which will come out more clearly by-and-by.

The composition of the Water Trust is a matter over which

there is sure to be animated contention. The Metropolitan Board will mark the fact that, while they were excluded as unsuited, by reason of their narrow area, to have charge of the water supply, Mr. Cross thinks the outlying area sufficiently represented by having two members sitting on the Water Trust—one from the northern fringe, and the other from the southern. These two “suburban members,” elected by the outlying Sanitary Authorities, are all the force that is to come out of that extensive region which, although included in the area of the water supply, lies outside the somewhat restricted jurisdiction of the Metropolitan Board. The introduction of the Lord Mayor, as an *ex officio* member of the Trust, although a compliment to the City, is scarcely anything more than a compliment. His lordship has enough to do in connection with his civic dignity, quite apart from the duties proper to a member of the Water Trust. Supposing his lordship to serve with diligence as a member of the Trust, he will only just have learned how to discharge his duties by the time he has to give them up. Sir J. M. Hogg, on the other hand, might plead that if he is to attend the sittings of the Water Trust, he might as well have the whole affair at Spring Gardens under the wing of a Metropolitan Board Committee. Supposing the Bill to pass with no material alteration in the clauses which constitute the Water Trust, we should await with considerable interest and curiosity the *début* of this oddly-constituted body. With twenty-one members so strangely brought together, the new corporation would be a phenomenon. Election, selection, and nomination, payment and non-payment, all enter into the composition of the new authority. Even if there were no quarrel over the purchase clauses of the Bill, the mode of forming the Trust would be enough to raise a storm.

After all, let the Bill be good, bad, or indifferent, what will the water consumers of the Metropolis gain by it? The *Spectator* predicts that if the Bill becomes law, “the patient ‘Issachar, the London ratepayer,’ will simply be ‘taxed’ again.” Perhaps the prophecy is not far wrong, and it is thus amplified by our contemporary:—“Besides his ‘water charges, already too high, he [the patient Issachar] will have fourpence or sixpence in the pound to pay for ‘better water and a constant supply, which, but for this ‘blundering, he might have obtained for nothing.’ We differ from some of these statements, but we accept the substratum of truth. Under Mr. Cross’s Bill, the process of improvement now going on will be confided to fresh hands, with a tolerable certainty that there will be an extra cost. Such is the natural result of an agitation which has long been stimulated by prejudice and misconception.

Communicated Article.

THE THEORY OF DISSOCIATION.

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III.

Among those bodies which yield a vapour of abnormal density, or whose molecules, as some chemists say, occupy in the gaseous state four times, instead of twice, the volume occupied by an atom of hydrogen, the best studied have been ammonium chloride, phosphorus pentachloride, sulphuric acid, chloral hydrate, and amylene hydrobromide. The first attempt to demonstrate the decomposition of these bodies, at the temperature employed to volatilize them, was made by Pébal. He submitted the vapour formed by heating solid ammonium chloride to diffusion through a porous diaphragm. If “dissociation” occurs at the temperature to which the substance is submitted, then the lighter of the two dissociated constituents will pass through the diaphragm more quickly than the denser, so that there will be found outside the diaphragm a mixture of gases containing more of the lighter constituent, and inside the diaphragm a mixture of gases containing more of the denser constituent than required to re-form the original ammonium chloride on cooling. Pébal performed his experiment in the following way:—In a hard glass tube, drawn out at one end, he placed a plug of asbestos. On this plug he supported some pieces of solid ammonium chloride. The tube was enclosed in an outer one, so that the space above the asbestos plug, containing the ammonium chloride, was in free communication, through the drawn-out end, with the annular space between the two tubes. Through this outer space a stream of hydrogen was passed. In the inner tube beneath the asbestos plug, another stream of hydrogen was kept up, and in the two tubes, by which the two streams of gas escaped, pieces of litmus paper were placed. The whole apparatus being heated in a charcoal furnace, it was found that the hydrogen from the inner tube became ammoniacal, and the hydrogen from the outer tube acid, owing to the dissociation of the ammonium chloride into free ammonia and free hydrochloric acid.



The ammonia, owing to its less density, diffused more quickly

through the porous plug than the hydrochloric acid, so that on the recombination of the dissociated gases in the cooler parts of the apparatus, an excess of ammonia was found in the inner tube, and an excess of hydrochloric acid in the outer tube. The former, carried along by the stream of hydrogen, restored the blue colour to reddened litmus; the latter, carried along by the other stream of hydrogen, reddened blue litmus. The fact that dissociation had taken place was thus established; but, as Deville pointed out, the experiment gave no evidence of the amount of the decomposition, leaving it uncertain whether complete dissociation of the ammonium chloride into ammonia and hydrochloric acid had taken place, or whether only a slight decomposition had occurred, the bulk of the vapour being still composed of molecules of the compound substance occupying an abnormal volume.

In 1863 Wanklyn and Robinson published their experiments on the vapour obtained when sulphuric acid or phosphorus pentachloride is heated. To eliminate the effect of any chemical action that a porous diaphragm at a high temperature might exercise on the substance under experiment, they allowed the heated vapour to diffuse through a narrow passage into a second vessel. A glass flask of about 500 cubic centimetres capacity, with a short neck 1 centimetre in diameter, contained the sulphuric acid. The neck of a second smaller flask was fitted loosely over the neck of the first, and a bent tube sealed into the upper flask brought into it a current of carbonic acid, which escaped through the interval between the two necks. In the first experiment the lower flask contained, before being heated, strong sulphuric acid, consisting of—

Hydrogen sulphate (H_2SO_4)	95
Water (H_2O)	5
	100

After being heated for an hour to 520°C ., the residue in the lower flask consisted of—

Hydrogen sulphate (H_2SO_4)	60
Anhydrous sulphur trioxide (SO_3)	40
	100

In another experiment the lower flask contained, before being heated, an acid consisting of—

Hydrogen sulphate (H_2SO_4)	99
Water (H_2O)	1
	100

After being heated to 435°C . for a shorter time than before, the residue consisted of—

Hydrogen sulphate (H_2SO_4)	75
Anhydrous sulphur trioxide (SO_3)	25
	100

In both cases the residue contained crystals, and fumed strongly in air.

The same apparatus was then employed to examine the vapour formed by heating phosphorus pentachloride. The pentachloride gave no reaction with potassium iodide, and was therefore free from chlorine, and no precipitate with solution of mercury perchloride, and was therefore free from phosphorus trichloride. After being heated for 45 minutes to 300°C ., and its vapour allowed to diffuse into carbonic acid, the residue in the lower flask was dissolved in water, acidified with hydrochloric acid, and treated with mercury perchloride. A precipitate of mercury protochloride was obtained, weighing 0.017 gram. The presence of free chlorine was proved by the blue colour exhibited by paper soaked in a solution of potassium iodide and starch, and held in the current of gas escaping from the apparatus.

The explanation of abnormal vapour density afforded by these experiments was not accepted by Deville. Admitting that decomposition occurred under the conditions of the experiment, Deville attributed the decomposition to the *force of diffusion*; that just as in the experiments of Graham on the diffusion of salts in solution, aqueous diffusion breaks up acid potassium sulphate into neutral potassium sulphate and sulphuric acid, and potassium alum into potassium sulphate and aluminium sulphate, so gaseous diffusion can decompose the vapours on which it acts. He writes: “The new agent of decomposition introduced by Graham is so energetic, that it is impossible any longer to consider as *spontaneous* those decompositions produced under its influence. It is in no way proved that sal-ammoniac, sulphuric acid, and phosphorus pentachloride would be decomposed in *their own vapour* at the temperatures employed.” To determine this point, Deville made the following experiments:—Into a vessel surrounded by the vapour of boiling mercury at 350°C . he introduced an air thermometer. When the thermometer had reached a constant temperature, a current of ammonia and a current of hydrochloric acid were quickly forced into the vessel through separate tubes. The thermometer indicated a sudden rise of temperature, reaching as high a degree as 394°C . Deville considered this experiment to show that not only is ammonium chloride undecomposed at 394°C ., but its elements unite at this temperature with considerable disengagement of heat. This important experiment was shortly afterwards repeated by Karl von Than. A large glass tube, closed at one end, and with the open end plunged into a reservoir of mercury, was partly filled with dry ammonia. Into the space above the mercury, a smaller thin glass vessel was introduced, with two narrow tubes passing down through the mercury, and bent so as to rise above the surface of the mercury in the reservoir. The inner vessel contained dry hydrochloric acid. By an ingenious contrivance

the pressure in the inner vessel could be adjusted so as to exactly equal that in the outer one. The upper part of the apparatus, containing the two gases, was enclosed in a charcoal furnace, and heated by radiation to about 360°. The level of the mercury in the tubes being adjusted and read, the inner vessel was broken by making it strike the walls of the outer vessel, and the two gases allowed to mix. No appreciable fall of the mercury was observed, from which Than argued that if ammonia and hydrochloric acid were heated to 360° before being allowed to mix, there was no disengagement of heat, and consequently no chemical union at that temperature. Deville replied by criticizing the arrangement of the experiment. The top of the column of mercury was at its boiling point, a quantity of mercurial vapour was therefore present in the space above. The level of the mercury could not be accurately read, and since the tube was of large diameter, a small change of volume in the vapour would not appreciably alter the level. The gases were not stirred; the heavier hydrochloric acid would at once fall to the bottom, and only mix slowly with the lighter ammonia, and therefore the heat due to chemical union would only be slowly evolved, and so cause very little rise of temperature. Deville then repeated his own experiment, passing the two gases through two coils of glass tube wound round the small flask in which they finally mixed. By this means he ensured the gases being at the temperature of the flask before coming into contact. The rise of temperature was marked by a small air thermometer, with its bulb in the flask. He obtained the same result as before, and concluded that ammonium chloride undergoes only a very trifling dissociation at 350° C., its molecule occupying four volumes without decomposition.

Again, Deville placed two similar tubes of porcelain side by side in a furnace. Into one of them, closed at one end, he placed some ammonium chloride. Through the other he passed a current of gaseous ammonia. He found that while the vapour given off by the sal-ammoniac re-formed that salt on cooling, the gas which had passed through the other tube contained—

Undecomposed ammonia	53.2
Nitrogen and hydrogen	46.8
	100.0

If, Deville argued, the ammonium chloride had been dissociated into free hydrochloric acid and ammonia, then the ammonia would have suffered further decomposition into hydrogen and nitrogen at the temperature of the furnace. To prove that hydrogen and nitrogen do not combine, in presence of hydrochloric acid, to form ammonia, Deville passed a mixture of the three gases through a tube heated to dull redness, and obtained no trace of ammonium chloride even when the gases were passed over platinum. It would seem, then, impossible for complete dissociation to have occurred when the ammonium chloride was heated, and for recombination to have taken place.

Ammonium cyanide exhibits an abnormal vapour density. Its molecule occupies four times the volume occupied by an atom of hydrogen. It is formed when ammonia comes in contact with carbon at very high temperatures. Deville found that hydrocyanic acid was decomposed at a dull red heat into a mixture of cyanogen, hydrogen, and nitrogen, while a small deposit of carbon was formed on the sides of the tube in which the acid was heated. Ammonia is also decomposed at a dull red heat. Ammonium cyanide could not, therefore, be dissociated into ammonia and hydrocyanic acid, both of which are broken up at a much lower temperature than that at which ammonium cyanide is formed.

Two years later Deville himself supplied facts which give an explanation of the stability of the ammonia supposed to be liberated at a high temperature when ammonium chloride is vaporized. By the passage of a series of electric sparks through dry ammonia over mercury, the gas is gradually doubled in volume, being converted into a mixture of hydrogen and nitrogen. On now passing up a drop of water, no measurable contraction occurs, but if a few bubbles of hydrochloric acid gas are sent up the tube, a slight white cloud of ammonium chloride is formed, showing that a small fraction of the ammonia that is present has remained undecomposed. Moreover, on sending a fresh series of sparks through the mixture containing free hydrochloric acid, a deposit of ammonium chloride is formed on the sides of the tube, and the mercury gradually rises. In presence of hydrochloric acid, hydrogen and nitrogen have the power of combining at the temperature of the electric spark; for the ammonia produced by their combination is, as it were, held prisoner, and its decomposition prevented by the acid. In a second series of experiments, Deville passed a mixture of hydrogen, nitrogen, and hydrochloric acid through a porcelain tube heated to bright redness, in the centre of which ran a smaller metal tube kept at 10° by a current of cold water passing through it. He found a slight deposit of ammonium chloride on the cold metal tube, indicating that the hydrogen and nitrogen had combined in presence of the hydrochloric acid. It seems probable, therefore, that the presence of a molecule of hydrochloric acid in its immediate neighbourhood may prevent the decomposition of a molecule of ammonia at a high temperature into hydrogen and nitrogen, and in virtue of this conservative power that ammonium chloride may be dissociated into ammonia and hydrochloric acid without these constituents undergoing any further decomposition in presence of each other.

About this same period (1865) Ad. Würtz noticed the fact that the vapour of amylene hydriodide diminished in density as the temperature increased. As bearing on the debated question of abnormal vapour density, Würtz extended his experiments with the hydriodide and with the hydrobromide of amylene, which latter body he found most convenient for experiment. Amylene hydrobromide (C₅H₁₀ H Br) boils at 113° C., and is not carbonized at a temperature of 360° C. Würtz determined its vapour density by Dumas's method at

different temperatures between 153° C. and 360° C., and the following are some of the densities obtained:—

Temp. Cent.	Density of Amylene Hydrobromide.	Theory.
153°	5.37	5.24 for 2 volumes.
183°	5.15	—
193°	4.84	—
205°	4.39	—
215°	4.12	—
236°	3.83	—
248°	3.30	—
305°	3.19	—
314°	2.98	—
320°	2.88	—
360°	2.61	2.62 for 4 volumes.

The theoretical density of the hydrobromide being 5.24, it appears that between 153° and 183° the density of the vapour is normal, but that at 190° the compound begins to break up, the density rapidly diminishing till a temperature of 248° is reached. At this point the rate of decomposition appears to diminish. The vapour of amylene hydrobromide, which remains in small quantity mixed with a large quantity of free amylene and hydrobromic acid, resists decomposition. Würtz lays great stress on this point. Without doubt, at 300°, the vapour of the hydrobromide of amylene, considered as pure, possesses a greater tendency to decompose than at 150°. But it is no longer so if we consider this vapour as diluted with the products of its own decomposition. As the relative volume of the products of decomposition increases, so the tendency of the undecomposed residue to split up diminishes. Accordingly, while the mass of the body has succumbed to the disintegrating force of heat at 320°, a small portion of amylene hydrobromide remains undecomposed at that temperature, the percentage of dissociation being given by the vapour density—

Temperature, 320° C.	
Dissociated amylene and hydrobromic acid . . .	90
Undissociated amylene hydrobromide	10
	100

If, then, two streams of amylene vapour and hydrobromic acid vapour were brought together in a flask at 320° C., both streams being previously heated to the temperature of the flask, 10 per cent. of the compound amylene hydrobromide would be produced, with a corresponding rise of temperature. To a similar, though perhaps less extensive combination of the heated gases was, no doubt, due the rise of temperature observed by Deville on bringing two streams of hydrochloric acid and ammonia into a flask at 350° C.
(To be continued.)

YESTERDAY'S PRICES OF GAS AND WATER SHARES.—Mr. A. G. Prater, Stock and Share Broker, of 23, Cornhill, gives the following as the closing prices yesterday of some of the principal gas and water shares:—

Gas Companies.		Phoenix	
Brentford	144 —148	South Metropolitan "A" . . .	198 —202
Brighton	34 — 35	Do. "B."	178 —183
Brighton and Hove . . .	34 — 35		
British	34 — 35	Water Companies.	
Commercial	183 —186	Chelsea	213 —218
Continental Union . . .	19½ — 20½	East London	207 —210
Do. 7 per cent. Pref. . .	23½ — 24	Grand Junction	118 —120
Crystal Palace District .	175 —178	Kent	300 —305
European	17 — 18	Lambeth	210 —213
Gaslight and Coke "A" .	178 —180	New River "New"	375 —385
Imperial Continental . .	179 —181	Southwark & Vauxhall . . .	228 —231
London	176 —180	West Middlesex	170 —175

PRESENTATION TO MR. J. C. PITT, OF THE HAGGERSTON GAS-WORKS.—Last Wednesday, Mr. J. C. Pitt, the Gas Examiner at the Haggerston works of the Chartered Company, who is, after 21 years service with them and their successors—the Imperial Company—leaving their employ, was presented with a testimonial consisting of a *secrétaire* fitted complete, with an inscription plate:—"A present from the Gas-Works, Shoreditch, to Mr. J. C. Pitt, February, 1880. H. Clarke, Esq., Engineer," accompanied with a handsome signet ring. Mr. J. Jackson presented the testimonial in a suitable speech, expressing on the part of the subscribers their hearty wishes for Mr. Pitt's future welfare and the happiness of his wife and family. Mr. Stephenson said he was very glad to add that in his friend Mr. Pitt he always found a substantial help in the several duties occurring between them, and was very sorry he was going, but sincerely hoped he would thoroughly succeed in his new occupation. Mr. Pitt, in responding, said he hoped their wishes would be realized; he thanked them heartily for the handsome but unexpected *souvenirs*, it being a source of much consolation to him that he had so many friends.

PRESENTATION TO MR. GEORGE ANDERSON.—At the twenty-first half-yearly meeting of the Walton-on-Thames and Weybridge Gas Company, held at the gas-works, Walton-on-Thames, on Saturday, the 28th ult., Mr. George Anderson, of Westminster, was presented by the Shareholders of the Company with a testimonial, consisting of a handsome silver salver and a silver cup, together weighing 160 ozs., and bearing the following inscription:—"Presented to George Anderson by the Shareholders of the Walton Gas Company, in recognition of skilful services rendered. 1879." The Company, which was incorporated by Act of Parliament in 1869, had never been able to declare a higher dividend than 5 per cent. per annum up to the time when Mr. Anderson first joined the Board—except on one single occasion, when a dividend of 6 per cent. per annum was paid—while for the half year to June, 1876, no dividend at all was declared. It was at this time that Mr. Anderson accepted a seat at the Board, and he has since freely given his services, without special fee or reward of any kind, to bring the manufacturing department into efficient working order. Under his able management the dividends soon rose to 6 and 7 per cent., and for the last two half years the Company have paid dividends at the rate of 8 per cent. per annum, besides accumulating a substantial depreciation-fund, while the plant is sufficient to overtake double the present business. The substantial recognition which has now been awarded for the skilful assistance so generously given to the Company must be as gratifying to Mr. Anderson as it is creditable to the Shareholders.

Parliamentary Intelligence.

PRIVATE BILLS RELATING TO GAS, WATER, ETC.
SESSION 1880.
PROGRESS MADE TO SATURDAY, MARCH 6.

Title of Bill.		Petition for Bill Presented.	Bill Read the First Time.	Bill Read a Second Time.	Bill Reported.	Bill Read the Third Time.	Bill Received Royal Assent.
Ackworth, Featherstone, Purston, and Sharlston Gas Bill	Lords	Feb. 9	Feb. 10	..	..	..	..
Birkenhead Borough " " " "	Commons	..	..	..	..	..	..
British Gaslight Company, Limited (Staffordshire Potteries), Bill	Lords	Feb. 10	Feb. 10	Feb. 23	..	..	..
Burton-upon-Trent Corporation Bill	Commons	..	..	..	..	..	..
Cardiff Water Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Chester Gas Bill	Lords	Feb. 10	Feb. 10	Feb. 20	..	..	..
Cork Gas Bill	Commons	..	..	..	..	..	..
Cork Improvement Bill	Lords	Feb. 9	Feb. 10	Feb. 24	March 2	..	..
Dagenham and District Farmers (Optional) Sewage Utili- zation Bill	Commons	Feb. 9	Feb. 10	March 1	..	..	..
Dartford Gas Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Dearne Valley Water Bill	Commons	Feb. 9	Feb. 10	Feb. 17	..	..	..
Denton and Haughton Gas Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Doncaster Corporation Water Bill	Commons	Feb. 10	Feb. 10	Feb. 16	..	..	..
Eastbourne Gas Bill	Lords	..	..	..	..	..	..
Edinburgh and District Water Bill	Commons	Feb. 9	Feb. 10	Feb. 25	..	..	..
Exmouth and District Water Bill	Lords	Feb. 10	Feb. 10	Feb. 16	Feb. 26	March 2	..
Gaslight and Coke, Commercial Gas, and South Metropolitan Gaslight and Coke Companies Bill	Commons	Feb. 9	Feb. 10	Feb. 17	..	..	..
Great Yarmouth Water Bill	Lords	Feb. 9	Feb. 10	March 1	..	..	..
Hinkley Local Board Gas Bill	Commons	Feb. 9	Feb. 10	..	..	..	..
Huddersfield Tramways and Improvement Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Hull Lighting Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
Hyde Gas Bill	Lords	Feb. 9	Feb. 10	Feb. 23	..	..	..
King's Lynn Corporation Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
Lancashire County Justices Bill	Lords	Feb. 10	Feb. 10	Feb. 16	..	..	..
Lancaster Corporation Bill	Commons	..	..	..	..	..	..
Lincoln Gas Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Liverpool Corporation Water Bill	Commons	Feb. 9	Feb. 10	..	..	..	..
Liverpool United Gas Bill	Lords	Feb. 9	Feb. 10	Feb. 24	..	..	..
London Gaslight Company Bill	Commons	Feb. 9	Feb. 10	Feb. 24	..	..	..
Maidstone Gas Bill	Lords	Feb. 9	Feb. 10	March 1	..	..	..
Malton Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 23	..	..	..
Oldham Improvement Bill	Lords	Feb. 9	Feb. 10	..	..	..	..
Phoenix Gaslight and Coke Company Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
Portmadoc Water Bill	Lords	Feb. 10	Feb. 10	Feb. 16	..	..	..
Prescot Gas Bill	Commons	..	..	..	..	..	..
Preston Improvement Bill	Lords	Feb. 9	Feb. 10	Feb. 23	..	..	..
Rathmines and Rathgar Township (Vartry Water Supply) Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
Rathmines and Rathgar Township Water Bill	Lords	Feb. 16	Feb. 16	..	..	..	..
Reading Gas Bill	Commons	Feb. 10	Feb. 10	Feb. 16	..	..	..
Rochester Corporation Bill	Lords	..	..	..	..	..	..
Sea Water Supply to London Bill	Commons	Feb. 9	Feb. 10	March 1	..	..	..
Sligo Borough Water Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
South Metropolitan Gas Company Bill	Commons	Feb. 10	Feb. 10	Feb. 16	..	..	..
Southwark and Vauxhall Water Bill	Lords	Feb. 9	Feb. 10	..	..	..	..
Stafford Borough Bill	Commons	Feb. 9	Feb. 10	Feb. 23	..	..	..
Wakefield Corporation Water Bill	Lords	Feb. 9	Feb. 10	Feb. 23	..	..	..
Wandsworth and Putney Gas Bill	Commons	Feb. 10	Feb. 10	Feb. 16	..	..	..
Wigan Improvement Bill	Lords	..	..	..	..	..	..
Wrexham Water Bill	Commons	Feb. 9	Feb. 10	March 2	..	..	..
Yeadon and Guiseley Gas Bill	Lords	Feb. 9	Feb. 10	Feb. 17	..	..	..
" "	Commons	Feb. 9	Feb. 10	March 4	..	..	..
" "	Lords	Feb. 9	Feb. 10	..	..	..	..
" "	Commons	Feb. 9	Feb. 10	..	..	..	..

HOUSE OF LORDS.

MONDAY, MARCH 1.

Portmadoc Water Bill.—The opposition to this Bill was withdrawn.

Lancashire County Justices (Water, &c.) Bill.—The Select Committee on this Bill reported that they had not proceeded with its consideration, no parties having appeared in opposition to it.

Rathmines and Rathgar Township (Vartry Water Supply) Bill.—A petition in favour of dispensing with Standing Orders in reference to this Bill was presented from Owners, &c., of property within the Rathmines and Rathgar Township; and one against dispensing with them, from the Rathmines and Rathgar Township Improvement Commissioners, and ratepayers of the Rathmines and Rathgar Township and of the City of Dublin.

British Gaslight Company, Limited (Staffordshire Potteries) Bill.—A petition against this Bill was presented from Corporation of Hanley, and consumers of gas in the district.

TUESDAY, MARCH 2.

The Standing Orders Committee reported that the Standing Orders not complied with in respect of the Rathmines and Rathgar Township (Vartry Water Supply) Bill ought to be dispensed with, and the Bill allowed to proceed.

The Wakefield Corporation Water Bill was referred to a Select Committee, consisting of Earl Ducie (Chairman), Earl St. Germans, Earl Vane, Lord de Ros, and Lord Hammond; to meet on Friday, March 5.

The Cardiff Water Bill was referred to a Select Committee, consisting of Earl Devon (Chairman), Viscount Sidmouth, Lord Thurlow, Lord Dunsany, and Lord De l'Isle and Dudley; to meet on Monday, March 8.

HOUSE OF COMMONS.

MONDAY, MARCH 1.

The petitions against the following Bills were withdrawn:—

- Prescot Gas Bill, of (1) London and North-Western Railway Company;
- (2) Ratepayers, inhabitants, and consumers of gas.

Stafford Borough Bill, of London and North-Western Railway Company.

TUESDAY, MARCH 2.

The Denton and Haughton Gas Bill, the Lancaster Corporation Bill, and the Liverpool United Gas Bill were referred to a Select Committee, consisting of Mr. Monk (Chairman), Colonel Makins, Mr. Hull, Mr. Stafford Howard, and Mr. Bonham-Carter (Referee); to meet on Tuesday, March 9.

The Burton-upon-Trent Corporation Bill, the Hyde Gas Bill, and the Stafford Borough Bill were referred to a Select Committee, consisting of Mr. Legh (Chairman), Viscount Emlyn, Mr. Rowley Hill, Mr. O'Shaughnessy, and Sir John Duckworth, Referee; to meet on Wednesday, March 10.

METROPOLIS WATER-WORKS PURCHASE BILL.

Mr. Cross, in moving for leave to bring in this Bill, which is to make further provision for the supply of the Metropolis and the adjoining populous places with water, said: In August last we had a discussion on the question of the Water Supply of London, upon the motion of the honourable member for Hackney, and, in the course of that discussion, I, on behalf of the Government, promised that the whole subject should be taken into consideration by them in the course of the recess, with the view of ascertaining whether the supply of water could not be greatly improved for the benefit of the inhabitants of London, whether that could be done without seriously increasing the cost of the supply to the individual consumer, and whether the mode of supply could not be improved. The result of that investigation, on behalf of my right honourable friend the President of the Local Government Board and myself, and also on behalf of the Government, has been the preparation of the Bill which I ask the leave of the House to-night to introduce. The result of all the investigations we have been able to make, and of the best advice we could obtain on the subject, has been to convince me that there is only one remedy for the existing state of things, and that is, a unification of all the existing Water Companies. That I believe to be absolutely essential to prevent the continuance of the confusion which undoubtedly exists at the present moment. It will be remembered that there are eight Companies at the present moment supplying what is generally called the Metropolis and the metropolitan area with water. I do not mean the Metropolis strictly so called, but all the adjoining districts for some little distance around. I am not speaking of the outlying Water Companies, such as the Croydon and the Richmond, but of the central Companies which supply the Metropolis and the adjacent districts. Of those eight Companies, five draw their water from the Thames, and three have what we will call a supply of their own, although of those three the East London Company certainly do draw water from the Thames to assist their supply, conveying the water at very great cost through the other districts to a long distance off, where it is required. Of the eight Companies five are north of the Thames and three south of the Thames, and they are all overlapping and interlacing with each other. There are several reservoirs and several Boards of Directors, and everything of that kind. There is not, that I know of, any natural boundary to one of the Companies, and no natural division of the water supply, but there is a duplication of mains and of the water arrangements. These, then, are the facts with which we have to deal. Of course, what we want to see is whether these things can be remedied and very much simplified—whether there cannot be a great reduction of expense and labour, and waste of material and money of all kinds. First of all there will be, by the unification of the Companies, a great reduction of expenditure for all new works and water apparatus, and matters of that kind; and I may state, in passing, that certainly such works will be entirely needless if the existing works are properly utilized. We have a notable instance in the present session. The Southwark and Vauxhall Company wish to expend half a million of money on new works, which would be absolutely needless if this Bill should become law. Then there are the proposed new works of the Grand Junction Company and of the West Middlesex Company; and altogether the new works and extensions which it is proposed to carry out would, no doubt, should the present eight Companies be allowed to exist, continue to be carried on for a long series of years, leading to a vast increase of the expenditure which would be absolutely necessary for providing a proper supply of water. Beyond that you will have undoubtedly the reduction that will be made in time by the consolidation of the various staffs of officers, you will have a proper division of the supply of water for places in districts outside the metropolitan area, and what is so much more important, you will be able to make a division of London according to the proper levels and zones for the purpose of putting out fires by having water at proper pressure coming from proper heights, at proper quarters of the town, in a more satisfactory way than you have at present. If any one will look at the map of London, and at the names of the various sources whence the different Companies draw their water supply, he will be amazed at the waste of power there is in producing the supply. Therefore my right honourable friend the President of the Local Government Board and I have come to the conclusion, on behalf of the Government, that unification is the great thing to be gained

if you want eventually—I am not speaking of the immediate future—to supply London with water at the cheapest possible cost and in the best possible manner. Then, of course, comes the question whether this result can be obtained in any other way, and I may point out that I do not think you could possibly obtain this unification by any mere arrangement amongst the Water Companies themselves. There is no real corporate body which can undertake this matter on behalf of the whole of London. You could not possibly have this unification of the management by the several metropolitan boroughs, which has sometimes been suggested, because it seems to me that if each of the metropolitan boroughs supplied quantities of water, you would probably have still greater confusion and still greater cost than now exist. Therefore we have come to the conclusion, and I hope that the House will be also of the opinion, that the only way of arriving at a satisfactory result is by the existing Companies surrendering the powers they now possess, under their several Acts of Parliament, to some central authority, which should have absolute power to supply London with water. This being so—if we are to approach the subject in that way, having come to the conclusion that unification is the great object to be gained, and that this can only be effected by the surrender of all the powers of all the existing Companies to one central body—how is that to be brought about? I ventured, in August last, before I knew so much of the matter as I do at present, to say that the question whether it would be necessary for the purpose that the whole of the Companies should, of course by agreement, surrender their power to some body to be appointed in a certain way was a point to be discussed and considered. To that I entirely adhere, and I want to remind the House that in that statement the central words were “by agreement.” There is no doubt that if you are to have all the powers of the existing Companies, there are only two ways in which it can be done. They must be taken either by compulsion or by agreement. Let me say one word first of all about taking them by compulsion. I am bound to admit that in this matter it would be a very strong step for the House to take. We have, from time to time, conferred enormous powers on these Companies, and on the faith of these powers there has been invested in them a very large amount of capital, subscribed by a great number of individuals; and that Parliament should now, after many of them have spent all their money and not yet reaped the full benefit, step in with a strong hand and say, “*Nolens volens*, we take these powers away from you, and pay you certainly a sum of money or something like compensation by arbitration,” is a course Parliament has not been accustomed to take. But there are very few instances in which Parliament has acted in that way, and I do not think it would be a wise precedent to set for future action. But if you were to bring in a Bill to acquire the powers of these Companies by compulsion, you would meet with such an amount of opposition from every one of the Companies, that I do not believe it would be possible that the measure would pass. Of course, if you bring in a Bill to enable a certain body to buy them up afterwards, then you will fall into this danger, that you leave it all to the uncertainty of arbitrations afterwards. Now, we have had some experience of arbitration in respect to matters taken in this way, and I do not think the experience we have gained is likely to lead us into the adoption of a similar method again; and I must say that if you were to go to arbitration with the Companies, and place the matter entirely in the hands of an arbitrator to decide what was and what was not proper to give, Parliament, as well as the Companies, would be acting very much in the dark, and you might find yourselves let in for a greater expenditure than if the other course were adopted. If that is so, the only other course by which to approach the subject is to take the Companies by agreement, and I am bound to say that that is not a very easy thing. We found that it was not very easy because, when we first approached the Companies and offered to take them by agreement, we were met in the first instance by most flat and positive refusal, and I do not in the least wonder at it. They all of them possess good going concerns and good prospects, and it was by no means easy to disturb them. And, of course, to come to an agreement, you must have both parties willing. If it is to be done by agreement, it must be agreement on both sides; and it becomes more difficult still when it becomes necessary to deal with eight Companies instead of one. The honourable member for Birmingham has had experience of one Company, and he probably found it difficult enough to deal with the one. It is much more difficult to deal with eight. But there is one advantage in dealing by agreement, and that is, that whatever the outlay may be, you know exactly the extent of your liability. When the price is once settled, the whole thing comes home upon you. If the House will allow me to read part of a clause of the Bill to show what the undertaking is that passes over to us, they will see that we have obtained everything we possibly can. It is as follows:—“The Companies shall pass over all such property, both real and personal, including cash balances, reserve-funds, and investments, and all other interests and rights, both real and personal, and all obligations and funds which shall be in their possession or come to them at any time between the 1st of January and the 1st of June, 1880.” Everything they possess comes to us, so that they cannot make any alteration in consequence of this Bill. Everything in their possession from the 1st of January, and everything that comes into their possession, passes into our hands, saving, of course, the amounts of their own dividends that are produced to them, and are payable on the 30th of June. There is one exception, and that is in the case of the New River Company. They possess considerable property in the county of Herts and elsewhere, which has nothing to do with the water supply of London. They are a Company who have existed for hundreds of years, and we have arranged with them with respect to that matter. They are allowed to keep this property in their own hands. The House will see that there can be no possible after-thought. We know exactly what the outlay will be when the scheme becomes law. The next question that presented itself to our minds was—How is the purchase-money for this matter to be obtained? There can be no doubt that such a large question as this—the supply of water to this great Metropolis of London—is an Imperial question, and no doubt suggestions have been made in many quarters that, it being so, the Imperial funds should be called upon to subscribe in some form or shape for the purchase of the Water Companies. We have thought it right to lay down as a natural principle that the State should not pay one farthing towards it. We do not think it fair to the other towns in the country that the State should do so. We have accordingly arranged that, unless the Bill fails, only the preliminary expenses, which must be paid by somebody, shall be excepted; and that the Imperial Exchequer shall not be called upon, either by guarantee or loan, or in any form or shape, to supply funds for the purchase. If the Bill passes, these expenses will eventually be paid by the proposed Water Trust. Then we were met by another difficulty. There was no corporate body which, in our opinion, ought to take this matter in hand. Neither the City nor the Metropolitan Board of Works is in a position to deal with the different Companies, and would not have had money to buy them up. Another difficulty was the borrowing of so large a sum as is needed; and to issue stock in any way for the sum required would have been attended with a certain amount of hazard, and might have disturbed the Money Market to a considerable extent, if we had borrowed so large a sum all at once. We, therefore, were obliged to have recourse to another mode of dealing with the ques-

tion. We have advised the Water Companies to consent to the Water Trust issuing a certain amount of water stock, and that the Companies should take the whole of that stock in exchange for their undertakings; so that practically it came to this, that the Companies create a stock, and then take that stock when it is created, and so provide for their own extinction. That plan gets rid of a considerable amount of difficulty. Of course, the agreement is not yet confirmed; but all the Companies have agreed, through their Directors, to take the whole of their purchase-money in this Three-and-a-half per Cent. Water Stock. Therefore, so far as they are concerned, no money is required from anybody. They receive their payment, not in money, not in cash, but in stock. That arrangement simplifies matters very much, and there can be no possible disturbance of the Money Market for the time being. Of course the stock must have something at the back of it to make it sound and marketable; and the first thing we put at the back of it is all the rents receivable by the Water Companies at the present time, but which will eventually be received by the Water Trust. But there must be some other guarantee to make it quite sound, and therefore we have placed the metropolitan rates behind it. I do not think these rates will ever be called upon to contribute a single sixpence; but in order that there may be a guarantee on the stock which is to be issued or proposed to be issued, we have charged it first on all the water-rents to be received from the consumers, with the further guarantee on the rates of the Metropolis and of the City of London separately, according to their several proportions. The next question, probably one of the most important of all, is that of price; and when we come to it I must again repeat what I said before, that this is a matter for agreement. The price must be agreed to on both sides. The Government find themselves and the Water Companies on the other. They have made the best bargain in this matter in a somewhat peculiar position; they are standing, as it were, between two parties—the water consumers on the one hand, they could with the Companies, and they present that bargain to Parliament to consider, not on this floor, but, as I shall presently explain, by means of a Committee upstairs, in order that the whole matter may be inquired into, so as to ascertain whether we may regard the arrangement as one that the country ought to accept. The Government have come before Parliament to show that they have made the best bargain that could be come to by agreement with the several Water Companies for these purposes. Of course the preferential stock, and the debenture shares, and the mortgages will remain precisely as they are. What we have now really to deal with is the available net surplus after all the charges and working expenses have been paid. I am afraid that one or two words I said on this subject in August last were somewhat misinterpreted. What I appear to have said was that Her Majesty's Government would take the stocks as they found them at the last half year, or on such a day of the last half year, and that no speculative change in the value of the stocks would have the slightest weight with the Government. Those words must be taken with the context. I said there should be no speculation on the Stock Exchange, and that if there was it should not be taken into consideration. Nor, on the other hand, if any action was taken by the Companies for the purpose of enhancing the price of their stocks, would that be taken into consideration. We take the stocks as we found them. No speculative change in their value, by people buying them and thinking they would get more for them when the Government took over the Companies, would be taken into consideration. All I can say is that plan has been strictly adhered to in the whole of the operations from beginning to end. The gentlemen advising me in this matter wished to find out what was the intrinsic value of the water undertakings at the time of purchase. In coming to conclusions as to what was the value, honourable members will see at once that the value of each Company must depend on various circumstances. It must depend, first, upon the powers it has under its own Act of Parliament, and also upon its present financial and commercial position. For instance, some Companies can only pay 7 per cent. dividend. Some shareholders can receive 10 per cent. dividend, and some can not only receive 10 per cent., but if they have not received 10 per cent. from their foundation can make it up to 10 per cent. for the future, and 10 per cent. for the past. In the case of the New River Company there is no limit. They have a perfect right to recoup themselves 10 per cent. for 150 years. That would be enormous, and, of course, could not be carried out; but they have the power. On the other hand, some Companies have no such power. Some are limited and some are not. Then they differ very much as to their commercial and financial position. You find some Companies with a practically assured dividend of 10 per cent., and which is never likely to be less. Some of the Companies would be absolutely certain to recoup themselves that dividend for a certain number of years. On the other hand, you find some of the Water Companies—those of younger date—who have expended a large amount of capital, and have not yet reaped the fruit of it. Their property is becoming developed year after year, with only the small expense of simply laying mains. Their property is increasing from year to year. At the same time, some of the Companies had in their limits undeveloped areas which are being rapidly built upon, and which in a short time will produce a large harvest. The average increase of the net income of the several Water Companies has for many years amounted to £35,000 a year. I do not think this is very much to be wondered at, if you consider that the growth of London is something like 19,000 houses, and that the last return I had showed 60 miles of new streets built within twelve months. All this shows that the Companies have a large and promising future before them. In the negotiations which have been carried out with them, I have had the advantage not only of two able persons in connection with the Companies—I mean Mr. Stoneham and Colonel Bolton—but I have also had the assistance of Mr. Edward Smith, who has been for so many years connected with the office of the Ecclesiastical Commissioners, and who has had such vast experience in the Commission, and has shown himself a most valuable servant. In coming to the negotiations with the Companies, we have had two points to consider—first, the present dividends that they are entitled to pay themselves, or rather that they would pay when the property is taken over on the 1st of July, 1880. Of course nobody who has invested money in the concerns would have been satisfied unless he obtained an equivalent for all this in water stock. Then beyond that they are entitled to the proximate and assured increment that would be quite certain to arise if the property continued to remain in their own possession. It is absolutely impossible to deal with the Water Companies unless that fact is recognized. It is a fact recognized in dealing with other companies circumstanced in like manner with them, and it was a claim we felt it absolutely impossible to resist. There is one matter to be considered in this approximate and assured increment—namely, that it is impossible at the present moment to find money to pay for the increments. The only means we now possess is the water-rent, from which it would be impossible to pay future unearned income. We have not in our pockets the money to pay the future dividends that the shareholders would in the course of time be entitled to receive; therefore the course we have taken is to spread this over some years, varying from four to twelve, so that we shall not pay any income to the Companies until we have earned the means that they would have earned had they to pay their shareholders. So that there is no present charge or dividend in this respect. It has all

to be paid by deferred stock. On the 80th of June, 1880, the Companies will have a certain amount of ordinary stock upon which dividends will be receivable immediately, and which will represent the dividends they themselves would have received. For the whole of the full increment which the Companies would have received, not in June, 1880, but in 1881 and in 1882, they will receive a certain amount of deferred stock given at the present moment, which will bear no interest at all for the first twelve months. Not until the end of 18 months will they receive their first dividend. In the same way we proceed with the deferred stock. Some will bear interest in 1881, some in 1882, some in 1883, and some in 1884, and so on until the whole series is completed. The Water Trust will not be called upon to pay interest on those deferred stocks until they have received income from the water-rents which will enable them to pay it. Although I am quite certain, from the calculations made, that there will be an ample sum to pay that interest when the rents become due, at present the interest will not be charged upon them. I do not think the House will now, or even on the second reading of the Bill, expect me to go into the condition of each individual Company. That will be considered in committee. It may be asked why certain Companies get so much, and why certain other Companies get so much more or so much less. The House will be interested to know the aggregate sum to be paid in regard to the present dividends payable in 1880-81. So far as that is concerned, the whole aggregate will come, in round numbers, to £22,000,000. That is the sum payable in future in the Three-and-a-half per Cent. Stock. With regard to the dividend on the unearned increments, this will be spread over a number of years—over a period in the case of one Company, the New River, as long as twelve years. Of course it is better to extend it over a long period than over a short one, because our income goes on increasing all the time. Other Companies, like the West Middlesex, get four years, and others various times. Of course, the full capital of each particular Company and the time of payment have been arranged, so that the Water Trust in one particular year shall not be called upon for a larger sum than they receive. If we take an average of twelve years, it will amount to little more than a quarter of a million each year. I do not know what is the value of the £500,000 which is not to receive interest for twelve years. You may discount it if you like. Probably the present value of the whole of the deferred stock will be between £6,000,000 and £7,000,000. If you add that to the £22,000,000, it will come to £28,000,000 or £29,000,000.

Mr. COURTNEY: What will be the ultimate maximum?

Mr. CROSS: If you take the ultimate maximum, it will be something like £31,000,000; but, of course, you must discount that according to what the present value is. Practically, when you go into the matter fully, it would strike any one that this way of treating it would be more beneficial to some Companies than to others, and would be most beneficial to the lower class of Companies. But that would be for this reason. Take the case of the New River, for instance. The New River Company was in such an absolutely assured state, that the value of it has risen very highly, whereas some of the lower Companies have not risen to the magnitude of the New River Company, although in their case also their future position was absolutely certain. There are several of the Water Companies paying 9 or 10 per cent. Some of the smaller ones would soon come to that amount, and the unearned increment of these smaller Companies will be found quite as large as that of the New River. Therefore some of the poorest Companies consider they have obtained a better bargain than the others. But I do not think, when you come to inquire into the matter, you will find this to be the fact. In the case of the Southwark and Vauxhall Company, I must say, comparing that with the dividend they have been receiving for some years past, it is a large sum. I do not wish to explain why some are so large, because I believe it is what they are entitled to, but the reason is this: Some years ago the Official Auditor found that the Company had paid something like £30,000 out of capital which ought to have been paid out of income, and he disallowed the payment, and said they must repay this sum by instalments of £8000 a year, which was to be placed to capital. This sum has been entirely repaid, but the dividends were reduced very low; but from time to time they will spring up again to their natural height. The result, as far as we have been able to make out, for the first portion of the year 1880-81, taking what we believe we shall have to receive and what to pay to the Companies in interest, is that we shall put into the pockets of the Water Trust a saving of £50,000, besides which there will be a saving that will accrue from the consolidation of the staff and engineering operations, and matters of that kind. As regards the saving on the staff, no change will come into operation till some of the officers who will have to be pensioned off cease to exist. Notwithstanding that, we have in the first year a saving of £50,000—I hope it may be more. There is one point I must mention, because it is very much to the credit of the Companies. After the matter of price had been arranged, there was one point which they pressed very strongly indeed, and that was the question of their own officers. I am not speaking of the Directors, but of the officers themselves. Of course, so far as all future officers are concerned, they will be placed on the usual superannuation scale; but as regards the present officers, the Companies were extremely stiff, and unless we had made favourable terms for those who had served a period of years, I firmly believe that the negotiations would have been broken off. I think this is a matter greatly to the Companies' credit. It is a question for a Committee to decide whether these sums are right or wrong; but the Companies insist strongly on their being placed in the Bill, and I am sure the bargain would never have been made if this had not been done. As regards the price, I am quite certain that if you were to try to purchase the water-works by agreement, you would not be able to purchase them for less, as every pressure has been put upon the Companies to get them to reduce their figure as low as possible, and I am sure they would never sell for less. If the offer were not accepted, the question would come to be one of buying by compulsion, or of passing some Bill to enable somebody to buy. This could not be done for some time, and it must be remembered that as years go on the value of the property increases. Had you bought the property ten years ago, you would have saved an enormous amount of money. If you postpone buying for five or ten years, you will have to pay enormously more. When the Committee come to investigate the question of price, I believe they will find it to be, on the whole, fair and reasonable. They will, at all events, find that we have made an honest endeavour to settle the question on terms which, in the long run, will be of great advantage. There is another question of a different character on which members will be anxious to know something; it is that of the composition of the Water Trust itself. That is, of course, a matter of considerable importance. We had no corporation, as I stated before, ready to take up this matter, and I do not imagine the House would consider it ought to be left with the Government. Therefore we propose that it should be placed in the hands of a Water Trust, and I think every one will agree that it is absolutely essential that the Water Trust should be such a body as would command the confidence of the Metropolis. We have proposed that there should be three paid members of the Trust—a Chairman, who shall receive £2000 a year, and two Vice-Chairmen (one for works and one for finance), who shall each receive £1800 a year. The first Chairman and the two Vice-Chairmen will be

appointed by the Government, and their names will be placed in the Bill, and so far as I am concerned the House may rely upon it that in a matter of this kind no party considerations will enter into the nominations. Vacancies occurring during the first three years will have to be filled up at the pleasure of the Crown; but after that we think the election of the two Vice-Chairmen ought to be left to the Trust itself. We have placed the Lord Mayor and the Chairman of the Metropolitan Board of Works on the Trust, as *ex officio* members, and we propose that there shall be four members nominated besides—viz., two by the departments of the Government who are very much interested in this matter, the Local Government Board and the Chief Commissioner of Works, in consequence of the great interest he has in the public buildings of the Metropolis.

Mr. COURTNEY: Will one be nominated by each?

Mr. CROSS: Yes; one by each. I will repeat what I have said. There will be one salaried Chairman, and two Vice-Chairmen; there will be two *ex officio* members, the Lord Mayor and the Chairman of the Metropolitan Board of Works; there will be two members nominated, one by the Local Government Board and one by the Chief Commissioner of Works. There will be two others nominated, one by the City of London—that is to say, by the Commissioners of Sewers, who have already considerable power and authority in the matter of the water supply—and one by the Metropolitan Board of Works. I do not think that in a Trust of this kind, where the ratepayers are very much interested, Parliament would be willing to leave affairs in the hands of a simply nominated body; therefore we propose, having obtained nine members in this way, that there should be twelve elected members. The question then arises, who are to elect? I do not think the House would like that there should be only an indirect election. It would probably not be satisfactory that the elected members should be simply elected by vestrymen. I think it had much better go on first principles, and if there is to be an election let it be a direct election. Now, the question is, who are to elect? and if you take the Vestries themselves, the District Boards, or whatever you call them, their number would be very large, and you would have a Board practically unmanageable. You might group them all together, certainly, but that too would be unsatisfactory. We have, therefore, on the whole, a simpler plan, established after the example of the School Board, and we take one member from each of the metropolitan boroughs—that would be one from the City of London, and one for each of Chelsea, Finsbury, Greenwich, Hackney, Lambeth, Marylebone, Southwark, the Tower Hamlets, and Westminster. We wish to make a Board of 21 members, on which the water consumers would be represented, and they would be represented directly as at the School Board elections. We have now nine nominated members, and ten elected by the constituencies, whose representatives are to be guaranties of the stock. But there are other persons who would take water besides the inhabitants of the Metropolis, and it is quite clear that although we do not look to them to join in the guaranties, for that would be almost impracticable—I am now talking of the inhabitants of a large area outside the Metropolis who take water as consumers, but are not called upon to guarantee the stock—still, it is but right that they should be represented on the Board, and we propose that one member should be elected by the inhabitants north of the Thames, and one by the inhabitants south of the Thames, outside the Metropolitan districts.

Sir CHARLES DILKE: Will the right honourable gentleman say what is the population in these districts?

Mr. CROSS: I have not it here at the present moment, but I will afterwards give it to the honourable baronet. We propose that all these elected members should hold their seats for five years, and that then there should be a fresh election. I think that is all I need say on this point.

Mr. COURTNEY: How long would the nominated members hold their seats?

Mr. CROSS: They will hold their seats at the pleasure of those who nominated them. Having now made it clear what is to be the composition of the Water Trust, I should like to read from one of the clauses the objects of the Trust. The objects are to supply pure and wholesome water for drinking and other domestic purposes; to supply water sufficient for watering the streets, for extinguishing fires, and for public purposes; also for manufacturing and other general purposes; for the maintenance, so near and so far as practicable, of a constant supply, and the maintenance of that supply in the mains at such a pressure as will efficiently provide for the extinction of fires. The Water Trust will hold the property as trustees for the benefit of the inhabitants of the Metropolitan water area, and the district around, and will be bound out of the profits to provide a reserve to extinguish the debt and then make such reduction in the price of water to consumers as may be practicable. All that I can say now is, that I hope in a short time the Trust will be able to fulfil these objects. As to the date of the purchase, we propose that it should be on the 1st of July; but, as I said before, it will practically have taken effect from the 1st of January. The Water Companies will be acting as our own trustees, because we have now a continuous audit by the Government Auditor over the whole of their proceedings, and they are simply acting as trustees who are to pay themselves a certain amount of dividend agreed on. If the purchase is completed on the 30th of July, they have nothing more to do except to leave the whole thing in working order. It is provided, however, that as the Trust could not probably come into efficient operation the moment that the Bill is passed, if necessary the Companies shall, at no expense beyond the ordinary expense of carrying on the business, continue to carry it on until the 1st of October. By that time the Water Trust will be able to attend to their own duties, and then the Companies will practically be extinct. There is a clause in the Bill that, after the increments have been paid, a certain amount shall be set aside to extinguish the whole debt, if it can be done, within a period of eighty years from this time. I think I have explained everything necessary for the present purpose of the House. This was the best bargain we could possibly make. I want to bear my testimony to the assiduity with which Mr. Smith has carried on the negotiations, and I am sure he has done everything in his power, and I have done everything in mine, to induce the Water Companies to take as little as possible. I have now to ask leave to introduce the Bill. I believe it will have to stand over till it has gone to the Examiners. Then I will ask the House to take the second reading, and if any members object to the principle of the Bill on that occasion, they will, of course, be entitled to do so. But I hope the House will see that this is a matter which would be much better considered in committee than on the floor of the House, where all the circumstances as to the conditions of the Companies cannot be freely gone into. I must remind the House that this is a bargain that we cannot alter so far as the Water Companies are concerned; they are shut out from opposing it. You cannot say to them that they must take less. The question for the House to consider will be whether this is not the best bargain that could be made; and I think it will prove so in the long run. At all events, as I have said, it is an honest endeavour on the part of the present Government to bring forward such a measure as would be beneficial to the inhabitants of this great Metropolis.

Mr. FAWCETT: I am very anxious to take the earliest opportunity of acknowledging the promptitude with which the Home Secretary has

redeemed the promise which he gave last August; but although I am anxious to do this, I feel that I should be doing a great injustice to the Home Secretary, and a still greater injustice to the extremely important question which he has brought under the notice of the House this evening, if I said a single word which would lead the House to express a premature opinion on the scheme which he has sketched out. On this question it would be extremely unfortunate for the House to express an opinion till we have seen the Bill, for there are great pecuniary interests at stake, and if to-morrow morning it should be reported in the public journals that the Bill had been favourably entertained by the House, it might be supposed that the House would pass it, and speculative transactions might be undertaken on that supposition. If, on the other hand, an unfavourable view were expressed, an opinion might spread that the Bill would not pass, and there might be a great and unnecessary depreciation in the value of the property. I avoid expressing any opinion as to the scheme until I see the Bill; but it is obvious, from what has been said, that very important questions will have to be taken into account. I will simply thank the Home Secretary for the promptitude with which he has redeemed his promise, and say whatever opinion we may ultimately form of the measure, I believe we shall come to the conclusion that the Home Secretary has been prompted with a desire to carry out such a measure as he thinks calculated to promote the best interests of the community.

Sir J. M. HOGG: I quite agree with the honourable member for Hackney that it is not advisable at present to express an opinion on the Bill, but he and the House will acknowledge that it is evidently a very careful and well-considered measure for carrying out the ends the Home Secretary has had in view. I may also say that I am exceedingly pleased that the Government have made up their minds to grapple with this question. It is one which I may say, without any arrogance, the Metropolitan Board endeavoured to take up two years ago. I can only say that we shall give this measure our most careful consideration, and anything we can do to promote the interest of the public in regard to it shall be cheerfully done.

Mr. SHAW-LEFEVRE: As the right honourable gentleman has referred to one proposal which I made some years ago in this House, I will say a few words with reference to it. The right honourable gentleman is mistaken in supposing that it was ever proposed to purchase the property of the Water Companies by compulsion by means of arbitration. The main object was to induce or compel them to give a constant supply of water to the Metropolis, and it was offered as an alternative that, if they objected, the Metropolitan Board of Works should be called upon to negotiate for a purchase. The Companies on that occasion agreed to give a constant supply, and it was also agreed that a constant supply should be given, subject to the recommendations of a Committee of the House. I am sorry to say that the recommendations of that Committee turned out to be such that practically the constant supply has not yet been given. I have always been strongly in favour of purchase in some form or other, and I ventured to say at the end of last session, when the debate was raised by my honourable friend the member for Hackney, that I added my strongest wishes to those expressed by him that the Government should take up the question, and I am glad of this opportunity of recognizing the promptitude with which the Home Secretary has gone into the matter. It is obvious that the subject is one of extreme difficulty and importance, and that it would not be wise to discuss it at present. I agree with what has been said on this point by the honourable member for Hackney, that it would not be wise to do anything which would indicate to the public what might not be the final opinion of the House.

Mr. CHAMBERLAIN: I feel that this is a matter which, in the first place, interests the Metropolitan members, and I am somewhat of an outsider on the question; at the same time it is a subject to which I have given a great deal of attention, and in regard to which I have some practical experience, having taken part in the transfer of a considerable water undertaking in the provinces. In these circumstances it is a great satisfaction to me to find that the principles laid down by the Home Secretary are precisely identical with those which guided the Corporation of Birmingham in the transfer to which I refer, and I myself am in entire agreement with the right honourable gentleman as far as these principles go. In a matter of this kind, however, everything depends on the application of those principles, and I acknowledge also that the case of the Metropolis is necessarily exceptional and widely different from that of a provincial town; but, after the interesting speech of the Home Secretary, it appears to me that the Metropolis will have to pay very dearly for their water. It is quite certain they will have to pay much more for the water undertakings than the people of Birmingham did. I find that the sum paid by agreement, in order to purchase the whole of the water supply for Birmingham and its district, was considerably less than £3 per head of the population. Now, if the payable value of this property—it amounts, as I understand the Home Secretary to state, to something like 30 millions—is divided among the population within the area of supply, it will give something like £6 per head. The right honourable gentleman said that the exact sum would be stated hereafter; but at the lowest it is quite clear the price would be about £5 per head, as compared with £3 in Birmingham. But that does not state the whole of the different cost; by paying £3 per head the Birmingham Corporation were enabled to take over an undertaking in admirable condition. We had a constant supply of water of pure quality, and no considerable increase was thought to be, or has since proved to be necessary. But the reason for undertaking the matter in London is that the supply is inferior in quality and insufficient in quantity, and it is quite certain that one of the first things the Water Trust will have to do will be to carry out that portion of their duty to which the Home Secretary briefly referred when he said that they were, as soon as might be possible, to give a continuous supply of water and a supply at high pressure. The Water Trust, it appears to me, will have to go far afield, inasmuch as five out of the eight Companies are drawing their supply from the Thames. An entirely new source will have to be sought at a very large increase of expense on the capital outlay now contemplated. I merely point out to the House that this is a gigantic undertaking, and that, whether necessary or not, one result will be that the Metropolis will have to pay very much more for its water than we in the country are obliged to pay. On the other hand, I see that an immense advantage may be gained from the unification of the various undertakings, and I do not doubt that this will probably exceed the most sanguine anticipations of the right honourable gentleman. I can only say that I wish success to the scheme, and I hope, on further investigation, it may prove to be as profitable as I may say it has been well received.

Sir CHARLES DILKE: I hope the right honourable gentleman will, as soon as possible, place on the table returns as to the precise population to be supplied. My impression is that in 1871 the population of the Metropolis was 3,200,000, and that it is not more than 4,000,000 now—that, at all events, it is within 4,500,000. In 1874 the population supplied by the Water Companies was between 3,600,000 and 3,700,000.

Mr. CROSS: I will give the honourable member the best information I have. I entirely agree that it is unwise to express any opinion on the scheme; for the present it is quite impossible that the House should do so. I should like to remind the honourable member for Birmingham that

the inhabitants of Birmingham were wiser in their generation than those of the Metropolis have been. In Birmingham, when they allowed the Water Company to have extra profit, they restricted the dividends, and there were other reasons why the case of that town was different from the case of the Metropolis. About getting new sources of supply, I do not think that will be at all necessary, at any rate in the immediate future. I have no doubt that the water obtained from the present sources is to a great extent capable of being made pure at very small cost. So far as the advantage of a constant supply of water goes, I may cite the example of the inhabitants of Liverpool. The arrangements for their constant supply were completed in January, 1875. They did it in something less than eighteen months, and at a very small cost indeed. What has been the result of the constant supply at Liverpool? Although since 1875 Liverpool has enormously increased in population, they are not, even at the present moment, using so much water as they were before they had a constant supply. People think that a constant supply makes the consumers use more water; but the fact is they use infinitely less. The people from Liverpool who were here not long ago in connection with their new Water Bill, assured me that they were not using so much water as before they tried a constant supply. I have only one thing more to say. The Bill will be in the hands of honourable members to-morrow morning; and I will, with the permission of the House, fix the second reading within such a limit as will give the Examiners time to look at the Bill.

Mr. SHAW-LEFEVRE: Supposing the water-rents do not increase within the next ten years, will the dividend be payable?

Mr. CROSS: Yes.

Leave was then given to bring in the Bill, and it was read the first time.

THURSDAY, MARCH 5.

The petition of the London and North-Western Railway Company against the Hinkley Local Board Gas Bill was withdrawn.

The *locus standi* of the Corporation of Bootle-cum-Linacre as petitioners against the Liverpool United Gas Bill was disallowed; as also that of Freemen of the Borough of Lancaster, against the Lancaster Corporation Bill.

METROPOLIS WATER-WORKS PURCHASE BILL.

Mr. MORLEY gave notice that, on the second reading of this Bill, he will move—"That, in the opinion of this House, the compensation proposed to be given to the Water Companies under the Metropolis Water-Works Purchase Bill is excessive, and would impose an unjust and unnecessary burden on the ratepayers of the Metropolis."

FRIDAY, MARCH 5.

METROPOLIS WATER-WORKS PURCHASE BILL.

Sir CHARLES DILKE gave notice that he would, on Monday, March 8, move for a "Return of financial statement on which the calculations are based of payments to be made to London Water Companies under proposed Metropolis Water-Works Purchase Bill—showing (in columns) name of Company; amount of preference and debenture stock, debentures, and loans; total of same; ordinary share capital; total net revenue; total dividend paid on debenture and preference stock, on debentures and loans, during the last five years; net revenue, less interest on debentures; rate per cent. of interest on ordinary capital; additional revenue required to provide for prospective increase on bonus proposed; years purchase proposed of net receipts, and interest on loan debentures, &c.; equivalent value per £100 of stock; market price of same on the 30th day of June, 1879, and present price; total gross receipts and working expenses, separating maintenance and management, in the latter specifying allowance to Directors; proposed compensation; estimated savings in salaries of Secretaries, Clerks, Auditors, commission to Collectors, law and parliamentary charges; rate of increase per cent. under all items of receipt and expenditure for five years past; rate of increase of net earnings per cent. for last five years; calculation of increase per annum up to 1892 inclusive, with statement for last five years of cost of repairs of reservoirs, filtering-beds; repairs of mains, pipes; pumping-engine charges; coals; wages; filtration; salaries of Engineers, Inspectors, and Superintendents; rates and taxes; miscellaneous rents; total maintenance; allowance to Directors; salaries of Officials, Secretaries; commission to Collectors; stationery, printing, and general charges; law and parliamentary charges; total management; total expenses, gross and net; per centage of gross receipts to net; also showing average cost, per million gallons, of working expenses."

Miscellaneous News.

METROPOLIS WATER.

The following are the returns of the Society of Medical Officers of Health on the Composition and Quality of the Metropolitan Waters in February, 1880:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitro- gen.— As Ni- trates, &c.		Ammonia.		Hardness (Clark's Scale).	
			Sa- line.	Or- ganic.	Before Boil- ing.	After Boil- ing.		
<i>Thames Water Companies.</i>								
Grand Junction	23.51	0.0122	0.195	0.000	0.0075	15.9	3.8	
West Middlesex	22.87	0.0204	0.180	0.000	0.007	15.9	3.8	
Southwark and Vauxhall	22.53	0.0612	0.165	0.001	0.012	15.0	3.8	
Chelsea	23.49	0.0378	0.180	0.001	0.008	15.6	4.2	
Lambeth	23.22	0.0163	0.180	0.000	0.005	15.4	4.0	
<i>Other Companies.</i>								
Kent	33.74	0.0082	0.420	0.000	0.002	20.6	6.3	
New River	23.14	0.0041	0.195	0.000	0.005	15.4	3.5	
East London	23.06	0.00326	0.180	0.0015	0.010	16.0	4.2	

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours.

The water was found to be clear and nearly colourless in all cases but the following, when it was slightly turbid—namely, Southwark and Vauxhall, East London.

C. MEYMOTT TIDY, M.B.

METROPOLIS WATER-WORKS PURCHASE BILL.

The Bill, under the above title, which, as will be seen from another column, was introduced by Mr. Cross in the House of Commons last Tuesday, was issued to the public the following morning. It consists of 43 clauses and 7 schedules, extending over 41 pages.

It is entitled "A Bill to make further provision for the supply of the Metropolis and the adjoining populous places with water;" and the preamble states that, with a view to improving the supply now afforded by the eight Companies, and at the same time diminishing its expense, it is expedient that the duty of providing the same should be vested in a single public authority—the Companies having consented to transfer their undertakings at a certain price mentioned in the first schedule.

According to clause 1, the Act is to be cited as the Metropolitan Water Act, 1880.

Clause 2 provides for the establishment of the Trust for the acquisition of the water undertakings. It is to be called the Metropolitan Water Trust, and the Trustees are to be a body corporate, having perpetual succession and a common seal.

The purposes of the Act are stated in clause 3. They are (1) the supply of pure and wholesome water for drinking and other domestic purposes; (2) the supply of water sufficient for watering the streets, the extinguishment of fires, and other public purposes; also for manufacturing and other general purposes; (3) the maintenance, so soon and so far as is practicable, of a constant supply of water; and (4) the maintenance of a supply in the mains under such pressure as will efficiently provide for high service and the extinguishment of fires.

The general character of the Trust is clearly laid down in clause 4, which is as follows:—"The Water Trust shall hold their property as trustees for the benefit of the inhabitants of the metropolitan water area; they shall apply all moneys received by them to carrying into effect the purposes of this Act; and shall from time to time, after providing a reserve for contingencies, make such reduction in the price to be paid for water by consumers as the Water Trust may find practicable and expedient."

The powers and duties of the Trust are defined in clauses 5 and 6, by which they are authorized, after acquiring the undertakings, to enlarge and improve them, and construct new works when thought expedient. They are also empowered to consolidate the works, so that water may be conveyed to any part of the districts from any one of the works.

Clauses 7, 8, and 9 refer to the purchase of the undertakings, which is to be deemed as having taken place on July 1 this year; though the "vesting period" is not to be till Oct. 1. In the interval between these dates, the Directors of the various Companies are to act as "trustees" for the Water Trust. The first payment of interest on the stock (which is afterwards to be referred to) is to be made on April 5, 1881, for the half year to Christmas next. The Directors of the Companies are to carry on the business of the undertakings, during the three months from July 1 to Sept. 30, just as though the works were still in their hands—subject, of course, to audit. On Oct. 1 the Trust are to assume control of the works, and be subject to the provisions of, and have the rights, powers, and privileges conferred by any Acts controlling the absorbed Companies.

The "financial clauses" are from clause 10 to clause 23 inclusive. These provide that the Trust shall forthwith create a sufficient amount of stock to effect the purchase. This is to be called "Metropolitan Consolidated Water Stock," and is to bear interest at the rate of 3½ per cent. per annum. It is to be divided into two classes, "ordinary" and "deferred," the object of which will be afterwards explained. When, however, the latter class of stock commences to bear interest, it will be merged in the ordinary stock. The entry in the share registers of the Companies is to be sufficient title to a proportion of the stock, the receipt of which shall be a discharge of all liability against the various Companies. The registers of Shareholders in the Companies are to be delivered to the Trust on or before July 15. The debenture stockholders, preferential shareholders and mortgagees of the Companies are to have equal claims upon the Trust as they have now on the Companies. The Trust may, however, with the consent of the holders, substitute ordinary water stock for the debenture bonds, preference shares, and mortgages; or, on calling a meeting of the holders, and obtaining the approval of three-fourths of the value represented, personally or by proxy, they may, if they see fit, effect the change. The Trust are, before the end of this year, to exhibit to the Commissioners of Inland Revenue a copy of the Act, stamped with an *ad valorem* stamp of the same amount as would have been needed had the works each been transferred by deed of conveyance. The money for this is to be raised by the creation of ordinary stock. The Trust are empowered to make a composition of 7s. 6d. per cent. for the stamp duty payable on the consolidated stock issued in lieu of the Companies shares. The Trust may arrange with the Bank of England as to the transfer and management of the stock. Clause 17 provides that, subject to all prior charges of principal and interest on July 1 next, the water stock shall primarily be a charge on the property of the Trust, the water-rents and revenues, and afterwards on the metropolitan consolidated rate and the rate levied by the Commissioners of Sewers of the City of London, in proportion to the values of the two districts. If any sum is thus advanced by the Metropolitan Board and the Commissioners of Sewers, it is to be repaid, with interest at the rate of 5 per cent. per annum, as soon as (in the opinion of the Secretary of State) the Trust are possessed of sufficient funds for the purpose. If the Trust at any time find they have not at their immediate disposal funds sufficient to provide the interest on their water stock, they will have to apply to the Secretary of State, who will issue a precept to the Metropolitan Board of Works and the Commissioners of Sewers, requiring them to pay over to the Trust the amount of deficiency; and if default be made by them, the amount will be deemed a debt to the Crown, enforceable by *mandamus*. With a view to supply funds to the Trust immediately on their entering upon their duties, and before the receipt of the then accruing water-rents, so as to meet current expenses, they are empowered to apply to the Bank of England for a loan not exceeding £500,000. They may also issue stock to the amount of not more than another £500,000 for extension of works, &c. It is also provided that at the expiration of twelve years from the passing of the Act, a sinking-fund shall be commenced, and sufficient shall be set aside each year to redeem the whole of the stock in 80 years from the creation of the fund.

Clauses 24 and 25 deal with the officers and servants of the present Companies, who are, "when it can conveniently be done," to be appointed under the Trust to similar posts to those they now hold. They and any other new officers appointed are, on retiring, to be entitled to pensions according to the provisions of the Superannuation Act, 1855, as though they were civil servants of the Crown. After three years of the passing of the Act no new salaried office is to be created until the Secretary of State has sanctioned the appointment. Officers and servants who are continued in the employ of the Trust are to receive not less than their present salaries, and are to count past years of service with the Companies for the purposes of superannuation allowances. Those who retire on the completion of the transfer are to be entitled to—if they have served 18 years or more, an annuity equal to one-half the annual emoluments then being received; if more than 18 years, the amount to be increased one-sixteenth for each year; and if less than 18 (down to 5) years, to be decreased one-sixteenth for each year. It is, however, provided that no retiring allowance shall be more than the amount at present received each year. Officers and servants in receipt of salary who have been less than five years in the employ of any Company, and servants on weekly wages who have been regularly employed for not less than ten years, are to petition the Trust; and, after inquiry, compensation may be awarded them. The Secretaries and Engineers of the Companies are specially provided for; their retiring allowances being fixed by the third schedule to the Bill, in case they are removed by the Trust, or see fit to retire after 40 years service. They may, nevertheless, claim, instead of this fixed sum, the compensation to which they would, in the ordinary way, be entitled.

Clauses 26, 27, and 28 define the constitution of the Trust. It is to con-

sist of 21 members—3 salaried members, 2 *ex officio* members, 4 nominated members, and 12 elected members. The first salaried members are to be appointed by the Crown—viz., a chairman, whose salary is to be £2000 a year; a vice-chairman of works, at £1800 a year; and a vice-chairman of finance, at a like salary. A vacancy occurring in the office of chairman is to be filled by the Secretary of State; while the vice-chairman will be re-appointed by the Trust themselves every five years. Any vice-chairman, other than those first appointed by the Crown, may be removed by a resolution agreed to by two-thirds of the members in a meeting specially convened for the purpose. In reference to these officers, it is provided that, "of the persons filling the offices of chairman and vice-chairmen, one only shall be qualified to be elected for or to sit in the Commons House of Parliament." The two *ex officio* members are to be the Lord Mayor for the time being of the City of London, and the Chairman for the time being of the Metropolitan Board of Works. The four nominated members are to be (a) one nominated by the President of the Local Government Board; (b) one nominated by the First Commissioner of Works; (c) one nominated by the Commissioners of Sewers of the City of London; and (d) one nominated by the Metropolitan Board of Works. Any one of these members may be removed at the pleasure of the Authority by whom he was nominated. The other members are to consist of two suburban members and twelve metropolitan members—one of the former being elected as representative of the Sanitary Authorities within the metropolitan water area situate north of the Thames, but not contained within the limits of the Metropolis; and the other by the similar Sanitary Authorities on the south of the Thames. The ten metropolitan members are to be elected one each by the ratepayers of the following divisions:—City of London, Chelsea, Finsbury, Greenwich, Hackney, Lambeth, Marylebone, Southwark, Tower Hamlets, and Westminster. The first elections are to be held some day in July, to be appointed by the Secretary of State; and subsequent elections every five years, due provision being made for the filling up of casual vacancies. The Trust thus constituted are to come into office on some day to be fixed, not later than Aug. 15. Disqualification to hold office would result from a member occupying a place of profit under the Trust, or participating in the profits of any work done by order of the Trust, or being concerned in or participating in the profit of any contract entered into by the Trust. A permanent secretary is to be nominated by the Secretary of State, at a salary not stated in the Bill; and subsequent secretaries are to be appointed by the Trust.

The second part of the Bill contains supplemental provisions as to adjustment of obligations, accounts, status of the Trust, &c. Clause 27 enacts that the rate of dividend which is mentioned in the table forming the first schedule of the Bill (subsequently given) may be paid to the ordinary shareholders of the Companies, for the period named ending July 1, out of any amount that may be received, and any deficiency is to be supplied by the Trust. On July 1 the Trust are, by clause 30, to assume all the debts, liabilities, and obligations of the Companies then incurred, as well as those which may be properly incurred in the interval between that day and the time the Trust take actual possession of the undertakings. The pensions already granted by any of the Companies are also to be continued. Clause 31 continues all arbitrations, actions, and other proceedings commenced by or against the Companies; and clause 32 makes the books and documents of the Companies the property of the Trust by Oct. 1. Clause 33 enacts that, "for the purpose of ascertaining with exactness the amount of property which the Water Trust may claim

under the expression 'the undertaking,' as defined by this Act," all the dealings of the Companies shall from Jan. 1 be subject to continuous audit, subject to reference, in case of dispute, to the Secretary of State. As to the accounts to be kept by the Trust, clause 34 provides that an annual abstract made up to March 25 each year shall be laid before Parliament by the Local Government Board, who are to direct the form in which the accounts are to be kept, and provide for the efficient auditing of them; the expense, however, is to be borne by the Trust. Clause 35 defines the legal status of the Trust, its mode of conducting business, &c., when formed. Among the miscellaneous provisions towards the end of the Bill is one (clause 36) for the appointment by the Local Government Board of "a person possessing competent knowledge, skill, and experience as an analyst of the water supplied by the Trust," the remuneration of him to be fixed by the Board but paid by the Trust. Clause 37 is to allow of surplus lands being disposed of; clause 38 gives power to the Companies to summon interim meetings of their Shareholders in reference to the winding up of their affairs; while clause 39 provides for the distribution of the amount to be paid to each Company for contingencies, as hereafter stated. A monopoly of supply is secured to the Trust by clause 40, which says: "From and after the passing of this Act, no Company or person shall be entitled to supply water for sale within the Metropolitan water area, except . . . the Companies at the date of the passing of this Act supplying water in the following districts; that is to say (1) Croydon, (2) South Essex, (3) Tottenham, (4) Enfield, (5) Bush Hill Park Estate, (6) Ware; and also the Authority having jurisdiction over the water under Orange Street: Provided that nothing in this section shall prejudicially affect the rights of any Sanitary Authority under the Public Health Act, 1875." Excepting in the case of the New River Company the record being made by the Registrar of Joint-Stock Companies, of the registers of shareholders having been given over to the Trust shall be held to constitute the dissolution of the Companies. The costs of the preliminary negotiations and of passing the Bill through Parliament are, by clause 42, to be paid by the Trust if incurred by order of the Secretary of State or the Local Government Board; but the costs of the Companies are to be met out of the sum allowed for contingencies. Clause 43 contains the definitions, according to which the word "undertaking," as applied to the property of the Companies, means "all such property, real and personal, including cash balances, reserve-funds, investments, and all other interests, and rights in, to, and out of the property, real and personal, and obligations and things in action as may be in the possession of the Company or belong to them at any time between the 1st day of January, 1880, and the 30th day of June, 1880, after allowing and providing for all proper outgoings certified by the Auditor as approved by him, and also for any dividend agreed to be received: Provided that, in the case of the New River Company, the undertaking of that Company shall not include any landed estate, houses, or property of the Company not directly used for or connected with their water supply, and which landed estate, houses, and property so excepted have been specified in a schedule sealed with the seal of the Company, and signed by the Governor of the Company, and by Edmund James Smith, Esq."

The following table is given in the first schedule, showing the amount of purchase stock, consisting partly of ordinary stock and partly of deferred stock, payable to each of the Companies, and the rate per annum of dividend to be received by them on their present share capital for certain periods ending July 1:—

Name of Company.	Ordinary Stock.	Deferred Stock.												Rate per Cent. of Dividend per An.	Duration of Periods for which Dividend payable.
		1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.		
New River Co.	£ 6,080,000	£ 217,000	£ 224,000	£ 231,000	£ 238,000	£ 245,000	£ 252,000	£ 259,000	£ 266,000	£ 273,000	£ 280,000	£ 287,000	£ 294,000	10½	Six months.
East London Co.	£ 3,223,600	—	—	—	£ 500,000	—	—	—	£ 500,000	—	£ 500,000	—	—	6½	Six months.
Southwark and Vauxhall Co.	£ 2,098,000	£ 150,000	£ 150,000	£ 150,000	£ 150,000	£ 150,000	—	—	—	—	—	—	—	7½	Nine months.
West Middlesex Co.	£ 3,134,000	£ 85,750	£ 85,750	£ 85,750	£ 85,750	—	—	—	—	—	—	—	—	10	Six months.
Lambeth Co.	£ 2,217,500	—	£ 338,000	—	—	—	£ 704,000	£ 178,000	—	—	—	—	—	6½	Nine months.
Chelsea Co.	£ 1,302,000	—	—	—	—	—	—	£ 350,000	—	£ 325,000	—	—	—	6½	Nine months.
Grand Junction Co.	£ 2,306,000	£ 150,000	£ 150,000	£ 150,000	£ 150,000	£ 150,000	£ 150,000	—	—	—	—	—	—	7½	Nine months.
Kent Co.	£ 1,737,600	£ 94,000	£ 94,000	£ 94,000	£ 94,000	£ 94,000	£ 91,000	£ 94,000	£ 94,000	£ 91,000	—	—	—	9	Six months.

Note.—Interest on all the stocks, whether ordinary stock or deferred stock (subject to the postponement of interest in the case of the deferred stock), is due, at the rate of 3½ per cent., on the 1st day of January and the 1st day of July in every year. "1881 stock" means stock, the interest on which begins to accrue on the 1st of July, 1881, and the first payment of interest on which will be due on the 1st of January, 1882, and not before. Similarly "1882 stock" means stock, the interest on which begins to accrue on the 1st of July, 1882, and the first payment of interest on which will be due on the 1st of January, 1883, and not before, and so with respect to the remainder of the deferred stock. The payment of interest on the above stocks will be made on the 5th day of April and the 5th day of October in respect of the interest becoming due on the preceding 1st day of January and 1st day of July respectively.

In addition to the foregoing, the following amounts of purchase stock are to be disposable by the Companies for contingencies:—
New River Company. £80,000
East London Company. 20,000
Southwark and Vauxhall Company 20,000
West Middlesex Company. 20,000
Lambeth Company 17,500
Chelsea Company. 19,457
Grand Junction Company. 20,000
Kent Company. 20,000

The second schedule contains provisions as to the stock and the stockholders—the register of the stock, certificates of title, receipts of joint holders, mode of transfer, the issue of stock certificates to bearer, &c.; also as to unclaimed interest, forgery of transfers of stock certificates, and personations of owners of stock; besides specifying the remedy for non-payment of interest due.
The third schedule shows the amount of compensation to be given to the Secretaries and Engineers of the Companies on the abolition of their offices, their retirement, or removal.
The fourth schedule mentions the names of the Sanitary Authorities—within the metropolitan areas situated north and south of the Thames, but not contained within the limits of the Metropolis—who, according to clause 26 of the Bill, are each to elect a member on the Trust. They are, in the north, the Urban Sanitary Authorities of Acton, Brentford, Chesham, Chiswick, Ealing, East Ham, Edmonton, Enfield, Hampton Wick, Hendon, Heston and Isleworth, Hornsey, Leyton, Romford, South Hornsey, Teddington, Tottenham, Twickenham, Waltham Holy Cross, Walthamstow, Wanstead, Ware, West Ham, Willesden, and Woodford; together with the Rural Sanitary Authorities of Brentford, Epping, Hertford, Romford, Staines, Ware, and West Ham. Those on the south are the Urban Sanitary Authorities of Beckenham, Bromley, Croydon, Dartford, East Molesey, Erith, Ham Common, Kingston-on-Thames, New

Malden, Surbiton, and Wimbledon; together with the Rural Sanitary Authorities of Bromley, Croydon, Dartford, Kingston, Lewisham, and Richmond. The districts electing the metropolitan members are nearly coterminous with the parliamentary divisions mentioned in clause 26.
The fifth schedule contains rules as to the election of members; the sixth schedule, as to the audit of the accounts; and the seventh and last schedule, as to the proceedings of the Trust at their meetings.

THE SALE OF COKE UNDER THE WEIGHTS AND MEASURES ACT, 1878.
Our readers will be glad to learn that at the last meeting of the Privy Council a new denomination of standard—the "Four-Bushel Measure"—was approved of, on the recommendation of the Board of Trade, and may henceforward be legally used.
During last year, after having had experience of the working of the Act, which came into operation on Jan. 1, 1879, representations were made to the Board of Trade of the inconvenience of carrying on the sale of coke with any of the standards authorized by the Act; and stating that unless some new standard suitable for the purpose were legalized, Gas Companies would be compelled to sell coke by weight, with all its objectionable contingencies. We believe Mr. I. A. Crookenden, the Secretary of the Phoenix Gaslight Company, suggested to the Board a remedy, which was to make a new denomination of measure, to be called "a sack," of the dimensions of 1 ft. 6 in. diameter and 2·897 feet deep, its contents being 5·12 cubic feet, and equal exactly to four of the "bushels" mentioned in the Act. This suggestion appears to have been acted upon, for the following Order of Her Majesty in Council has been published in the *London Gazette*:—
"At the Court at Windsor, the 26th day of February.
"Present: The Queen's Most Excellent Majesty in Council.
"Whereas by the Weights and Measures Act, 1878, it is (among other things) provided that the Board of Trade shall from time to time cause

such new denominations of standards, being either equivalent to or multiples or aliquot parts of the Imperial weights and measures ascertained by the said Act, as appear to them to be required in addition to those mentioned in the second schedule to the said Act, to be made and duly verified, and that those new denominations of standards, when approved by Her Majesty in Council, shall be Board of Trade standards in like manner as if they were mentioned in the said schedule:

"And whereas it has been made to appear to the Board of Trade, that a new denomination of standard measure of four bushels, being a multiple of the Imperial measure of capacity of a bushel ascertained by the same Act, is required, and they have caused the same to be made and duly verified and deposited in their custody:

"And whereas the Board of Trade have given to the said new standard measure of capacity the denomination of Four-Bushel Measure:

"Now, therefore, Her Majesty, by virtue of the power vested in Her by the said Act, by and with the advice of Her Privy Council, is pleased to approve of the 'Four-Bushel Measure' as a new denomination of standard, and doth direct that the same shall be a Board of Trade Standard in like manner as if it was mentioned in the second schedule to the Weights and Measures Act, 1878.

(Signed) "C. L. PEEL."

The only variation that is now necessary in the coke business is one of terms. The quotation of "chaldron" must be dropped, and "twelve four-bushel measures" substituted.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

The Tenth Annual and Forty-first Quarterly Meeting of this Institution was held on Saturday, February 28th, at the Mitre Hotel, Manchester. Mr. T. NEWBIGGING, the retiring President, occupied the chair at the commencement of the proceedings. There was a very large attendance of members.

The HONORARY SECRETARY (Mr. R. Hunter, Stalybridge) read the minutes of the last meeting, which, on the motion of the PRESIDENT, seconded by Mr. SMEDLEY (Buxton), were confirmed.

On the motion of Mr. MOORE (Macclesfield), seconded by the HONORARY SECRETARY, Mr. George Steele Furnivall, Lessee and Resident Manager of the Biddulph and Bradley Green Gas-Works, near Congleton, Cheshire, was elected a member of the Institution, and introduced to the meeting.

ANNUAL REPORT.

The HONORARY SECRETARY next read the annual report of the Committee, which was as follows:—

Gentlemen,—The Committee, in presenting their report for the past year, have to congratulate the members on the continued prosperity of the Institution. Thirteen new members have been elected during the year, although the actual number on the roll shows only an increase of three—the total number being 79, some numbers having resigned, and others having been struck off the roll in accordance with the new rule adopted at last quarterly meeting. The Committee regret exceedingly that the number has been still further reduced by the death, at the early age of 33, of Mr. F. W. Brothers, of Chorley. He was a very promising member, and contributed a paper at our last meeting.

A large number of very excellent papers have been presented during the year, viz:—

"On the Distributing Plant, from the Gasholder to the Consumer's Burner." By Mr. Chew, of Blackpool.

"On a Description of the Various Apparatus used in Determining the Amount of Sulphur Compounds in Coal Gas." By Mr. W. W. Hutchinson, of Ramsley.

"On the Economy of Heat in Retort-Settings." By Mr. W. H. Y. Webber, of Manchester.

"Notes on Condensation." By Mr. T. O. Paterson, of Rochdale.

"On the Testing of Gas-Mains." By Mr. F. W. Brothers, of Chorley.

"On an Improved Purifier." By Mr. W. Tyrell, of Dryolsden.

The usual picnic in May was to Hebdon Bridge and Haworth, to visit the old church and district with which the name of Charlotte Brontë is so intimately connected, and was a perfect success.

As will be seen by the statement of accounts sent to each member, the funds are in a satisfactory condition, although the expenditure has been somewhat heavier than formerly. This has been caused partly by the expense of taking verbatim reports of proceedings. These reports have been published in the JOURNAL OF GAS LIGHTING, and other papers connected with our profession, and have been highly appreciated by the profession in general.

The Committee hope that the members generally will strive to promote the usefulness of the Institution, by contributing papers upon such subjects as may come under their notice, and would remind members that failures are often more instructive than continued success, as the record of a failure may lead to an efficient remedy.

In concluding, the Committee beg to thank the members generally for the encouragement and support given to them during the past year, more especially those gentlemen who have contributed papers.

The two members of Committee whose term of office expires at this meeting are Mr. W. Smith and Mr. S. R. Ogden, they having been elected in 1878, to complete the term of Messrs. Clarke and Hunter, elected to other offices; and, in consequence of the election of Mr. Carr as President, another member of Committee must be elected to complete his term of one year.

The report was adopted, on the motion of the PRESIDENT, seconded by Mr. CHEW (Blackpool).

The HONORARY SECRETARY announced that Mr. Littlewood (Manchester) who had promised to contribute a paper on "Mechanical Stoking," could not, owing to a family bereavement, attend the meeting.

Mr. NEWBIGGING then rose and said that the term of his presidency having expired, he had now to relinquish the responsible trust which, twelve months ago, the members did him the honour to place upon his shoulders. He was glad that, in retiring from the duties of the position, he would be succeeded by a gentleman who had been elected to the presidency by their unanimous voice; and who, he was well convinced, would add dignity to the chair, and conduct the business of the meetings with wisdom and ability. He had the pleasure to introduce Mr. William Carr as the President of the Manchester District Institution of Gas Engineers, and to call upon him to take the chair which he (Mr. Newbigging) now vacated.

Mr. Carr on taking the chair was received with applause.

ELECTION OF OFFICERS.

The next business was the election of Vice-President for the year.

Mr. SMEDLEY (Buxton) proposed that Mr. Chew should be elected to fill this office. He said he knew no one who was more fitted for it than Mr. Chew, who had rendered very efficient service to the Institution, and had read one or two papers from which the members could not have failed to receive some useful information.

Mr. COLES (Todmorden) seconded the proposition.

The PRESIDENT, in submitting it to the meeting, said it would be a matter of much pleasure to him to have a gentleman like Mr. Chew occupying the vice-chair, and to know that at any time when he was unable to attend the meetings the chair would be filled so ably as he was sure it would be by Mr. Chew.

The motion was carried unanimously.

Mr. CHEW briefly thanked the meeting for the honour which they had conferred upon him, and took the vice-chair.

The PRESIDENT then proposed that Mr. Paterson (Warrington) be again elected Treasurer. He had, he said, filled the office with so much ability and credit to himself and the Institution that they would be very remiss if they departed from the usual custom and failed to re-elect him.

Mr. HARRISON VEEVERS (Dukinfield) seconded the motion, which was also carried unanimously.

Mr. PATERSON, in acknowledging the compliment, said his duties as Treasurer were extremely easy; he had, therefore, no reluctance whatever in undertaking the duties of the office. He could not sit down, however, without expressing his great satisfaction at the wisdom the meeting had shown in electing his friend Mr. Carr as President. He was sure Mr. Carr would conduct the business and preside in the same admirable way in which the office had been filled in preceding years. He had observed with much pleasure the prudence and the wisdom of their President's observations in the past, and he had formed a very high opinion of the practical knowledge possessed by him on all subjects connected with their profession. It was the highest honour they could confer, and it was one that Mr. Carr thoroughly deserved.

Mr. NEWBIGGING moved the re-election of Mr. Robert Hunter as Honorary Secretary for the coming year. He said he had desired that he might have the honour of proposing this resolution, because the President for the year, more than any one else, was able to bear testimony to the manner in which a Secretary discharged his duties. The duties of a post of this kind could be made either comparatively light or exceedingly onerous, according as the Secretary was enthusiastic and conscientious or otherwise in his work. The Institution from the beginning had been fortunate in having earnest and hard-working Secretaries, and hence its vitality at this moment. In Mr. Hunter he could honestly assert that they had a gentleman who thought no effort or labour burdensome that would add to the interest of the meetings, and render them instructive and valuable to the members. The way in which he conducted the correspondence and general business of the Institution did him infinite credit, and he could say with confidence that Mr. Hunter had earned the respect and esteem of every individual member.

Mr. PATERSON seconded the proposition. They had, he considered, in Mr. Hunter one who was thoroughly conscientious in the discharge of his duties, and he thought it would be difficult to find one more fitted for the office.

The resolution was carried with applause.

Mr. HUNTER thanked the members for the honour they had again done him in re-electing him Secretary. He should endeavour, he said, still to do his duty to the best of his ability.

The next business was the election of two members of the Committee in place of those retiring by rotation.

Mr. VEEVERS proposed, and Mr. NEWBIGGING seconded, the election of Mr. Barrett, of the Gaythorn Gas-Works, Manchester, as one; and Mr. CLARKE (Ashton-under-Lyne) proposed, and Mr. SAVILLE (Sowerby Bridge) seconded, the election of Mr. Coles, of Todmorden, as the other.

Both propositions were carried unanimously.

One member of the Committee had also to be elected in the place of Mr. Carr, whose elevation to the office of President left vacant his seat on the Committee.

The HONORARY SECRETARY proposed that Mr. Veevers be elected to fill this vacancy.

Mr. FRITH (Runcorn) seconded the motion.

The PRESIDENT, in putting the question, said the election would be for only one year, and Mr. Veevers was hit upon because he had already served on the Committee, and because it was thought he would be of more service than other members who had not held office, and who it was desirable should be elected for the full term of three years.

The motion was carried; after which,

Mr. MOORE proposed the re-election of the Auditors, Mr. Edmund Lord and Mr. George Smedley.

Mr. BOOTH (Southport) seconded the motion, and it was adopted.

PRESIDENT'S ADDRESS.

The PRESIDENT said: Gentlemen,—In entering for the first time upon my duties as your President, allow me to thank you most cordially for the honour that you have conferred upon me in electing me to this position. At the same time I wish to congratulate you upon the fact that this is the tenth annual meeting of the Institution. We can now look to an existence stretching over a decade, and to a work which, if it has not been brilliant or extraordinary, has been none the less useful and necessary to the members belonging to the Institution. For the past ten years a work has been carried on here, quietly and unostentatiously, which has influenced to a very great extent not only the district from which its members have been gathered, but other districts outside; for members have, from time to time, left and gone farther afield, and have doubtless carried with them, to a greater extent probably than many of them have been aware, the beneficial influence which the Institution has had over them. It is not always easy for a man to tell precisely to what extent he is benefited by his association with his fellows. I myself have often returned from meetings with a sickening sense of having wasted the time spent there, and have been very much surprised to hear other members, at a later period, refer to the same meeting as the most profitable that they ever attended. So it is, and ever will be. A man will regard as profitable only those meetings at which he has been a receiver of information; but if he will just consider the matter, there must come times when it will be his function to give, while it is that of others to receive. I am not now alluding to the reading of papers only, but am including the discussions as well; so that when the paper and discussion cover ground with which a member is perfectly familiar, he must, instead of regarding it as common-place or time wasted, really look upon it as one of his best opportunities, for it is upon such occasions that any remarks he may make will be of most value to his fellow-members. If ever he could speak with authority, and with some hope of interesting and instructing those whom he is addressing, it must be on such an occasion as that. All things considered, I think we shall be justified in saying that, although we cannot look back to any great and brilliant achievement in the history of the Institution, we know, those of us who have taken any active interest in it, that sufficient has been done to justify its existence, and to warrant its continuance in a flourishing condition.

With regard to the immediate past, I can speak with even greater confidence, for we have gone through a year which has been marked by a series of the most successful meetings we have ever had. This has been, in a great measure, due to the efforts of my predecessor. I can never regard the accession of Mr. Newbigging, first to the Institution and afterwards to the Presidency, as anything less than a stroke of good fortune for us; but, as he himself would be the first to proclaim, his efforts would have been futile had it not been for the valuable assistance of our indefatigable Secretary, backed by that of an efficient Committee, who, I believe (with the exception of about two members, in which number I include myself), have stood to their posts in a manner which does them credit. Behind all this, there has been a willingness on the part of a great many members to provide papers on matters of interest to us. I have alluded to these things more particularly, because I hope and believe they will not terminate with my predecessor's year of office. With the impulse that has been given, we are not even justified in staying where we are, but should go on improving; and I am quite certain that if we do so, no one will profit so much by that improvement as those who contribute towards it. Many of the papers we have had read have been of a most valuable character to

us; still, they have made no pretensions to having exhausted the subjects upon which they treated, but may be regarded more as introducing fresh matter for our consideration and investigation; and, therefore, we ought, in the ordinary course of things, to hear something more, at no distant period, on such subjects as regenerator furnaces, carburetting gas, &c.

It is scarcely necessary for me to say anything, by way of justifying the existence of such institutions as this, for they have already become so firmly and so extensively established throughout the country, that any championship of mine would be superfluous. Nevertheless, in the hope that these remarks may meet the eye of some who are not gas managers or engineers, I will take the liberty of saying a word or two with regard to the action of these institutions. We meet for the purpose of exchanging views and opinions with regard to the most approved method of manufacturing gas. As there must of necessity exist a great diversity of opinion amongst gas engineers on the different details connected with the manufacture and manipulation of gas, and as each engineer is of necessity isolated, and often at some distance from the nearest of those who are engaged in the same business, it follows that if they are to have an opportunity of comparing notes, and profiting by the experience of each other, it must be by the agency of some institution of this kind. It unfortunately happens that the engineer who is comfortably located, having no pecuniary interest in the success of the undertaking he controls, has only his own sense of duty to stimulate him to further effort than is required to keep his concern going in a fairly prosperous condition. But, to their credit be it said, the absence of a pecuniary interest has seemed to have no effect whatever in the vast majority of cases; for, if we consider the improvements which have been made during the past few years, we must come to the conclusion that great efforts have been made, and with substantial results, as is shown by the reduced price at which gas is now sold throughout almost the entire length and breadth of the land, compared with what it was, say, ten years ago. To my mind, this improvement is in a great measure due to the influence of this and other similar institutions, and to the good and generous feeling which is begotten by them. You may rely upon it that the moment a man opens his heart for the purpose of benefiting others, he opens his brain and begins to receive; for the action of revolving in his mind what he is about to communicate is, in itself, an educational one, and a man discovers flaws in his own theory sooner by this process than by any other. There are a few men, I am sorry to admit, who have come to the conclusion that they, at least, have nothing to learn by attending meetings of, and exchanging notes with their professional brethren. They must have made up their minds that gas manufacture is an exact science, and by them perfectly understood, and that, therefore, it is quite unnecessary for any one to attend meetings to talk matters over—that what we ought really to do is to make our works a *fac simile* of theirs, and then sit down. Still, in spite of this, it is pleasant to be able to relate that a very large proportion, headed by some of the brightest ornaments of our calling, think otherwise. I am sure, as a body, we ought to feel grateful to, and proud of such men as Messrs. Livesey, Woodall, Newbidding, and a number of others, men whose numerous engagements would have afforded them ample excuse for absenting themselves; but who have resolutely sacrificed their time—often, I feel sure, at great inconvenience—in order that they might be present to lend a helping hand to others; thus showing that it is not inconsistent with the greatest dignity to exist in cordial relationship with those who are engaged in the same class of work, and to try as far as possible to lift up the profession to which they themselves belong. At the same time, so rapidly and so surely does nature compensate, that I have not the least hesitation in saying that any one of the gentlemen mentioned would be ready to admit that he himself was the first to benefit from the action he had taken. Therefore, I say, although an improvement would have resulted in individual cases, it would not have been so great, nor would it have been so general as it has been during the past few years. If we take, as an average for the whole country, the quantity of gas sold as 3500 cubic feet per head of the population per annum—which is somewhat below the rate at Halifax, and will, no doubt, be very much below that of larger towns, although it may be in excess of the rate of small country places—and take one-half the population of Great Britain as being gas consumers, we have at this rate a total annual consumption of 16,000,000 × 3500 = 56,000,000,000 cubic feet of gas. If we assume that the average reduction in the price of gas all over the country has been equal to 6d. per 1000, as compared with what the charge was before the advance in the price of coal took place, or, in other words, when coal was about the same price as it is now, we have a gross saving to the consumers of £1,400,000 per annum, exclusive of the increased dividends which have gone into the pockets of shareholders. I think I shall not be accused of having taken too high an estimate in saying that the average reduction is equal to 6d. per 1000. I have taken it so low that it might be independent of any slight advantage in the increased value of residuals. The gas-consuming public have been relieved by an amount, at a very moderate estimate, equal to £1,400,000 sterling annually, and consequently the country is the richer by that amount. This has not been owing to any effort of the consumers themselves, nor of those who represent the proprietors, but has been purely an engineer's or manager's saving; and that this improvement has been so general, and not isolated, has, in my opinion, been almost exclusively owing to the influence and good effect of institutions such as ours. Yet there are managers of small works who find it difficult at times to provide the means to attend the meetings, and there are instances, I am told, where even the question of obtaining leave of absence is a material consideration; but if those who represent the proprietors of gas-works only understood the nature of the business they are supposed to govern—how it changes from time to time, how we have occasionally to retrace our steps and to reject new, or throw out hitherto accepted theories—they would be anxious, and, in fact, would insist upon it, that their engineer or manager should attend, and keep himself posted with the foremost thought and the best experience of the day.

It has frequently been stated, and occasionally by people of some degree of eminence, that gas manufacture has made no progress since it was first introduced—that virtually we proceed upon the same lines as those pursued by the gas engineers of the early part of this century, and that although some alterations of detail have been made, in the main principles there has been no improvement. Well, if these persons mean that we still have to distil, to condense, to purify, and to store, I plead guilty at once. So long as coal is the material from which the gas is to be obtained, we shall always be compelled, by the laws of nature, to confine ourselves within certain lines of action. It would be just as reasonable for me to say that the manufacturers of calico, here in Manchester, have made no improvement, because they still spin and weave, as they did in the very earliest and crudest calico-making period. Their legitimate field of improvement was and is the way in which the spinning and weaving was and is accomplished, and they do both now with such facility and dexterity as was never dreamt of in the old days. And so I believe that if some of those brave old men, whose memory I would treat with all honour and respect, who, in the early days, did so much for the introduction of gas, could only see one of the most improved modern gas-works, they would be compelled to confess that things were very much changed.

We have been confined, in the possibility of improvement, to the mode of distilling, purifying, &c., and as the calico manufacturers was a mechanical field, while ours was, to a large extent, a physical and chemical one, it gave him the greater opportunity for the display of human ingenuity.

In approaching the consideration of gas manufacture itself, I feel that little that I can say will possess even the semblance of originality. So much has been and is being written and said week after week, that, unless one has had special opportunities for original research, there is very little probability of anything new coming to the surface—that is, unless we depart from the region of experience, and begin to draw upon our imaginations. But, as was once remarked by an eminent statesman, when addressing his constituents, although what he had to say to them might have been said on many previous occasions, and might even then be undergoing repetition by other speakers in many other parts of the country, still it was necessary that it should be so, as it was only by repeating the great political truths that they could ensure that progress and that permanent improvement which were necessary for the welfare of the community. I shall, therefore, not attempt to excuse myself for being homely and common-place in my remarks to-day, for experience tells me that, in the gas-manufacturing world, it is precisely the same as it is in the great social and political world outside; for although we may settle a question to-day, it will, in the course of another generation, if not at a much earlier period, crop up again for solution, and will be discussed and experimented upon with as much vigour and animation as if it were quite a new thing. If any of you will take the trouble to refer to the list of patents for two or three generations back, you will be astonished to find how frequently the same set of ideas have formed the subject of the specifications. They seem to have been patented, tried, and abandoned over and over again, with an interval of a few years between each effort, and each time they are brought out as, and they probably are, in a measure, fresh discoveries. A very small percentage of the patents taken out can claim originality. Then, again, we find from time to time, in the pages of the JOURNAL OF GAS LIGHTING, inquiries being made which a brief knowledge of the work of a few years ago would have rendered unnecessary. I have a case in my mind where a President of the British Association of Gas Managers made a very clear and distinct statement on a subject which was at that time occupying the minds of gas engineers. This statement has been more than once published for the benefit of all, and yet only a short time ago information was being sought on this very head in the correspondence columns of the JOURNAL.

One of the great difficulties which gas engineers labour under is the want of a definite factor of excellence, which will give them an idea of what is possible when perfection in manipulation has been reached. I am perfectly well aware that a chemist can take a ton of coal and resolve it into its ultimate constituents, but that is no guide to us as to what it will, or can, or ought to resolve itself into when distilled in a retort at a given temperature; and as it is practically impossible, in the way in which the carbonization of coal is at present conducted, to feel any confidence in the maintenance of any given temperature for more than an hour or two at a time, it would not help us very much if it were. Another great need, and the first thing which ought to be aimed at, is uniformity of working. I do not mean uniformity as between one gas-works and another so much as uniformity in the same works; that is to say, we want to feel sure that our works of to-day will be like what they were yesterday, and what they will be to-morrow. We shall then have accomplished one great step towards a more perfect and scientific treatment of our business. When that is done, we shall begin to observe that different classes of coal do not give the same results, although we have an uniform method of treatment, nor do they work off with equal facility. The only inference we can draw from this is what I feel quite sure we shall find in practice—that in order to get out the full benefit of what a coal contains, it will require a special treatment of its own, as different from that required by other coals as its nature differs from theirs. (Of course there are coals of which the nature and composition so nearly agree that they may be said to belong to the same family; but I am referring now to coals of different families.) The custom which at present obtains in this country is to leave the coal in the retort for six hours in some works, in others for five, in others for four, and in some cases two of these periods are used according to the different facilities of the retorts for heating; but in no case that I have ever heard of has it been thought advisable to change the working when a change has been made in the coal that was being used, although it would seem the natural course to pursue, for any one of us who has been in the habit of using different classes of coal can testify to the fact that some coals burn off as well in five hours as others do in six, under the same conditions and temperature. Then why have we never adopted a different treatment for the different classes of coal? Well, there is the difficulty, in the first place, after you have brought the men into one system of working, of changing them suddenly on to another, thus upsetting your previous plans and disturbing your otherwise methodical arrangements. There is also the fact, as before stated, that with our present system of carbonization it is impossible to tell, with any degree of certainty, what is the proper duration of a charge of any particular coal; and this is the great difficulty that stands in the way. If we can only by any means maintain something near uniformity of temperature, we can then set about the distillation of coal in a scientific manner; but until that time comes all our efforts will be of a more or less crude and unscientific character. We may sometimes hit the mark, or we may be unfortunate and miss it; in either case it is more a matter of intuitive action, or of luck, than of scientific management or otherwise. The principal obstacles that we have to encounter are—the nature and construction of the furnace; the mode of firing and cleaning; the surroundings of the retort-setting, which allow of a great amount and variety of radiation; and the fact that we have periodically to put in a charge of cold coal. The last is the only difficulty which cannot be dealt with, and in a great measure obviated. An attempt is now being made to deal with the first and most formidable obstacle, by way of regenerator furnaces; and I am very glad to know that a few English engineers are introducing these furnaces to take the place of the ordinary system; for the present system, with all its defects—such as cleaning with an empty furnace, as is done in the majority of cases, thus letting down the temperature of the setting, and afterwards firing extra hard to make up for it, with the consequent great wear and tear of the furnace sides and roof, greatly diminishing the life of the whole setting—is most unsatisfactory. I sincerely hope that before long we shall have arrived at some improved method of firing (about the improvement of which there can be no mistake) which will entirely replace the old system. We shall then be able to give our attention to the proper duration of charges under distillation, with a view to treating each different class of coal in a manner calculated to bring out the best results from it. We may also be able to discover the nature of the process which goes on in the deposition of carbon on the sides of the retort, as well as that other bugbear of carbonization—choked ascension-pipes. Both these difficulties, which we have hitherto struggled in vain to remedy or satisfactorily account for, arise, in my opinion, in a great measure, from this defect in the duration of the charges, and those works which are freest from deposits of carbon and choked ascension-pipes will be those works where the weight and quality of the coal used are most in accordance with the heat of, and

the length of time the charge will remain in the retort. Even in this case, however, a change in the quality of the coal often produces such disastrous results, that the engineer is fain to get back to the old kind at the earliest possible opportunity, even though it has to be purchased at a slightly enhanced price. Thus we find that in many parts of the country a certain quality of coal is preferred above all others—not necessarily the same kind or quality—and it often happens that the coal in question is of a very poor description; but an experience, stretching over many years, has taught managers how to treat that particular coal, and rather than undergo another educational course with another coal, they cleave to the old. There is greater room for improvement in the carbonizing of coal than in all the other departments of gas manufacture combined, and any improvement effected there will yield a much quicker and greater return of benefit to the operator.

While upon the subject of carbonization, I will take the liberty of saying a few words on the question of the contact of tar with coal gas. It is a subject which has recently been receiving much attention at the hands of gas engineers, and there appeared in the pages of the JOURNAL, about four months ago, a series of articles upon it by Mr. R. H. Patterson, ex-Gas Referee. I have no doubt that those articles have been carefully read by you, as well as his more recent articles upon the hydraulic main. They are exceedingly suggestive, and are of great value to us, inasmuch as they constitute a thoughtful and fair *résumé* of the best views and experience on the subject up to the present day, with here and there a few suggestive ideas of his own. It is of the greater importance to us, because the present tendency of those best informed on the subject is to reverse the policy of the past, which I may say has been to aim at keeping up the contact of the tar and the gas. It is a serious reflection upon those who were responsible for the theory that gas was enriched by being kept in contact with the tar as long as possible. How that theory came to life, Mr. Patterson does not say. It was doubtless one of those ideas which insinuated itself into the minds of some of the leading engineers, and having been suggested as probable, it came, after a time, to be accepted as axiomatic. I know, when I learned that coal under a high heat gave off gas, I also learned that gas kept in contact with tar was improved by it. It was one of the great truths in those days, but to-day we are in a position to affirm that even the truth is no longer true, and that is about all we can say with any degree of confidence; for although we have decided that, on the whole, contact is not desirable, there are conditions under which we are bound to admit that the reverse is the case. This much we can say with certainty, that of all the tars precipitated at a temperature of 120° Fahr., or above that, the sooner it is removed from connection with the gas the better. One of the main conclusions come to by Mr. Patterson is that you cannot, under any circumstances, treat cold gas—i.e., gas at the normal temperature—with cold tar without its resulting to the disadvantage of the gas. On several occasions in my experience I have known gas to be treated to a washing with tar, both designedly and otherwise, and on one or two occasions with positive advantage to the gas, but it was when the tar was of low specific gravity, and when the gas was of poor quality to commence with; indeed, at one works it was resorted to for the very purpose of improving the illuminating power when the gas fell below a certain standard, and very often with success. We have also had an apparatus described by one of our members (Mr. T. O. Paterson, of Rochdale), which is, and has been for some time at work at the Rochdale Gas-Works, the effects of which would lead us to a somewhat different conclusion to that arrived at by the writer of those articles in the JOURNAL, for at Rochdale all the tar, and the liquor also, is taken directly from the hydraulic main and put into the condenser, and the gas is blown through the whole at a rapid rate. So far their experience of it has been very satisfactory. I mention these two circumstances to show that it will not be wise to come hastily to the conclusion that all contact is bad, or that the whole question is definitely and finally settled by the Aitken and Young analyzer; not that I wish in any way to disparage that machine, for, in my opinion, it is the most intelligent attempt which has yet been made at a solution of this difficulty. There is, however, still room for investigation and experiment. In a new works which we have erected at Halifax, I have tried to embody all these modern ideas in a crude way. The whole of the tar and liquor formed in the hydraulic is removed at the end of the main, and does not travel with the gas at all; there is also a stream of water kept continuously running in at one end of each main to help off the tar, and there is a diaphragm placed in front of the outlet of the tar, which goes to within an inch of the bottom of the main, so as to ensure the passage of the tar. The temperature of the gas in the hydraulic main varies from 145° to 165° Fahr., and when it leaves the hydraulic it travels through a long length of foul main until it arrives near the condensers, when the tar and liquor are again taken out. The temperature here will have fallen from 10° to 20°. The condensers are on the principle known as Graham's, and the gas enters at a temperature of from 125° to 145° Fahr., without any accompaniment of either tar or liquor; but the whole of the tar and liquor which is suspended at the above temperatures, and which is precipitated as it travels through the condenser, is compelled to travel with it not only throughout the whole condenser, but also for some distance beyond. I may state also that there is no seal in the hydraulic main when the retorts are at work, as I have adopted a removable dip arrangement brought out by Mr. H. Woodall, of Leeds. Our parliamentary standard at Halifax is 14 candles by the standard burner, but we try to keep the gas we supply at from 17½ to 18 candles, and during the past five or six months we have been supplying one half the town from the new works, and the other from the old. In the old works we have used about 18 per cent. of cannel, while we have used nothing but coal in the new, and the gas from the latter place has been the better of the two. We have also had a very much larger yield of gas from the new works, but as this is in a great measure incident upon a different system of working, I will say nothing about it. I give you these particulars as bearing on the question of dealing with the tar. The results at Halifax, in the quality of the gas, have been much in excess of what I anticipated.

The question of the pulsation caused by the action of the dip-pipe in the hydraulic main, which was first raised by Mr. W. Young, of Clippens, simple as it may seem at first, is also one of great importance, and I should like to say here that I consider Mr. Young has laid the members of our profession in this country under a great obligation for the able manner in which he has devoted himself to the explosion of some of the old theories, and to the establishment of new and better ones. He has, however, been met by Mr. Patterson, who does not agree with him as to the ill effect of pulsation; but I think Mr. Patterson is in the wrong. He certainly is with regard to the extension of the pulsation to the retort, for I have often observed, on attaching a gauge to the retort-lid, an oscillation of from 2 to 3 inches; and I think if Mr. Patterson would only try his idea of a water cistern, and notice the effect on the elastic air confined within, instead of on the unelastic water, he would find a different result from that he describes. I believe that the pulsation is the one objectionable feature of the dip, and is the only thing which calls for its removal; but this is a mechanical action, and Mr. Patterson, who is exceedingly safe and trustworthy as far as the chemical action of all matters pertaining to gas manufacture go, does not seem to be quite so clear where the mechanical comes in, and it is on this point that careful attention is required. We

find that a similar result is produced at Rochdale with the St. John apparatus, by mechanical action, as is produced by heat in the Aitken and Young apparatus. At our last meeting I alluded to a fact which occurred at the Sowerby Bridge Gas-Works, where a vertical condenser was made into a horizontal condenser, and although it had before been very effectual in taking out the tar, it was not equal to it in the horizontal position, and large quantities of tar passed forward. There was the same surface—in fact, they were the same pipes in both cases. How can the difference be accounted for? In the new works at Halifax the main falls perpendicularly from one level to another a distance of about 16 or 18 feet between the condensers and the exhauster, and in that particular place there is a great precipitation of thin oily tar. All experience goes to show that vertical condensers take out the tar more rapidly and effectually than horizontal ones, for the same amount of surface, even when they do not reduce the temperature lower than is done by the horizontal. I am not prepared with any theory by way of accounting for these apparent anomalies, but think it highly probable that, when they come to be properly understood, we may, by giving intelligent direction to them, turn them to account.

From what has already been said, you will see that I regard the methods of condensation now in vogue as being somewhat crude and very imperfectly understood. Nor can I throw any new light upon the subject; like yourselves, I am to a great extent in the dark. If it were simply a question of cooling the gas down to the normal temperature, then we should have no difficulty; but as nearly the whole of those constituents which render coal gas luminous are more or less condensable, we ought to be careful in our operations, or else we may lose much of that material which we desire to retain in the gas. Of this I am quite satisfied, that very many of those condensers which are the most efficient as condensers—that is to say, which reduce the gas down to the required temperature most quickly and effectually—are the very worst you could use, and that all condensers which precipitate a large quantity of tar ought, instead of being regarded as the cream of condensers, to be looked upon with suspicion as being, to say the least of it, very questionable improvements upon the forms that they have superseded.

The subject of purification in closed vessels is one which has from time to time occupied a great deal of attention, and is one in which some progress has been made; but it is not of that sweeping character which will enable us to dispense with any of the older forms of purification. It is at best, as far as it has gone at present, merely an auxiliary. We still have to keep on with the scrubbing, and the lime or oxide systems of purification with which we have grown so familiar. What is wanted is a cheap, or, what amounts to the same thing, a profitable solution which will take up carbonic acid or sulphuretted hydrogen. When the solution is found there will be no difficulty about adapting a machine for the use of it—indeed, there are several in use now which are admirably suited for such a purpose; still, if none of these is quite the machine required, there is sufficient ingenuity in, or connected with the gas-making industry to provide one at a very early date. If our chemists will only give this subject some of their attention, it may fall to the lot of one of them to discover something which will be a great boon to us, and will mark the commencement of a new era in the history of the progress of gas manufacture.

There can be no better proof that the gas engineering profession progresses with the times than is shown by the present arrangements for storing gas. Here is a field where the mechanical element came into play, and bravely has it been worked. When we compare the vast and somewhat aerial structures of modern days, with the cramped, heavy, clumsy concerns of a few years ago, we can at least throw back the taunt that we are content to copy the structures of our fathers, instead of making new and better ones for ourselves. The engineering and constructive ability displayed in some of the modern gasholders will compare favourably with that in any other branch of industry throughout the country.

With regard to the question of leakage, I have expressed the opinion that I do not think the difference between the consumers meters and the station-meters should be taken to represent the whole sum and substance of what is good and bad in this particular, although it serves as a good and useful guide for the engineer of the works in question; still there are some engineers who may be mindful of these modern ideas of keeping the hydrocarbons suspended in the gas, whose average temperature at the station-meter may be, say, 60° Fahr., while others, who have a large proportion of the powerful condensers, may measure it at 42° Fahr. It will make a difference of about 3·66 per cent. in what is now summed up as leakage, and will be held up to the discredit of the man who is really trying to carry on his work in a scientific manner. To my mind, the place which succeeds in selling the most gas per ton of coal carbonized, the quality of coal and the quality of gas being allowed for, is the place where the leakage is the smallest.

We are to have a paper to-day giving the results of three months experience with the electric light. I will, therefore, reserve what I have to say on that subject until the discussion of the paper comes on, contenting myself for the present with this allusion to it, that, as was anticipated by many, so far from it having injured or in any way interfered with the prospects of gas manufacturers, it has not even been able to establish itself in that special field which it was said it would create. In the meantime, the business which we represent has gone on improving and increasing in such a way as to inspire us with every confidence and satisfaction. I believe that you, gentlemen, are far more likely to influence the future of gas lighting than is the electric light, or anything else that exists, or is about to exist, outside our profession. For the present the matter rests with you.

There has been much written and said about the gas manager of the future—what he should be, and what he should not be; but you see, gentlemen, it is not for us to say who shall be the gas manager of the future. We may train up a set of youths who shall be prodigies of intellectual attainment, who shall be able to pass the most rigid examination; yet those who have the appointment of them may prefer the frugal stoker after all, and our efforts may be thrown away. What we are responsible for, and what we ought at any time to be ready to give a good account of, is the gas manager of the present, and we ought so to conduct ourselves and our business that the gas manager of the future will have something to follow and to emulate, and nothing to despise.

I shall be glad to see the day—and I hope I may see it—when all gas managers will be paid by results, when each individual shall have a direct interest in the work he has in hand; I do not mean when fixed salaries will be altogether done away with. A nominal salary should always be paid, but there should be some standard of excellence, and if a manager can go beyond this, he should have some reward for so doing, and the reward should bear some relation to the effort put forth in doing it. When this plan is adopted it will, in my opinion, lead to greater confidence and more amicable relations between employer and employee.

In concluding this address, I wish to make one more appeal to you for your sympathy and support in the work of the Institution. I do not mean passive sympathy and support—that which simply pays its subscriptions and acquiesces in the work of others, but rather that active support, which will bring to you some of those blessings which it has been the burden of this address to show, in some vague way, do accrue to all creatures in this world, whatever their circle of existence may be, who endeavour to do

good. We have had numerous papers of a suggestive character read, which open out a large field for further investigation, and Mr. Newbigging, in his address a year ago, gave a good list of other subjects which may well claim our attention. I will not, however, occupy your time with repeating the list, as you have all the means of referring to it, but I would urge you to take up such subjects as you feel specially interested in or qualified to deal with. I should also like to say, particularly to managers of small works, do not be afraid of expressing what you think, or of undertaking the investigation of a subject, however large it may seem, for it is a great mistake to measure your ability by the size of the works you control. In any thing in which you can experiment you possess a great advantage over those whose duties are so multitudinous as is the case with some of our engineers, because you have a much better opportunity of concentrating your thought and your action; for in a large works any experiment covering the whole works must necessarily be entrusted to a number of people, and the result may be marred by the carelessness of any one of them. Many of you can, however, if you wish to make a special effort, have the greater part of important investigations or experiments conducted under your own eyes; so that, if you will only take the pains to notice, any observations you may make should be of proportionately greater value. Be not afraid, therefore, either to observe, or to speak of what you have observed, for it is only by each contributing what he can, however small it may seem individually, that great steps can be taken. If we all join together in this effort, we may leave the profession somewhat better than we found it, and with the infinite satisfaction of having done our duty.

The VICE-PRESIDENT (Mr. Chew) said there were many points in the address which would afford abundant scope for animated discussion. Personally he felt very much obliged to the President for the manner in which he had dealt with these questions, and he had pleasure in proposing that the best thanks of the meeting be given to him for the very instructive address which he had delivered.

Mr. PATERSON seconded the motion. He said that like all present he had listened with more than usual interest to the President's admirable discussion of the subjects which he had brought before them. He had gone over a very wide field indeed, and dealt with many questions of interest to their profession. The views brought forward were those which entirely agreed with his own sentiments and opinions in many respects. They had had a very admirable review of the destructive distillation of coal, and the peculiar characteristics manifested by the working of different coals under different temperatures. There could be no doubt at all that what he had said—viz., that there were various qualities of coal which required various modes of treatment—that was to say, all qualities of coal should not be submitted to the same temperature—was perfectly correct. If they were dealing with high-class coal, they required a less high temperature than was required for poor coal. If they took, for example, one of the best of the Lancashire coals—the Arley, which was of very good quality—the residual products were obtained from it at a very ordinary temperature; and if they took another coal of about the same quality, the composition of which was somewhat different—say, some of the South Yorkshire coals—they found that they required to treat it at a different temperature again. If they used the same temperature in both cases they would find that they only produced from the Yorkshire coal a large quantity of tar and liquor, at the expense of the other constituents which went to make up coal. In his own experience he had found that in the distillation of Yorkshire coal it was not possible to destroy the illuminating power by high temperature. The higher he had the temperature, the larger the production of gas, and the better the results obtained. This rather tended to refute the theory that the quality of the gas was obtained at the expense of the quantity. With regard to the choking of the ascension-pipes, he was not sure that this was not to be attributed to the same cause—viz., that they distilled all coals at the same temperature. In working poor coal at the same temperature as high-class coal, they gave rise to a large quantity of very heavy hydrocarbons, which were deposited upon the pipes as they came in contact with them; so that it was really when they were using poor coals at a high temperature that they were liable to have these stoppages in ascension-pipes. The President had also referred to regenerator furnaces. He (Mr. Paterson) confessed he was not in a position to speak either for or against them. So far as his information went, it was altogether in favour of them; but in constructing works which they were at present putting up in Warrington, he had not ventured, without more knowledge than he possessed, to adopt them, though he had no doubt that some system of the kind would be an improvement upon the present mode of heating. The question of condensation had also been referred to by the President, and it was one of very great importance to the profession. It was one that had given rise to a great deal of discussion, and certainly refuted the notions hitherto entertained. From his own experiments he found that keeping the gas in contact with heavy tars robbed the gas of several of its hydrocarbons. He was disposed to believe with Mr. R. H. Patterson that it was desirable to get quit of the heavy tar as soon as possible. In the arrangement he was making now he was disposed to do this, and should not allow the gas to come into contact with the heavy tar at all. But while he objected to the gas and heavy tar going together, he had no objection to the gas and thinner liquid tar going together, because he thought it was possible they might have some of these liquids converted into gas. He was not prepared to offer any information as to the different methods of condensation. At the present moment they were altogether in the dark. They had been going on the principle of putting down a series of pipes for the purpose of condensation, but they had no scientific idea or system in doing so. Now the process he was adopting, and he thought it came as near as possible to the principle of what he conceived to be a good condenser, was Cleland's slow-speed condenser, with some modifications which would be carried out. With regard to the Rochdale washer and condenser, he did not hold with the President that, in adopting it, the process was reversed, because there the heavy tar fell to the bottom. It was the liquid hydrocarbons with which the gas came in contact, and the gas did not touch the heavy hydrocarbons, so that really the argument of the President in the Rochdale case did not, he thought, apply. With these observations he had pleasure in seconding the motion.

Mr. CLARKE thought it was an unusual course to have any discussion on the President's address. He believed they would withdraw from the effect of the address if they began to discuss it; and at least, if it was the intention of the members to enter into a discussion, the President ought to have timely notice of the fact.

The proposition was then put and carried with cheers.

The PRESIDENT said he was much obliged to the members for their vote of thanks. He did not expect that all would agree with everything he had said. He might remark, with regard to the discussion, that it was usual to move a vote of thanks, and to mention incidentally anything which occurred to the members, and he wished it to be understood that he did not take exception to any of the remarks that had been made. He thought it was perfectly in order for anybody to make observations, though it was not usual to call upon the meeting to discuss the address.

Mr. VEEVERS (Dukinfield) said that he considered the address a quarry from which members could take many valuable stones, and he might state at once that he would take a stone, and read a paper at a future meeting on making gas from various descriptions of coal at different temperatures.

[The report of the subsequent proceedings we reserve till next week.]

REDHILL GAS COMPANY.

The Twentieth Annual Meeting of this Company was held on Friday, Feb. 20, when the following report of the Directors, on their operations during the past year, was submitted:—

The reduction in the price of gas, referred to by your Directors in their last report, took effect on the 1st of April last, and they are pleased to be able to report that the consequent diminution in the rental of the Company has been already to some extent recovered by the increased consumption. They are thereby encouraged to hope that at no very distant period they may be in a position to consider the propriety of a further reduction.

An additional holder, for providing the necessary increase in the storage capacity of the works, is being proceeded with as rapidly as the state of the weather will permit. The castings are now in course of delivery on the works, and the Directors anticipate that the holder will be completed and in working order early in the autumn.

The continuous increase in the business of the Company has rendered necessary the remodelling of the works, and also considerable additions to, and improvements in the plant and machinery. These important matters are receiving the careful attention of your Directors, who are also maintaining the entire property of the Company in a good state of repair.

After much consideration, your Directors resolved to offer *pro rata* amongst the Shareholders the remaining 3700 unissued shares in the capital of the Company. The whole of these shares were at once applied for and allotted, and the first call thereon has been paid.

The net profit on the working of the past year amounts to £3510 1s. 5d., out of which the Directors recommend that a dividend, free of income-tax, be declared on the paid-up capital of the Company of 10 per cent., with the addition of a bonus of 2 per cent. upon so much of the capital as was subscribed prior to Jan. 1, 1874, towards making up the deficiency in the dividend paid thereon below the statutory rate in antecedent years. An interim dividend of 5 per cent. was paid in September last, leaving 5 per cent. in addition to the before-mentioned bonus, to be paid, and a balance of £378 1s. 5d. to be carried forward.

The total share and loan capital of the Company is £27,950—viz., £26,700 of 10 per cent. shares, and £1250 of debenture bonds. The outlay on capital account, including £1623 expended last year, is £30,344; but through £2155 having been received in anticipation of calls on the additional capital, the balance against the account is only £289. After the balance of the annexed revenue account has been carried to profit and loss account, the interest on debentures met, and £300 carried to reserve-fund (which will then amount to £2275), there will be £3510 available for dividend on the ordinary stock of the Company. During last year, 3456 tons of coal were carbonized.

Dr. Revenue Account, for the Year ending Dec. 31, 1879.				Cr.	
Coals, including all expenses	£2891	14	1	Sale of gas—	
Purifying materials, &c.	114	4	0	Private rental,	
Wages at works	356	11	9	811,800 cubic	
Repairs and maintenance of				feet at 5s. 6d.	
works and plant	391	6	5	per 1000	£223 4 5
	£3753	16	3	Ditto, 7,432,500	
Less old material sold	13	3	0	cubic feet at	
	£3740	13	3	5s. per 1000	1858 2 6
Repair, maintenance, and re-				Ditto, 12,673,300	
newal of mains and service-				cubic feet at	
pipes	255	15	10	4s. 6d. per 1000	2853 2 0
Repairing & renewing meters	7	17	3	Public lighting	
Lighting and repairing public				and under	
lamps	161	10	11	contracts	1787 19 3
Rents	10	0	0	Rental of meters	£6722 8 2
Rates and taxes	177	19	9	Service-pipes, fittings, &c.	220 15 1
Directors remuneration	300	0	0	Residual products—	111 5 6
Salaries of Secretary, Clerks,				Coke	£962 14 0
&c.	409	9	0	Broeze	91 4 10
Stationery and printing	25	1	6	Tar	358 7 11
General establishment charges	79	14	10	Ammoniacal	
Auditors and Accountants fees	16	16	0	liquor	205 8 7
Bad debts and allowances	7	7	9		1620 15 4
Tubes, fittings, and sundries	96	9	4	Rents	126 16 6
	£5288	6	5	Transfer fees	0 16 2
Balance	3551	11	10	Sundry goods	4 1 6
	£8839	18	3		£8839 18 3

WOLVERHAMPTON GAS COMPANY.

The Fifty-sixth Half-Yearly Meeting of this Company was held on Tuesday, the 24th ult.—Mr. J. UNDERHILL in the chair.

The SECRETARY (Mr. A. Jones) read the following report:—

Your Directors have much pleasure in presenting their fifty-sixth half-yearly balance-sheet and statement of accounts, duly certified by your Auditor, showing the revenue for the half year ending Dec. 31 to be £26,518 1s. 5d., and the expenditure £20,608 3s. 7d., leaving a balance of £5909 17s. 10d., which, added to the balance of last account, amounts to £7132 10s. 9d. From your Directors recommend the payment of a 5 per cent. dividend upon the consolidated stock, and 3 per cent. (less income-tax) upon the paid-up capital of the preference shares.

Your Directors have considered the recently published accounts of the working of the Birmingham Corporation Gas-Works in comparison with the results of the working of the Wolverhampton Gas-Works during the last year. The production of gas in Birmingham was, in round figures, 2645 million cubic feet, as against 364 millions in Wolverhampton, and the cost of manufacture and distribution was £321,803 in Birmingham, as against £39,048 in Wolverhampton. From this it will be seen that both quantity and cost in Birmingham were about eight times as great as in Wolverhampton. The revenue in Birmingham was £464,064, as against £50,024 in Wolverhampton, or upwards of nine times as great as here. The tariff in Birmingham ranges from 2s. 6d. to 4s. 3d. per 1000 cubic feet, in Wolverhampton the uniform price is 2s. 6d. If the same prices were charged in Wolverhampton as in Birmingham, the Wolverhampton revenue would show a considerable increase.

At this meeting three of your Directors retire by rotation—viz., Mr. Ironmonger, Mr. Fowler, and Mr. Savage, but offer themselves for re-election. Your Auditor, Mr. Smith, also retires, but offers himself for re-election.

In conclusion, your Directors beg to assure you they will continue to devote their best attention to the interests you have committed to their care.

The CHAIRMAN, in moving the adoption of the report, said that it and the balance-sheet were, as they had been regularly for many years past, satisfactory. Nothing calling for special comment had occurred in the working of the concern during the half year, but he thought that, owing to the improvement of the mains and other things, which had been mentioned at their meetings from time to time, they had had fewer complaints of the quality or the quantity of gas supplied than they usually had at this time of the year. They had in the report made a comparison of the working of the Birmingham Corporation Gas-Works and their own works. They found that the production of gas in Birmingham was about eight times as much as in Wolverhampton, while the cost of manufacture was about eight times as much. The latter was a feather in their cap, because every one knew that where there was a larger return the article ought to be produced at a smaller price. In Birmingham the charge for gas ranged from 2s. 6d. to 4s. 3d. per 1000 feet; whereas the Directors of the Company, after long consideration, had seen no reason to alter their

custom of charging a uniform rate to everybody, whether great or small consumers. The plan had given general satisfaction throughout the borough, and until a very strong feeling rose up in opposition to it among the Shareholders, they could not do better than continue it. Four towns in England had been mentioned as selling gas at an equally low, or a lower rate than it was sold in Wolverhampton—viz., Walsall, Plymouth, Sunderland, and Sheffield. He thought, however, they could not institute comparisons with Walsall, because there the works were in the hands of the Corporation, whose capital required an infinitesimal amount of interest, and the undertaking could not be set on a level with one which had to pay dividend. In Plymouth the price of gas was 2s. 3d. per 1000 feet, but the light supplied was that of only 14 candles, which was very much lower in quality than that supplied here. In Sunderland the price ranged from 2s. 4d. to 2s. 10d. per 1000 feet, giving as the mean price 2s. 7d., the figure charged in Wolverhampton. While at Sheffield, a place almost as large as Birmingham, there were two prices of 2s. 4d. and 2s. 8d. per 1000 feet. Taking all the circumstances into consideration, therefore, there was not a town in England or the United Kingdom which could compare with Wolverhampton in the matter of gas and its price. Notwithstanding this, however, the Directors thought it was their duty, in the interests of the consumers and the public, to make a further reduction in the price as soon as possible, and if their contracts for coal were carried out satisfactorily, and the sale of residual products went well during the ensuing half year, they hoped to be able in their next report to recommend a reduction.

Mr. OWEN seconded the motion.

In reply to observations of Shareholders,

The CHAIRMAN said he had no doubt that if there was a general wish among the Shareholders to that effect, the Directors would order the report to be printed. He himself saw no objection to such a course. The cost of the land for the new offices that were being built was about £4000, and the buildings would cost rather more than this amount. Against it, however, they would have two shops to let off, and would save the rent of their present offices; they would have greater facilities for carrying on their fitting business, more space for show-rooms, and altogether they would be much better able to carry on their business, and in a very few years they would show a considerable profit on the new buildings.

The motion was then put and adopted, and the dividends as recommended were declared.

The retiring Directors, as also the Auditor, were re-appointed, and votes of thanks were accorded to the Directors, to Mr. J. Annan (the Engineer), and the other Officials of the Company.

READING GAS COMPANY.

The Half-Yearly Meeting of this Company was held on Monday, Feb. 24, when the Directors, in presenting the accounts for the six months ended Dec. 31, 1879, recommended the payment of maximum dividends on all the stocks and shares of the Company. The report continued: "The great increase in the Company's business (the make of gas having, since the passing of the Act of 1870, doubled in 7½ years), and the growing prospect of still greater increase, has forced upon your Directors the absolute necessity of extending the works of the Company. The whole of the present site of the works in King's Road being covered, an application to Parliament in the present session became necessary, to enable the Company to acquire more land, construct additional works, and raise the capital required for these purposes. Your Directors have been able to secure the land for the site of the proposed extension, and have made such arrangements with the Urban Sanitary Authority and others as will secure the Bill from opposition. The plans deposited with the Bill have been prepared by Mr. Baker, the Company's Engineer. Mr. Baker's management of the works continues to be highly satisfactory; the loss of gas by condensation, waste, &c., being still further reduced."

The capital of the Company consists of £20,000 of 8 per cent., and £5000 of 5 per cent. stock; £5000 of 6 per cent. preference shares; £36,000 of 7 per cent. shares; and £12,000 of mortgage bonds at 4, 4½, and 4¾ per cent. There has also been received £5990 from premiums on the sale of shares. The whole of this amount of £83,990 has been expended, except £54. The profit and loss account shows a balance of £11,833 to meet the dividends declared at the meeting, which amount to about £2300. The Company have a reserve-fund of £6000, and a contingency-fund of £1551. During last half year 7917 tons of coal were carbonized.

Dr.	Revenue Account, for the Half Year ending Dec. 31, 1879.	Cr.
Coals delivered	£6,783 16 11	
Purifying materials	74 7 5	
Salaries, &c.	332 10 0	
Wages	1,500 2 5	
Repairs and maintenance of works and plant	2,494 14 6	
Salaries of Inspectors	52 4 0	
Repair, maintenance, and renewal of mains and service-pipes	911 0 8	
Repairing, renewing, and refixing meters	721 1 4	
Lighting, &c., public lamps	241 2 8	
Rates and taxes	582 6 6	
Directors' allowances	125 0 0	
Salary of Secretary and for offices	125 0 0	
Collectors' commission	294 13 5	
Stationery, printing, &c.	63 13 0	
General establishment charges	192 15 2	
Auditors' fees	39 10 0	
Contingency-fund	390 0 0	
Bad debts	59 6 6	
Total expenditure	£14,957 4 6	
Balance	3,250 18 3	
	£18,208 2 9	£18,208 2 9

CORK GAS CONSUMERS COMPANY.

The Twenty-second Half-Yearly Meeting of this Company was held on Monday, Feb. 23—Mr. T. MAHONY in the chair.

The SECRETARY (Mr. Denny Lane) read the following reports:—

Directors' Report.

The accounts for the past half year, which we now lay before you, will, we hope, prove satisfactory. In the private rental there is an increase of £600 over that received in the corresponding period of 1878, while the revenue from public lamps shows a small decrease.

We have been very fortunate in being able to secure exceptionally low freights for coal. The importance of this saving may be estimated, when you remember that 1s. a ton in the cost of coal is more than £1000 a year. We have also been enabled to dispose of our residuals on advantageous terms.

The renewal of service-pipes has been continued, and in every case they have been covered with a preparation of asphalt. The fact that we had to break many connections in doing this work has, of course, caused some waste of gas; but a beneficial result of the renewals is already shown in a considerable diminution of the gas not accounted for. We will continue the course we have hitherto adopted until this cause of loss is reduced to the minimum which is possible under the conditions of this locality.

We have added a small sum to the insurance-fund, and also increased the depreciation-fund, which is not large enough for plant so long in use as yours. As we do not see any prospect of receiving dividends out of the estate of Bowles Brothers, which has been so long in liquidation, we have written off the amount of £138 4s. appearing under this head as a suspense account.

In view of the general depression and consequent risk which all traders incur at present in this country, we have added to the reserve for bad debts and allowances, which we trust will be sufficient to cover any loss under these heads.

The balance of profit and loss remains at £6321, and out of this we recommend the usual dividend to be paid, which will absorb £5416, and leave £906 to be carried to reserve.

We have so lately consulted you on the Bill which we have promoted in Parliament, and which has met with your unanimous approval, that we deem it unnecessary to make any further remark on the subject.

Engineer's Report.

To the Directors of the Cork Gas Consumers Company.

Gentlemen,—I beg to report that I inspected the works last October, and again last week. Extensive repairs have been made in No. 4 gasholder, one of those received from the Old Company, which will make it serviceable for many years. A considerable addition has been made to the tanks for storing tar and ammoniacal liquor, and to the workshops, which will enable the department of general stores to be better and more conveniently arranged. The extra attention, by asphaltting and renewing service-pipes, begins to tell favourably on the leakage account, and must be continued, especially on the pipes received from the Old Company. There has been ample means throughout the winter to produce an abundant supply of good gas. The works have been kept in an efficient state, and call for no particular remark.

(Signed) GEORGE ANDERSON.

London, Feb. 14, 1880.

Dr.	Capital Account, Dec. 31, 1879.	Cr.
Share capital of the Company	£150,000 0 0	Amount paid on shares £135,413 0 0
Debentures	20,000 0 0	Ditto debentures 20,000 0 0
		Uncalled capital and shares not registered 14,397 0 0
		Due by Shareholders on registered shares 190 0 0
	£170,000 0 0	£170,000 0 0
Dr.	Revenue Account.	Cr.
Coals	£7,118 2 7	Rental—
Labour	2,858 8 10	Sept. quarter £4,965 2 1
Wear and tear	2,423 13 11	Dec. ditto 11,854 19 3
Purifying materials	72 3 6	
Water and gas at works	115 1 11	Public lighting—
Public lighting	296 11 1	Sept. quarter £786 12 5
Salaries	980 16 8	Dec. ditto 1,284 2 10
Rents	152 0 6	
Rates	1,229 7 0	Residuals 2,070 15 3
Advertising and stationery	51 11 7	Transfer fees 4 5 0
Office expenses	148 11 0	
House and office repairs	30 10 4	
Auditors	20 0 0	
Directors	175 0 0	
Profit and loss	8,778 11 8	
	£24,480 10 7	£24,480 10 7

The CHAIRMAN moved that the report and statement of accounts be adopted. He said he considered that all the Shareholders ought to be satisfied with the results which they exhibited. In reference to the working of the sliding scale proposed in the Company's Bill now before Parliament, he explained the advantages which the consumers of gas would gain by it over the Shareholders, saying that 1 per cent. on the Company's paid-up capital would amount to £1300, whilst 1d. reduction per 1000 feet of gas amounted to about £700; therefore, before they could increase the dividend 1 per cent. (£1300), they would have to make a reduction to the public of 4d. per 1000 feet, which would amount to £2800. As to the quality of their gas, the illuminating power they were bound to give was 14 candles, and that they did give it was secured by the fact that the Corporation daily tested the gas, and they themselves tested it twice a day at the office and also at the works. There was a rule that it should be tested twice a day, but he need hardly tell them the Manager of the works (Mr. T. Travers) did not limit himself to two tests, he tested constantly. If they did not keep up the illuminating power they were bound to do, they would have had complaints; but, as a matter of fact, they had none. In regard to the reserve-fund, which their Act of Parliament permitted them to put by, in order that they might be able to keep up their dividend to 8 per cent., they were allowed to reserve more than £18,000 for the purpose of assimilating and equalizing their dividends. Supposing, as might happen, the profits made did not admit of their dividing 8 per cent. at any time, they were allowed to supplement the profits out of the fund. So that the fund belonged to the Shareholders and not to the consumers; but by the Bill which they were promoting in Parliament, with the consent of the Shareholders, they proposed to divide a portion of the reserve-fund with the consumers, who would receive in the proportion of two-thirds to every one-third the Shareholders could take. However, threatened as the Company were with opposition from more quarters than one, the Directors deemed it unwise at present to enter upon the discussion of questions that might interfere with their subsequent proceedings in Parliament. Such discussion might possibly prove injurious, and it could do no good in any way.

Mr. BRESNAN seconded the motion, which was agreed to.

Alderman KELLER thought the difference between the Company and the Corporation could be very well settled in Cork, and it was not necessary to go to the expense of opposing the Bill before a Committee of the House of Commons.

Mr. B. J. ALCOCK moved that a dividend at the rate of 8 per cent. per annum be declared for the half year ending Dec. 31, 1879, on the paid-up capital of the Company.

The Rev. Mr. DELACOUR seconded the resolution, which was passed unanimously.

Mr. WILLIAM HARRINGTON having been moved to the second chair,

Mr. J. T. LAMERTE proposed a cordial vote of thanks to the Chairman. They must, he said, all feel deeply indebted to him for the lively interest he had always taken in the affairs of the Company; and they were perfectly safe under the guidance of Mr. Timothy Mahony and the Board of Directors.

The resolution was carried unanimously; and the CHAIRMAN having acknowledged the vote, the proceedings terminated.

BRIGHTON GASLIGHT AND COKE COMPANY.

The Half-Yearly Meeting of this Company was held at the London Offices, Moorgate Street Chambers, E.C., on Thursday, Feb. 26, when the following report was presented:—

The working of the past six months shows that the re-adjustment of the mains and addition to the plant at Black Rock have been both necessary and remunerative. Notwithstanding delay caused by unprecedentedly bad weather, all the material alterations were concluded before the extreme demand for gas commenced; not, however, without entailing extra expenditure, which, under the circumstances, was unavoidable.

A steady increase in the demand for gas continues, and it is a matter for congratulation that the Preston district, which is now being largely built over, has every facility for being supplied with any quantity of gas it may require.

The Directors recommend the declaration of a dividend on the paid-up capital of the Company of 5 per cent. for the half year ending Dec. 25 last, less income-tax.

The death of Mr. P. Bunnell, who was for many years a Director of the Company, has caused a vacancy at the Board, which has been filled up by the appointment of Mr. Michael Sarson, one of the Auditors.

Dr. Profit and Loss Account, for the Half Year ending Dec. 25, 1879.				Cr.			
Coals	£12,999	12	9	Gas and meter rental	£24,006	1	0
Coal insurance	250	0	0	Coke, &c.	4,830	6	1
Contingency-fund	400	0	0	Interest and discounts, and			
Materials for purification	334	9	0	old stores, &c.	121	12	10
Wages	2,531	12	7				
Rent, rates, and taxes	420	8	8				
Salaries, Collectors commis-							
sion, Directors, & Auditors	1,437	18	11				
General charges	216	7	4				
Wear and tear	4,469	17	11				
Bad and doubtful debts and							
allowances	150	0	0				
Law and parliamentary	200	0	0				
Balance	5,547	12	9				
	£28,957	19	11		£28,957	19	11
Balance-Sheet, Dec. 25, 1879.							
Capital	£110,800	0	0	Expended on works	£97,166	0	5
Contingency-fund	6,375	12	6	Works in progress	5,723	0	0
Depreciation account	1,977	3	11	Meters	2,322	3	3
Coal insurance account	2,498	17	1	Coal, coke, &c., in stock	2,351	2	8
Dividends unpaid	2,178	4	3	Mains, service-pipes, and			
Tradesmen's accounts, &c.,				general stores in stock	1,652	14	8
owing	4,715	18	7	Sundry debtors for gas	16,220	12	4
Profit and loss balance—				Ditto for coke, &c.	2,663	7	9
From last half				Cash at bankers and in hand	6,781	1	6
year	£789	13	6				
This half year,							
as above	5,547	12	9				
	£134,883	2	7		£134,883	2	7

BARNET DISTRICT GAS AND WATER COMPANY.
The Half-Yearly General Meeting of this Company was held at the Guildhall Tavern, Gresham Street, on Friday, the 27th ult.—J. F. BONTENS, Esq., in the chair.
The SECRETARY (Mr. Alfred Lass) having read the notice convening the meeting, the following report was presented:—
The Directors beg to submit to the Proprietors the accounts for the half year ending Dec. 31 last.
The balance of the profit and loss net revenue account amounts to £3827 9s, out of which the Directors recommend the declaration of a dividend, free of income-tax, for the half year ending Dec. 31 last, at the rate of 5 per cent. per annum on the A stock and shares, and 4 per cent. per annum on the B stock.
The gas-rental for the last half year has amounted to £4984 2s. 3d., which shows an increase of £392 12s. 8d. on the corresponding period of last year. The water-rental has amounted to £2829 0s. 2d., which shows, on the same period, an increase of £333 9s. 10d.
The retiring Directors are James Glaisher, Esq., F.R.S. (Deputy-Chairman), and William Joslin, Esq., who, being eligible, offer themselves for re-election. The retiring Auditor is Mr. F. Lennard, who, being eligible, offers himself for re-election.
The Directors have to report that a reduction of 3d. per 1000 cubic feet will be made, on and after April 3, 1880, to those consumers who are now charged 6s. per 1000 cubic feet.

[The capital of the Company consists of £116,690 in shares, and £20,140 of mortgage bonds—£136,830 in all, and the capital account shows that £2183 has been expended beyond this amount. During the past six months £171 additional has been laid out on the gas-works, and £3602 on the water-works, making with the previous outlays £70,875 and £68,137 respectively. The balances of the subjoined revenue accounts, added to the amount brought forward from the previous half year (after paying dividends), and £33 received for fittings, leave £4498 to meet interest on mortgages and temporary loans. These absorb £671, leaving (as stated in the report) £3827 applicable to dividend on the ordinary stock and shares.]

Dr. Gas Revenue Account, for the Half Year ending Dec. 31, 1879.				Cr.			
Coals	£1489	8	5	Sale of gas—			
Purifying	64	6	7	Private rental	£4678	15	0
Salaries of Engineer, &c.	100	0	0	Public lighting	305	7	3
Wages	296	6	8				
Repair and maintenance of					£4984	2	3
works and plant	526	9	11	Rental of meters		107	2
Salaries of Inspector & Clerks	129	11	8	Residual products—			
Repair and maintenance of				Coke	645	14	1
mains and services	79	8	9	Breeze	14	4	5
Repairing & renewing meters	60	4	3	Tar	114	8	5
Lighting and repairing public				Sulphate account	27	15	4
lamps	89	2	7	Rent account	21	0	0
Rent	3	10	0				
Rates and taxes	89	1	4				
Directors allowances	100	0	0				
Salaries of Secretary and Ac-							
countant	83	6	8				
Collector's commission	33	5	5				
Stationery and printing	33	7	6				
General establishment charges	62	13	4				
Auditor's fees	9	11	8				
Law charges	2	12	6				
Bad debts and allowances	15	12	7				
	£3298	9	10				
Balance	2618	17	1				
	£5917	6	11		£5917	6	11

Dr. Water Revenue Account, for the Half Year ending Dec. 31, 1879.				Cr.			
Coals	£323	1	10	Sale of water	£2829	0	2
Wages	173	9	11	Rents	16	5	0
Repair and maintenance of							
works and plant	429	4	5				
Salaries of Inspector & Clerks	25	16	8				
Repair and maintenance of							
mains and services	74	5	7				
Salaries of Engineer, &c.	50	0	0				
Rent	14	11	8				
Rates and taxes	89	1	4				
Directors allowances	50	0	0				
Salaries of Secretary, Ac-							
countant, &c.	41	13	4				
Collector's commission	36	7	7				
Stationery and printing	33	7	6				
General establishment charges	62	13	4				
Auditor's fees	1	6	3				
Law charges	8	12	9				
Bad debts	16	15	0				
	£1431	7	2				
Balance	1413	18	0				
	£2845	5	2		£2845	5	2

The CHAIRMAN: It is now my business to move the adoption of the report and balance-sheet, and in doing so I shall not have occasion to detain you many minutes. I have made a few comparisons between the results of the last half year's business and those of the business of the corresponding period of 1878, and I find that the balance of profit is £3827 in the past half year, while at the same period of 1878 it was £2778, so

that the increase is £1049. Comparing the same periods, the increase of the gas-rental is £392, and that of the water-rental £333; so that the total increase of revenue in the past half year, as compared with 1878, is £725. This has enabled us to spend the necessary amount in improving our works, and leaves us with our prospects for the future in a better position than they were twelve months ago. I have looked carefully through the expenses of management, and I cannot find in them any increase upon which it is necessary for me to remark, or which is likely to cause any question to be raised at this meeting. The expenditure on capital account during the half year has been £171 on the gas account, and £3602 on the water account. In one sense we all regret the necessity for such a continual and rapid expenditure of capital, but it arises from the extent of our district, and the necessity that exists for laying down pipes to supply both water and gas—but chiefly water—to new buildings which are constantly rising up, and also to new customers residing in old buildings; so that while, in one sense, we regret the increase in our expenditure on capital account, we have to be satisfied that we can get the capital when we want it, and use it so as to improve our rental, as we have hitherto done. I am happy to say that considerable building operations are going on, and are likely to go on, in our district in the coming year. The British Land Company, of which I am Chairman, have purchased at Finchley a large estate, which is filling very fast, and no doubt a great many buildings will be erected this year, and bring us a large number of fresh customers. Mr. Lass has taken the trouble to give me some statistics showing the increase in our gas and water rental, as compared with five years ago. These figures show that the gas-rental has increased since 1874 from £6222 to £9131, or 46½ per cent., and the water-rental from £2592 to £5450, or 110½ per cent., so you see we are proceeding at a very encouraging rate. As to the employment of our capital—what we have done with it in order to make it profitable for the future—these figures will, I think, satisfy you that we have done very well in this respect. Five years ago, we had one well with two 6-inch pipes, and the daily water supply was 120,000 gallons. Now we have two wells, with new machinery in both, that in No. 1 well being now nearly completed, and the yield of the two wells will be 1,000,000 gallons a day; so that we have increased our water supply from 120,000 to 1,000,000 gallons a day. This will be satisfactory to you, as showing that your capital has not been badly expended; and the information will also be acceptable to our customers, because it will convince them that they have no need to be afraid of having an insufficiency of water. I now move that the report and balance-sheet be adopted.

The DEPUTY-CHAIRMAN (Mr. J. Glaisher, F.R.S.) seconded the motion.
Mr. J. RANDALL said he noticed in the item of residual products that ammoniacal liquor had been manufactured into sulphate of ammonia, and he wished to know how long the Company had manufactured sulphate.

The ENGINEER and MANAGER (Mr. T. H. Martin) said they had manufactured it for about twelve months.
Mr. RANDALL said the return was £27, which would only represent about 1½ tons of sulphate, at the current price. The quantity made ought to be stated in the accounts. He presumed that against the sulphate account there was a debit for acid that was not shown. Taking their tonnage of coal—1874 tons—they should have had considerably more for the sulphate account.

Mr. MARTIN said the reason there was so small an amount of sulphate was owing to their apparatus not being in order. Then they had very large storage for liquor—sufficient for twice the quantity of coals they were carbonizing.

Mr. H. P. STEPHENSON said if the Company had ammoniacal liquor in stock they would, no doubt, have taken credit for it in stock. Probably 15 or 16 cwt. of sulphate of ammonia ought to be produced for every 100 tons of coal. The usual way was to deduct the cost of manufacture before the amount was shown in the balance-sheet, and he presumed this was done in the present accounts. He hoped, as the manufacture had been in operation only a short time, the Company might look for a considerable amount of improvement in the item.

Mr. LASS stated that the stock of liquor had been duly credited, and was included in the balance-sheet.

Mr. SPORNE said there was no doubt that next year they would have far better returns. He supported the adoption of the report, believing it to be the best which had ever been presented to the Shareholders, and he was sure they could but congratulate the Directors, the Manager, and all concerned on the prosperous condition in which the Company found themselves. All they now wanted was a great many more customers in their large district, and there was no doubt the Company bade fair to be one of the leading Companies in the environs of the Metropolis.

Mr. LONDON thought that the valuable statistics prepared by Mr. Lass and quoted by the Chairman should be printed, as the information they afforded was, he thought, something on which the Company might congratulate themselves.

The CHAIRMAN: We always send a report of the proceedings of the meeting to the Shareholders, and in that report will be included the figures I have quoted.

The motion for the adoption of the report was put, and carried unanimously, and the dividends therein recommended were declared. It was also resolved that the next meeting of the Company should be held at Barnet.

The CHAIRMAN then proposed the re-election of the retiring Directors (Mr. J. Glaisher and Mr. Joslin), both of whom, he said—the former as an eminent scientific man, and the latter as a resident in the neighbourhood of Barnet—took a great deal of trouble in promoting the interests of the Company.

The motion was carried unanimously.
Mr. GLAISHER, in responding, thanked the Shareholders for again placing him in what he considered to be a position of trust. Up to this time he thought he might fairly say he had done the best he possibly could to advance the interests of the Company, which he believed would in the future occupy a high position. In five years they had increased their gas-rental by nearly 50 per cent., and their water-rental by 110 per cent., and he hoped, if they went on progressing, what he had said would be realized.

Mr. JOSLIN having briefly returned thanks for his re-election, the retiring Auditor (Mr. Lennard) was re-appointed.

Some conversation then took place as to the remuneration of the Directors, and it was at length resolved unanimously, on the motion of Mr. PLUMMER, seconded by Mr. LONDON—"That the remuneration of the Directors be increased from £300 to £400 per annum." A further resolution was passed increasing the Auditor's remuneration from 7½ to 10 guineas.

The CHAIRMAN returned thanks on behalf of the Directors, adding that as it was always gratifying to them to express their satisfaction with the conduct of the staff, he had much pleasure in asking the Shareholders to give a vote of thanks to the Secretary (Mr. Lass), the Engineer (Mr. Martin), the Collector (Mr. Wright), and the staff generally.

Mr. LASS and Mr. MARTIN having responded, the proceedings closed with a vote of thanks to the Directors.

BLACKBURN CORPORATION GAS SUPPLY.

The balance-sheet of the Blackburn Corporation Gas-Works, for the year ending Dec. 31 last, has just been issued. It is accompanied by the following report and working statement prepared by the Engineer and Manager (Mr. S. R. Ogden):—

To the Chairman and Members of the Gas Committee.

Gentlemen, I have the pleasure of laying before you the annual statement, showing the result of the working of your gas-works for the year ending Dec. 31, 1879.

I am happy to inform you that the No. 2 works are in good condition, and when the new purifiers and other improvements you have contracted for are completed, I am confident they will give you satisfaction as regards the better purification of the gas.

In respect to the No. 1 works, they are in good working order, having been thoroughly repaired and not much used during the present season, consequently they will not require much outlay during the next year.

Considering the great outlay on revenue account for the laying of larger mains, new beds of retorts, increase of rates, and also the depressed state of the trade of the district, I am sure you will be pleased to hear of the result of our operations for the year being so satisfactory.

I also enclose for your perusal my working statement for the year 1879.

(Signed) S. R. OGDEN, Engineer and Manager.

WORKING STATEMENT FOR THE YEAR ENDING DEC. 31, 1879.

Gas made, as per station-meter.	317,547,000 cubic feet.
Gas sold to private consumers.	261,146,200 cubic feet.
Gas sold for public lighting.	20,700,300 "
Gas used on the works.	2,563,300 "
	284,409,800 "

Unaccounted for 33,137,200 cubic feet.

Or 10·4 per cent.

Capital employed—

Share capital.	£238,035 0 0
Loan ditto.	96,144 10 0

Total. £334,179 10 0, or £11 3s. 7½d. per ton, or £1 3s. 9½d. per 1000 feet sold.

Coal carbonized—

Common.	23,322 tons = 78·06 per cent.
Cannel.	6,564 " = 21·94 "

29,886 tons.

Illuminating power required by the Act.	16·00 candles.
Illuminating power supplied.	17·70 "
Gas made.	317,547,000 cubic feet.
Gas made per ton.	10,625 "
Gas sold.	281,846,500 "
Gas sold per ton.	9,430 "
Gas sold per cent. on make.	88·75 "
Used at works and offices.	2,563,300 "
Used at works and offices, per cent. on make.	80 per cent.
Gas unaccounted for.	33,137,200 cubic feet.
Gas unaccounted for, per cent. on make.	10·43 per cent.
Coke made.	17,930 tons.
Coke used for fuel.	6,974 "
Coke used for fuel, per cent. on make.	38 per cent.
Average price of coke sold.	5s. 2·9d. per ton.
Tar made, 1770 tons = at 200 gallons per ton.	354,000 gallons.
Tar made per ton of coals.	11·84 "
Average price of tar per gallon.	2½d.
Liquor made, 3226 tons = at 220 gallons per ton.	709,720 gallons.
Liquor made per ton of coals.	233 "
Average price of liquor per 1000 gallons.	91s. 6½d.
Net proceeds of coke and other residuals per cent. on cost of coal.	53·33 per cent.

	£	s.	d.	£	s.	d.	Cost per 1000 Cubic Feet Sold.	Cost per Ton of Coal Carbonized.
Coal	—	—	—	19,203	5	3	—	16 3s.
Less residuals—	—	—	—	—	—	—	—	12 10 2½
Coke	2,871	9	4	—	—	—	2·41	1 11·06
Tar	3,342	10	2½	—	—	—	3·02	2 1·45
Liquor	3,248	13	8	—	—	—	2·77	2 2·08
Spent lime	2	19	0	—	—	—	—	0 0·02
	—	—	—	9,665	12	2½	8·23	6 5·61
Net for coals.	—	—	—	9,537	13	0½	8·12	6 4·60
Purifying.	361	1	0	—	—	—	0·31	0 2·89
Salary of Engineer.	600	0	0	—	—	—	0·51	0 4·85
Wages at works.	4,796	6	11	—	—	—	4·08	3 2·51
Repairs and maintenance of works.	3,851	3	1	—	—	—	3·28	2 6·92
Salaries of Meter Inspectors.	585	11	0	—	—	—	0·50	0 4·70
Repairs of mains and services.	1,736	2	8	—	—	—	1·48	1 1·94
Repairing, renewing, and refixing meters.	1,337	17	3	—	—	—	1·13	0 10·74
Rents.	490	18	0	—	—	—	0·42	0 3·94
Rates and taxes.	5,097	10	9	—	—	—	4·34	3 4·93
Salary of Chief Clerk and Office Clerks.	564	4	2	—	—	—	0·48	0 4·53
Collector's salary.	400	0	0	—	—	—	0·34	0 3·22
Stationery and printing.	135	8	9	—	—	—	0·12	0 1·08
General establishment charges.	509	3	8½	—	—	—	0·43	0 4·08
Treasurer and Auditors fees.	83	6	8	—	—	—	0·07	0 0·67
Bad debts.	104	15	5½	—	—	—	0·09	0 0·81
Total working expenses.	—	—	—	20,653	13	2	17·58	13 9·84
Coal and working expenses, less residuals.	—	—	—	30,191	6	2½	25·70	20 2·44
Rental.	50,788	9	0	—	—	—	13·24	33 11·84
Public lighting.	3,225	5	5	—	—	—	2·74	2 1·90
Total rental and lamps.	—	—	—	54,013	14	5	15·98	36 1·74
Profit on gas manufacture.	—	—	—	23,922	8	2½	20·28	15 11·80

Summary.

Profit on gas manufacture, as per above statement.	£23,922 8 2½
Add not included in the above—	
Rent of meters.	£1,585 3 3½
Rents.	320 6 9
Transfer fees.	14 7 6
Sundries—receipts.	427 19 0½
Profits on meters sold.	17 12 10
Profit on fitting up and fittings.	82 17 0
	2,418 6 5
Deduct—	
Expenses re-sale of plant to the Darwen Corporation.	£26,370 14 7½
	304 13 6
Profit, as per balance-sheet.	£25,966 1 1½

RICHMOND (SURREY) GAS COMPANY.

The Half-Yearly Meeting of this Company was held on Thursday, Feb. 26—Mr. G. T. Noyce, in the absence of the Chairman (Mr. F. Chapman), presiding.

The SECRETARY (Mr. E. B. Blott) read the notice convening the meeting, the following report being taken as read:—

The Directors beg to present to the Shareholders the accounts containing a statement of the affairs of the Company for the half year ended Dec. 31, 1879, and in doing so have to congratulate them on the satisfactory results shown therein.

They recommend that a dividend be declared of 5 per cent. on the original capital, and 4 per cent. on the new capital, making for the year 10 per cent. on the original capital, and 8 per cent. on the new.

They are also happy to say that they have felt themselves justified in reducing the price of the gas 3d. per 1000 feet, as intimated by them at the meeting in August. The price, therefore, for the present is 3s. 9d. per 1000 feet in Richmond, and 4s. 3d. in the outlying districts.

[The total capital received to Dec. 30, 1879, was £66,750, viz.:—£55,500 in shares, and £11,250 by loans; and is within £2850 of the amount the Company are authorized to raise. The expenditure on capital account to June last year was £62,945, and during last half year £861 additional was laid out. There is a reserve-fund of £6000. The quantity of coal and cannel carbonized during the past six months was 5516 tons.]

Revenue Account, for the Half Year ended Dec. 31, 1879.

Coals, including cartage, &c.	£4,854 15 11	Sale of gas—	
Purifying materials, &c.	281 18 5	43,796,300 cubic feet at 4s.	£8759 5 4
Salary of Engineer & Assistant.	290 0 0	per 1000.	
Wages and gratuities.	715 11 2	3,524,100 cubic feet at 4s. 6d. per 1000.	792 18 7
Repairs and maintenance of works and plant.	1,247 11 2	Public lighting and under contracts.	922 2 7
	£7,419 16 8	Rental of meters.	326 1 6
Less old material sold.	13 2 6		£10,800 8 0
	£7,406 14 2		
Salaries.	155 5 6	Coke less labour and cartage.	£1609 14 10
Repair and maintenance of mains and service-pipes.	130 3 8	Breeze labour and Tar cartage.	38 9 10
Repairing, renewing, and refixing meters.	127 18 4	Sulphate of ammonia and less labour and cartage.	481 17 4
Lighting and repairing public lamps.	211 5 3		
Rents.	15 0 0		
Rates and taxes.	423 10 2		
Directors' allowances.	200 0 0	Rents.	2,396 2 6
Salaries.	176 1 8	Services.	61 11 0
Collector's commission.	145 5 11		111 13 5
Stationery and printing.	46 15 10		
General charges and incidental.	170 1 7		
Auditors.	25 0 0		
Law charges.	7 13 0		
Bad debts.	112 9 1		
Allowances.	11 2 9		
Total expenditure.	£9,364 6 11		
Balance.	4,005 8 0		
	£13,369 14 11		£13,369 14 11

The CHAIRMAN, in moving that the report and accounts be adopted, congratulated the Shareholders on the satisfactory nature of them. He said that after paying the dividend recommended there would be a balance carried forward of about £2900; and in anticipation of so favourable a result, the Directors had reduced the price of gas 3d. per 1000 feet from the beginning of this year. Another item to which he called attention was the balance of £2942 10s. 10d. standing unspent on capital account. This the Directors considered was a very small floating capital on the amount of business done; besides, it would be a consequence of the anticipated increase of business to extend the purifying power, and for these purposes it was found necessary to call up the remaining £3 upon the new shares, issued in 1877. This would be payable on the 31st inst. He added that their Manager (Mr. J. Eldridge) having been put to some expense in consequence of the Directors requiring to pull down his old house, they had unanimously voted him £100, and for this the Shareholders sanction was asked.

Mr. WARREN seconded the motion, which was carried unanimously.

The dividends recommended in the report were then declared, and the retiring Directors (Messrs. John H. Gosling and George T. Noyce) and Auditor (Mr. J. H. Ford) re-elected.

A vote of thanks having been passed to the Chairman, a similar compliment was paid to the Directors generally, and to the Officers of the Company, and the proceedings terminated.

CANTERBURY GAS AND WATER COMPANY.

The Half-Yearly General Meeting of this Company was held on Monday, the 23rd ult.—Mr. G. FURLEY in the chair.

The following report was taken as read:—

The Directors again submit to the Shareholders the usual statement of accounts and balance-sheet, and congratulate them on the continued prosperity of the Company's business. During the last half year, doubtless owing to the very dark and cold weather, the consumption of gas has considerably increased, but the efficient state of the works has enabled the Company to promptly meet the additional requirements of the public.

As previously intimated, attention is being given to the distributory plant. It has been determined that a new leading gas-main shall be laid down, from Wincheap through Rhodans Town and Upper Bridge Street, to afford a better supply of gas to the city and barracks. Advantage has been taken of the recent very low price of iron to purchase the necessary pipes for this work.

The severe frost of the present winter has much delayed the extensions in progress at the water-works, but it is hoped that they will be completed in time for the increased demand for water in the ensuing summer.

Your Directors have considered that the time has arrived when the Company's reserve-fund ought to be invested, so that, should the necessity arise, it may be immediately available for the purposes authorized by law—viz., to answer any future deficiency which may happen in profits, or to meet an extraordinary claim or demand. A sum of £6375 7s. 9d. has accordingly been purchased in Three per Cent. Consols, and the dividends arising therefrom will from time to time be added to the capital, until the maximum amount has been reached. The balance standing to the credit of the profit and loss account is £6420 18s. 10½d., and your Directors have again the pleasure to recommend that the usual dividend for the half year at the rate of 8 per cent. per annum, free from income-tax, be declared and paid.

Your Directors have much pleasure in announcing that the price of gas to the consumers, from Dec. 31 last, will be reduced 3d. per 1000 feet, making the price 3s. 4d., which will involve a reduction in the Company's profits of nearly £1000 per annum.

The retiring Directors this year are Colonel Horsley, Major Castle, Messrs. R. Y. Fill, and E. Rayner. Major Castle, owing to ill health, does not seek to retain his seat at the Board; the others, having given the notice required by the bye-laws, offer themselves for re-election.

The CHAIRMAN, in moving the adoption of the report, observed that, in his opinion, the balance-sheet now presented was the best that had been issued by the Company for many years. The first matter that had claimed the attention of the Directors was the reserve-fund—a fund that had accumulated from time to time from unappropriated profits. It had been used in assisting the capital of the Company as occasion required, but the Directors felt that the time had arrived when the fund should be put into a different channel, and he was happy to be able to state that it now took the form of an investment in Consols to the value of £6445. The Shareholders must not imagine that, because this money was put into

Consols, if they wanted to extend the works they could go to the reserve-fund for the purpose, for every extension of the Company's works must be paid for out of capital in hand or by money raised for the purpose. The reserve-fund was for two purposes—firstly, in the event of the profits in any half year being insufficient to pay the authorized dividend of 8 per cent. per annum, they might take from the fund a sum sufficient to enable them to pay the dividend; secondly, if any accident happened to the works, they would have to replace them, and in order to do this they could have recourse to the reserve-fund. He was happy to say that the Directors had been able to announce a reduction of 3d. per 1000 feet in the price of gas, although it would entail a loss to the Company, in the shape of profit, of £1000 per annum.

Mr. FLINT seconded the motion, and it was carried, and a dividend of 8 per cent. per annum declared. The retiring Directors and Auditor were then severally re-elected, the usual vote of thanks being passed to them and the other officers.

The meeting was afterwards made special for the purpose of considering the advisability of authorizing the issue of 1050 new £10 B shares.

The CHAIRMAN moved the following resolution:—"That 1050 new £10 B shares be created and issued for the purposes of the Company's water undertaking, and that such shares be offered at par to the present Proprietors, in the proportion of one share to every £78 of capital, and that Proprietors holding less than the before-named sum be offered one share each; that any remaining share or shares not taken up by the Proprietors be disposed of by the Directors in such manner as they may think fit." In doing so, he explained that the capital proposed to be raised for the extension of the water-works, which the increased demand for supply necessitated, amounted to £3825, and the sum actually to be expended at present was £2300, so that they would have a balance of something like £900 to the credit of the capital account. It was only intended, however, to call up £2 per share on the 1050 new shares, as the money was not immediately required.

Mr. T. F. COZENS seconded the motion, which was carried, and the proceedings terminated.

NEWCASTLE AND GATESHEAD WATER COMPANY.

The Thirty-fifth Annual General Meeting of this Company was held on the 26th ult.—Mr. B. PLUMMER in the chair.

The SECRETARY (Mr. D. D. Main) read the notice convening the meeting, and the following report was submitted:—

The Directors beg to present the accounts for the year ending Feb. 1, 1880, to the Shareholders.

The following is the comparison of the number of tenants and revenue for the past year and the year preceding:—

	Tenants.	Revenue.
Year ending Feb. 1, 1879 . . .	57,644 . . .	£53,946 13s. 9d.
Year ending Feb. 1, 1880 . . .	58,463 . . .	54,494 10s. 4d.

It will be seen that the increase in the revenue has only amounted to £547 16s. 7d. This increase has arisen in the last three months, when a favourable change occurred in the consumption of water for manufactories, in consequence of a revival in the staple industries of the district, which have for a lengthened period been in a depressed condition. There is evidence now, however, of a better state of things, and that the worst is past. Manufactories that have long been idle are about to re-open, and many houses that have been empty will again be occupied. These hopeful circumstances, in conjunction with a revised scale of the rates for manufacturing purposes which has been made, and is now in operation, will have an important effect upon the Company's revenue for the current year.

The large reservoir on the Swinburn is making satisfactory progress, and will probably be finished before the end of the year. The aqueduct and tunnel connecting the works on the Swinburn with the Hallington reservoir is completed, and the water of the Swinburn is now conveyed through it to that reservoir.

Additional filters at Throckley and a new reservoir at Carr's Hill, for the supply of the higher districts of Gateshead, are also in progress, and will be finished in the spring.

An additional main has been laid during the year between the filters at Throckley and the Benwell reservoirs, and in connection therewith it is intended to concentrate the pumping power at Benwell for the supply of the higher districts of Newcastle. This will add materially to the Company's power of meeting the growing requirements of these districts, and be more economical in working than the present mode.

The following are the lengths and dimensions of pipes laid during the past year:—2-inch, 402 yards; 3-inch, 9633 yards; 4-inch, 2925 yards; 6-inch, 1845 yards; 8-inch, 42 yards; 10-inch, 27 yards; 12-inch, 114 yards; 15-inch, 1761 yards; 24-inch, 7166 yards; 48-inch, 326 yards—total, 24,241 yards.

A dividend at the rate of 5 per cent. per annum having been paid for the first half year, the Directors recommend that a dividend at the rate of 5½ per cent. per annum be declared for the half year ending the 1st of February, with 5 per cent. on the preference shares.

The Directors retiring in the order of rotation are Mr. Benjamin Plummer, Mr. W. D. Cruddas, and Mr. W. B. Wilkinson, all of whom are eligible for re-election. The Auditor retiring is Mr. J. B. Alexander, who is also eligible for re-election.

The CHAIRMAN, in moving the adoption of the report, said that, notwithstanding the great difficulties the Company had had to contend against, they were able to pay a better dividend than was paid last year. He felt sanguine that better days were in store. Since February, 1879, they had had 819 new tenants; but their revenue had increased only £547 16s. 7d. Still, it was an increase; and the Shareholders must bear in mind that a great many factories had been closed. Those factories were, however, now beginning to reopen, and of course they would renew their consumption. There was every probability that the large reservoir at Swinburn would be completed by the end of the year, and this would almost double the Company's storage power. For upwards of two years their water had been wasted, because they had no storage for it; but when they had this extended storage, they would have no need to go to any fresh stream for a great many years, and they would have accommodation sufficient, he fully believed, to meet the greatest and longest drought that had ever occurred. They would also be able to increase the number of their customers almost to any extent. As illustrative of the Company's growth, he gave to the Shareholders the following figures:—In 1873 the increase in the number of customers was 1765, and the increase of revenue therefrom was £4000; in 1874, increase of customers 1825, increase of revenue £4773; in 1875, increase of customers 1838, increase of revenue £776; in 1876, increase of customers 3487, increase of revenue £3178. The average upon the four years increase in the number of customers was 2228, and upon the revenue £3214. In 1877 the increase in the number of customers was 3514, and the increase of revenue £1651. In 1878 there was an increase in the number of customers of 2041, but there was a decrease in the revenue amounting to £259. That was owing to old customers using very much less water, some manufactories being closed altogether. In 1879 there were 1193 new customers, and an increase in the revenue of £1743. In 1880 (last year) there was an increase of new customers—and that was a year when some of the largest works were closed—of 819, and the increase of revenue amounted to £547 16s. 7d. The average of these four years was 1891 new customers, with an increase of revenue of £920 13s. 5d. He considered that the future of the Company would be more prosperous than ever.

Alderman POTTER seconded the motion. He believed that never, since he had become a Director, were the Company in a better position than now, not only with regard to meeting the requirements of the district, but also to paying a dividend to the Shareholders. In the last ten years they had added largely to their power of supply. During that time they had only had reservoir capacity of about 750 million gallons; but at the end of this year they fully expected to have the Swinburn reservoir com-

pleted, and they would then have reservoir capacity of close upon 2400 million gallons. Now that they had the new main from Throckley, they were able to bring into the town something like 18 million gallons of water a day, while the requirements were only about half that quantity. He considered the Company were in a position to meet the demands of the district for many years, and he should be very much disappointed indeed if next year they were not able to pay 6 per cent. dividend.

The CHAIRMAN, in answer to a Shareholder, said that the average quantity of water daily delivered by them in ordinary times was 9 million gallons, or a little over. During the late frost, however, partly from burst pipes and partly on account of people allowing water to run constantly, it rose to 13 million gallons. The average of the whole year, including these extraordinary times, was nearly 10 million gallons a day.

The report was adopted, the retiring Directors and Auditor were re-elected, and the proceedings closed with a vote of thanks to the Chairman.

THE PRODUCTION OF OZONE DURING THE COMBUSTION OF COAL GAS.

At the Meeting of the Chemical Society on Thursday, Feb. 19, a paper on the above-named subject was read by Mr. R. H. RIDOUT.

The Author stated that some years ago he possessed a Bunsen burner which always emitted the smell of ozone. By means of an aspirator and suction-tube he determined that the greatest production took place at the apex of the flame. The burner, however, was injured, and he had not been able to get the same action again, either with it or with other burners. He noticed subsequently, while working with singing flames, the same smell; and in consequence made several experiments. A glass tube, ½-inch bore, conveying coal gas, was placed inside another tube ½-inch bore, 15 inches long, and a strip of iodized paper was pasted inside the tube throughout its length. The gas burned with a blue flame. After a short interval the paper was discoloured, and on being moistened gave the oxidizing reaction, commencing at a point about ½-inch above the flame, and decreasing towards the top. The Author endeavoured to apply this method of producing ozone to technical purposes, but without success. From several experiments he concludes that the sulphur in the coal gas is eliminated as sulphuric acid under the above circumstances. Various experiments were made to determine the nature of the body which gave the blue reaction with starch. It was not absorbed by passing it through caustic potash or water, which would remove all oxides of nitrogen, whilst no oxidizing action was observed in a chromate of potash solution, indicating the absence of peroxide of hydrogen. The Author concludes, therefore, that the substance formed was ozone. Ether and alcohol, burned from wicks of capillary glass tubes, gave similar results. Ozone was also produced by the flame of a minute glass Herapath blow-pipe, as long as the cone was perfect and of a violet colour; but as soon as the inner bright green cone was exposed, the production of ozone ceased. The same violet colour attends the formation, whilst a green tint indicates the destruction of ozone in the electric discharge.

ELGIN GAS ARBITRATION CASE.

After much delay in the negotiations, the two gentlemen who were engaged in the arbitration for the acquisition of the Elgin Gas-Works by the Corporation have at last completed their work, their final meeting taking place in Elgin last Thursday, when they settled the important transaction with which they were entrusted. As previously mentioned in the JOURNAL, the arbiters were Ex-Provost Robertson, of Dundee, for the Town Council, and Mr. Geo. R. Hislop, of the Corporation Gas-Works, Paisley. There is some satisfaction in knowing that although the case was many months in dependence, owing to difficulties having arisen as to obtaining sufficient information, it has come to an amicable conclusion without the intervention of the oversman—the gentleman who was appointed to that office being, it may be remembered, Mr. William Foulis, of Glasgow. It is believed that the community of Elgin will not only be pleased that the case has been brought to a termination, but that the decision arrived at is in their favour rather than otherwise. They were certainly tired of the delay.

When the arbiters met on Thursday they endeavoured to come to terms, and they found that, after a good deal of communing, there was only a difference of £749 between them. The representatives of the two parties on whose behalf the bargain was to be made thought that, when they had come so near the point in meeting each other, it would be unwise, in a £12,000 bargain, to incur further expenses in allowing the final settlement to devolve on the oversman. Accordingly, they held consultations with their respective constituents, and then tried once more to come to terms; and the result was that, by concessions on both sides, they ultimately settled the price at £19 11s. 11½d. per share, as against £17 10s. per share, which was offered many months ago by the Town Council—the decision being eventually 15s. less than half way between the offer of the Town Council, and £22 16s. 11d. per share, which was the claim of the Gas Company, after being formulated into shape on Thursday morning. The price agreed upon by Messrs. Robertson and Hislop is, by some of the townspeople, considered to be a somewhat high one; but it is rather under than above the sum which a considerable proportion of the Town Council expected they might ultimately have to pay for the works. The expenses of the arbitration, in terms of the Burghs Gas Supply (Scotland) Act, fall upon the Town Council, and when they are added to the purchase price, the cost of the undertaking will be something over £20 per share.

The Elgin Gas Company were formed in the year 1830, with a capital of £2500 in 250 £10 shares. From time to time the capital was increased by the issue of new stock to the sum of £6912 10s., and from the year 1836 bonus additions to capital were made to the extent of £3023 10s.; the total being £9936, which was equal to £16 per share on the 621 shares that were eventually issued. The affairs of the Gas Company have been all along very prosperous, as, in addition to the increase made to capital out of undivided profits, the Company have spent annually on the maintenance of the works a sum equal to 2 per cent. of the structural value of their property. Furthermore, by a comparison with the price of gas paid in other northern towns, the charge in Elgin has always been at a moderate rate, from which it may be concluded that the profits have been justly earned. The transfer of the works to the Corporation is to be effected as on the 6th of June next, interest at 5 per cent. being exigible on the purchase price until payment is made.

A fear has been expressed locally that the large sum of money—£12,170—required for the purchase of the works, for the expenses of the arbitration, for the acquisition of the stock-in-trade of the Gas Company, in the shape of coals, implements, and other appliances, together with the outlay which is almost certain to be required in a very short time for additions and repairs, will make it difficult for the Town Council, for some considerable time, to reduce the price of gas; but the community hold that the supply of such necessities of life as gas and water should be in their own hands instead of those of private companies. Their wishes in that respect have now been accomplished. The water undertaking has turned out a very complete success, the supply being ample, and the assessment 8d. per £1 of rental. It is alleged that the price of the gas-

works is considerably higher in comparison than that of the water-works; but it is confidently anticipated that, with careful management, the community will, in the end, benefit by the purchase of the works, although it may be some time before they reap any direct advantage from the important transaction just concluded. When the negotiations with the Town Council began, the shares of the Gas Company were understood to be worth in the market £17, and latterly, it is said, speculative buyers have given more than £20 for them.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

All descriptions of round coal continue a drag on the market, and there are heavy stocks held throughout the district, both in waggons under load and on the pit banks, whilst short time is now being worked at a large number of the collieries. In prices the tendency is still downwards, and during the past week there has been a general reduction of 10d. per ton in the delivery rates for house coal to private consumers in the Manchester district, whilst all through the market there is an easier tone. An extra quantity of coal has been thrown upon the hands of colliery proprietors, owing to the very limited amount which has recently been going away for shipment, the result of which has been that surplus stocks have been pressed at low figures, and selling prices in the open market for prompt delivery have been 8d. to 6d. per ton lower than they were last week, holders in some cases not being particular as to price where anything like good orders have been in question. The increased consumption for iron-making purposes is still inadequate to absorb the large supplies of common round coal now offering in the market, and although I understand the railway contracts for locomotive coal are not being tendered for at quite such low figures as last year, there is still plenty of steam and forge coal to be bought for early delivery at extremely low prices. In gas-making coals the business doing is only nominal, the small quantity now going away being mostly on old contracts, and it is as yet too early for the inquiries for next season to be coming into the market. For round coal the average quotations at the pit mouth are about as under:—Best Wigan Arley, 8s. to 8s. 6d.; inferior sorts, from 5s. 9d. to 6s. 6d.; Pemberton four-feet, 6s. 8d. to 6s. 9d.; and common Wigan mines, 5s. to 5s. 6d. per ton. For engine classes of fuel there is generally a good demand, and prices are firm, the best sorts fetching 8s. 3d. to 8s. 6d. per ton, and good ordinary qualities 2s. 6d. to 3s. per ton at the pit.

Cokes continue in steady demand, the better sorts moving off very well, and good large Lancashire cokes at the ovens are quoted at about 16s. per ton.

The iron trade has been rather dull during the past week, the downward movement in Scotch warrants naturally having a tendency to cause buyers to hold back. The business doing has been chiefly confined to cheap lots of second-hand iron, which holders have been pressing on the market at low figures; but makers, as a rule, have not given way, as they have still very little iron to offer, although local producers have not been able to advance their prices as contemplated, and Lancashire pig iron delivered into the Manchester district remains at about 70s. per ton, less 2½ per cent. Finished iron is rather easier so far as bars are concerned, second-hand lots being offered at about £8 5s. per ton delivered equal to Manchester, whilst makers prices range from £8 10s. to £9 per ton.

Machine makers, engineers, and founders are getting busier, but most of the small concerns are still short of orders.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

What I have been reporting from Newcastle over the past three or four weeks is pretty well confirmed by results—viz., that the coal trade generally is somewhat dull, and that business, in many branches of it, has got behind. At the same time, as most of the better qualities of gas coals have been fully contracted for over the year, the Durham gas collieries are extremely well employed. Special sorts of manufacturing coals, too, keep a good position in the market; and as a large amount of sailing and steam tonnage has been engaged to load Northumberland coals over March, there is a good deal of activity in that trade. Second-class coals do not show a large improvement in price. They are less in request than they were some weeks ago. House coals are not much inquired after. Coke keeps in good demand.

The freight market is unchanged. There is very little advance in rates, neither is there much depression. The late stormy weather has prevented sailing vessels and steamers from keeping their time; but there has been an abundance of tonnage to meet the requirements of merchants. Orders are not coming to hand so rapidly as merchants would have liked. The manufacturing iron trade on the Tyne is busy, with the exception of water and gas pipes, which are not so much in demand. The chemical business shows an improvement. There have been larger importations of lead from Germany, but not so great from Spain. The price of lead is a little easier. The American hard wood business is likely to be pretty busy this season. Large ships are paid higher rates to load timber in baulks from Quebec. There will be large deliveries of Baltic timber also. The price of timber does not advance so rapidly as some would like. It was expected that there would be a sudden rise in prices, but this has not been achieved, nor is it likely to be at present.

The demand for coke is fully sustained.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

On Monday, the 1st inst., the Directors of the Dunfermline Gas Company held their usual monthly meeting—Mr. Russell presiding. The Manager (Mr. Mackenzie) reported the nature and extent of the explosion and fire which occurred on the preceding Friday, as mentioned in last week's JOURNAL, and power was given him to have the meter-house re-erected. The cause of the accident was the snapping of the suspending gear of the cone-valve of one of the governors, so that the "bell" almost completely unseated itself, and the result was a large escape of gas. In a very brief space of time, scarcely amounting to minutes, Mr. Mackenzie had the gas diverted; but so great was the flame that it set the house on fire beyond all hope of saving it. Things are being rapidly put to rights, and it is expected that the damage will be scarcely so great as was at first imagined.

At the usual monthly meeting of the Dundee Gas Commission, held last Wednesday, the following regulations were adopted in reference to the collection of gas-rentals:—(1.) That before actually cutting off gas from any consumer a notice be sent to such consumer, intimating that the cutting-off will take place on the expiry of 48 hours. (2.) That in the case of parties wishing a supply of gas to premises from which meters have been removed, they be informed that, if desired, the Commissioners will fit up meters at a cost not exceeding 1s. 6d. per meter for ordinary household meters.

The proposal to hold an exhibition of gas apparatus in Glasgow has now made a decided step forward. Stimulated from the outside, the Council of the Philosophical Society of Glasgow took up the matter some time ago in a quiet way; and a few weeks since a memorial on the subject

was laid before the Works Committee of the Corporation Gas Committee by a deputation from the Council, accompanied by Mr. D. M. Nelson, whose advice had been asked in the matter. At last Thursday's meeting of the Town Council there were presented the minutes of the Gas Committee dated the 26th of February, which stated the Committee had taken into consideration the memorandum submitted by the deputation from the Glasgow Philosophical Society, in regard to a gas exhibition in the city, which the Council of the Society are desirous of promoting. In this memorandum the Council request—(1) that the Gas Trust and the Corporation generally should co-operate with them in promoting and carrying out the intended exhibition; (2) that the Works Committee of the Gas Trust should allow their names, as individuals, to be used in the General Committee for promoting and carrying out the exhibition, in the first instance, and also to be placed on that Committee in allowing such members of their practical staff as may be willing of themselves to do so; (3) that the Corporation should undertake to supply gas to the building which may be selected for the exhibition, and to the exhibits during the exhibition, free of charge, and grant the use of their operative staff and materials to make the necessary connections; and (4) that the Town Clerk should be asked to give his views as to the rights and interests of the Society in the proceeds of the General Exhibition of Arts and Manufactures held by the Society in 1846, which were handed over to the Corporation, and have been accumulating in their hands since 1847, which accumulated funds, it is believed, are available for any purpose such as that contemplated by the proposed gas exhibition. The Sub-Committee, after deliberation, cordially approved of the proposed exhibition, and unanimously resolved to recommend the Town Council to accede to the various requests made by the Philosophical Society, as before specified. On the motion of Mr. Walls, Convener of the Gas Committee, the minutes were approved of. It is probable that arrangements will forthwith be entered into for holding the proposed exhibition next autumn, and that it will be on a large and more complete scale than any exhibition of the sort hitherto held.

At last Thursday's meeting of the Town Council of Hamilton the Gas Committee reported that the West of Scotland Association of Gas Managers are to meet at Hamilton in the latter part of next month, and the Committee suggested that the Town Hall should be placed at their disposal. On the motion of Bailie Cassels, the report was adopted.

It may be remembered that some three or four weeks ago an Inverness baker, named Andrew Fullarton, was convicted of the first of two charges of illegally appropriating gas from the main-pipe of the Police Commissioners, by laying down, without the Commissioners' knowledge, pipes connecting his own premises with the main, and not passing through a meter. On Tuesday last, in connection with the same case, John Miller, a brassfounder and gas-fitter, the man who had been employed by Fullarton to lay down or connect the pipes, was brought up before a Justice of Peace Court in the Castle on the two charges that had been preferred against Fullarton. Messrs. James Fraser and Robert Grant were on the bench. Through his agent, Mr. James Ross, Miller pleaded guilty to the second charge, and not guilty to the first; and as regards all the other particulars in the charge, such as using the gas in question, he pleaded not guilty. This plea was accepted by Mr. Anderson, who, in moving for sentence, observed that the sole object of the prosecution was to provide a warning to others. It was proper that tradesmen and everybody else should know that if they take part, however indirectly or unintentionally, in a dishonest act, they are as liable to punishment as the party who is primarily guilty. The Court ordered Miller to pay a fine of £5, together with £6 8s. expenses, or, failing payment, to go to prison for two months. Mr. Miller attempted to make a statement of his connection with the matter, saying he was a strictly honest man; but the Assessor said it was too late for him to make any statement.

There was a tremendous drop in the Glasgow pig iron market last week, and without the slightest recovery, the closing price on Friday afternoon being 60s. 6d. cash, and 61s. one month buyers, and sellers 1½d. per ton more. Holders appear to have completely lost confidence, and the greatest anxiety has been displayed to get quit of the iron held.

The coal market continues depressed. The shipping trade has not been so dull for years back as it is at present. Any orders going are keenly competed for, and coalmasters take them at very low and unprofitable prices.

CLEATOR MOOR GAS COMPANY, LIMITED.—The annual meeting of this Company was held on Wednesday, Feb. 25—Mr. R. S. Slater presiding—when, after the notice of meeting had been read by the Secretary (Mr. R. Baxter), the Chairman moved the adoption of the report presented by the Directors. It stated that the accounts for the past year showed the receipts on revenue account to have been £1980 10s. 8d., and the expenditure £1027 0s. 1d., leaving a balance of £953 10s. 7d. to credit of profit and loss account. This, after providing for dividend on preference shares, bank interest, bad debts, &c., left an available balance of £665 9s., and the Directors recommended a dividend at the rate of 5 per cent. per annum (which would amount to £384 5s.), £150 to be placed to the reserve-fund, and the balance of £131 4s. to be carried to credit of the current year. An amendment, that 6½ per cent. dividend be paid, was proposed, but did not meet with much support, the feeling of those present being generally that it was more advisable to have an adequate reserve-fund than a larger dividend at present.

WELLINGBOROUGH GAS COMPANY, LIMITED.—The half-yearly meeting of this Company was held on Monday, the 23rd ult., when a favourable report and balance-sheet were submitted, and a dividend of 5 per cent. for the half year was declared. At the previous meeting of the Company in August last a sum of money was voted for the purchase of a testimonial to Mr. J. W. Sharman, the Chairman of the Directors, and this was privately presented at Christmas last. At the request of the Shareholders the testimonial was exhibited at the meeting. It consisted of Keith Johnstone's Royal Atlas; an electro-silver breakfast dish; four electro *entrées* dishes; and a claret jug. The plate all bore the monogram of the Chairman and the date of presentation; and on the cover of the atlas was the following inscription:—"Presented to Mr. John Wood Sharman, by the Wellingborough Gaslight Company, in recognition of many years valuable voluntary services.—Dec. 25, 1879." After the ordinary business of the meeting, the health of Mr. Sharman was proposed and suitably honoured. The healths of the Directors, the Manager (Mr. G. Powell), the Secretary (Mr. S. H. Kimbell), and others, were also proposed and acknowledged.

WINCHESTER WATER AND GAS COMPANY.—The half-yearly meeting of this Company was held on Monday, Feb. 23, when the Directors, in their report, congratulated the Shareholders on the continued improvement in the Company's business. There had, they stated, been some delay on the part of the contractors in finishing the new gasholder, which was not dividend at the rate of 10 per cent. per annum for the half year, less completed before the severe frost set in. The Directors, therefore, thought it prudent to stop the work altogether until the spring, when they fully expect to arrange for its satisfactory completion. They announced that they had decided that, from and after Midsummer next, the price of gas shall be reduced to 4s. 8d. per 1000 cubic feet; and they recommended a

income-tax. The total receipts from all sources amounted to £8182; against which there was a charge for production of £4259, and miscellaneous items of £174. The balance of profit and loss account was £5823, which, after the payment of the dividends for the past half year, would leave £3323 to carry forward. The Company have a reserve-fund, beyond this, of £3788.

LECTURE AT ANDOVER ON "GAS AND THE METER."—Last Tuesday evening, Mr. K. R. Moorhouse, the Manager of the Andover Gas-Works, read a paper before the local debating society, his subject being, "The Cost of Gas, Distribution, and the Mechanism of the Meter." According to the *Andover Advertiser*, Mr. Moorhouse handled the various points in a manner which proved that he was well qualified to lecture on the subject; and his paper, which was of a most interesting and instructive nature, was listened to throughout with marked attention. The illustrations with which he demonstrated his observations were varied and practical in character, amongst others working models of the wet and dry meter being regarded with especial interest. Many points but hitherto imperfectly understood by those present were explained in an able and lucid manner, some of them proving that much of the blame for deficient light, often attributed to gas companies, was in reality misapplied and undeserved, the causes lying more within the control of the consumer than of those responsible for the supply. Mr. Moorhouse, at the conclusion of the paper, resumed his seat amidst general applause. A number of questions bearing on the paper, and on the subject of gas generally, were asked by several of the members, each receiving a reply which in ability and detail showed that Mr. Moorhouse was master of the subject he had undertaken. A cordial vote of thanks brought to a close a very pleasant and intellectual evening.

Register of Patents.

APPLICATIONS FOR LETTERS PATENT.

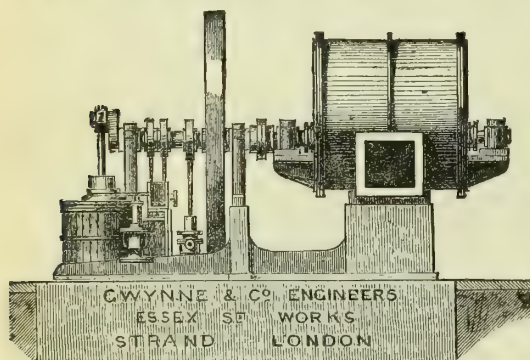
- 745.—WALBANK, B., Leeds, Yorks, "Improvement of the gratebars of steam-boiler and other furnaces." Feb. 20, 1880.
760.—EDWARDS, E., Chancery Lane, London, "Improvements in motive-power engines actuated by the combustion of a mixture of gas and air, or by the pressure of steam or other elastic fluid, parts of which invention are also applicable to other purposes." Feb. 20, 1880.

- 772.—MATHEWS, C. R., Drury Lane, London, "Improvements in fixing, connecting, and disconnecting gas pendants, brackets, pillar or ground connections, especially adapted for outside reflecting lamps." Feb. 21, 1880.
786.—HEGENER, A., Cologne, Germany, "Improvements in apparatus for producing gaseous fuel for combustion in furnaces, ovens, or kilns, and for utilizing the waste heat of the products of such combustion, more particularly applicable for heating the retorts in gas-works." Feb. 23, 1880.
789.—HARRISON, C., Peterborough, Northampton, "Improvements in the manufacture of gas, and in the apparatus for effecting the same." Feb. 23, 1880.
791.—CHAMBERLAIN, A. P., Finsbury, London, "Improvements in the manufacture of gas for illuminating and heating and other purposes." Feb. 23, 1880.
809.—ROSS, W., Glasgow, "Improvements in service-valves and their fittings for regulating and preventing waste by the delivery and supply of uniform quantities of water to water-closets and urinals, and for the like supply of liquids to other vessels." Feb. 24, 1880.
822.—ASHTON, D. R., Clapton, London, "High-pressure lever cock for water." Feb. 25, 1880.
855.—CLARKE, C. L., and LEIGH, J., Manchester, "Improvements in apparatus for lighting gas." Feb. 26, 1880.
890.—CLARK, A. M., Chancery Lane, London, "Improved apparatus for desiccating and saturating sewage and other matters, for the manufacture of sulphates of ammonia, and for treating liquid and other matters generally which are capable of distillation." A communication. Feb. 28, 1880.
894.—WADDELL, C. J., Manchester, "Improvements in cocks or taps for fluids." March 1, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 3561.—PICKING, G. G., and HOPKINS, W., Bow, London, "Improvements in gas-motor engines." Sept. 4, 1879.
3604.—THOMPSON, W. P., Liverpool, "Improvements in and appertaining to apparatus for heating by means of gas or hydrocarbon flames." A communication. Sept. 8, 1879.
3613.—TREWBY, G. C., and FENNER, H. W., Beckton, Essex, "Improvements in the distillation of coal tar." Sept. 9, 1879.
3732.—GLASER, F. C., Berlin, "Improvements in gas and petroleum engines." A communication. Sept. 17, 1879.

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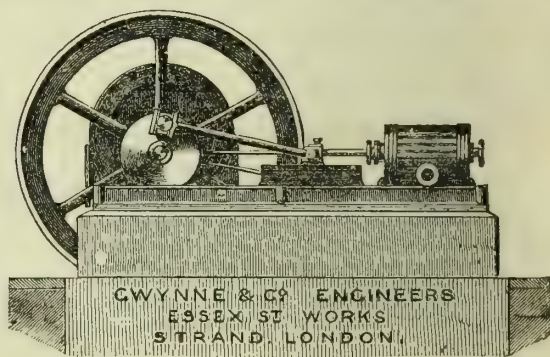
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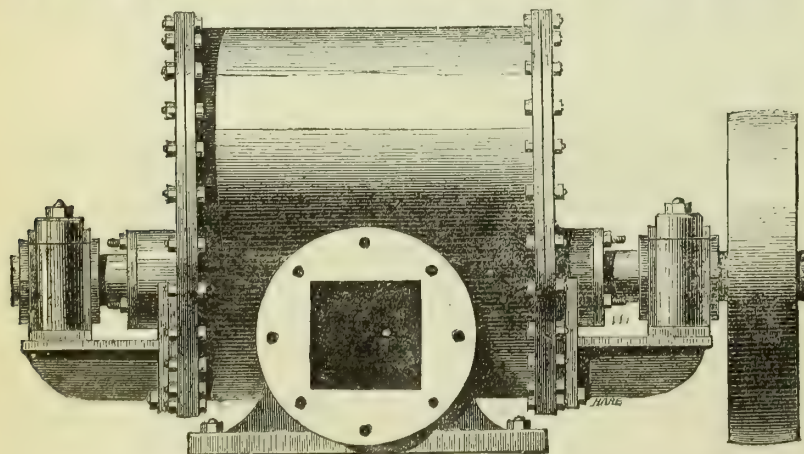


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TO CORRESPONDENTS.

An interesting report by Mr. Newbigging, on the Heywood Local Board Gas-Works, already in type, as well as several other reports, &c., are obliged to be deferred till next week.

SOUTH-WEST OF ENGLAND DISTRICT ASSOCIATION OF GAS MANAGERS.—Our report of the meeting of this Association, at Taunton, on Tuesday last, is also unavoidably held over.

C. E. J.—Thanks for information. Shall be pleased to refer to the matter in next issue.

J. H.—Received yesterday—too late for notice in to-day's JOURNAL.

B. T.—The balance-sheet you forward exhibits a very satisfactory state of affairs indeed.

ERRATUM.—In some copies of last week's JOURNAL, p. 358, second column, 37th line from bottom, for "successors" read "predecessors."

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 16, 1880.

Circular to Gas Companies.

THE scheme for the amalgamation of the South Metropolitan and Phoenix Gas Companies still remains unconfirmed; but we are in a position again to state that not the least obstacle exists to its confirmation. It simply awaits the pleasure of the President of the Board of Trade in sending it forward to the Privy Council, and as there will be a meeting of the Council next Thursday at Windsor, we fully anticipate that in our next issue we shall be able to announce that the scheme has been sanctioned. The position of the Companies implicated in the scheme will not, of course, be changed. We have repeatedly said that the success of the proposal would involve the withdrawal of the Bill promoted by the Phoenix Company, and we understand that this has now been resolved upon. The measure promoted by the South Metropolitan Company will go forward, and we hope will be passed this year, as it is very desirable that the united Company should obtain the powers asked for as early as possible. It will be none too soon to commence next year their new works at Greenwich. To effect their completion will occupy a long time, and as soon as they can be brought into working

order we are satisfied that the wants of the united district will require them.

We learn from Lieut.-Col. W. Haywood's report on the proceedings of the Commissioners of Sewers of the City of London during the year 1879, an abstract of part of which will be found in another column, that the experiment made with the electric light on the Holborn Viaduct was not a success, economic or otherwise. The light proved to be expensive—6s. 3d. per lamp per night—and the illumination was not more than twice that afforded by an ordinary gas-lamp. When so many complaints are made about a defective supply of gas to public lights, it is very satisfactory to find Lieut.-Col. Haywood reporting that the quantity contracted for in the City is regularly supplied. The Commissioners of Sewers have a certain number of metered lamps which establish this fact, and they also have inspectors whose experience enables them by the eye alone to decide that the full quantity of gas is being consumed in the other lamps. In all probability, in many cases, more than the contract quantity is being burned; for we have ourselves often been deceived, guessing that five feet were being consumed, when, as a fact, eight or more feet were burning. It is to be regretted that the use of the improved gas-lights in Queen Victoria Street was so quickly discontinued, but there is no answer to the fact that after business hours the traffic in that street is not great. The vehicular traffic is considerable up to a late hour; but foot passengers, except those on their way to the Metropolitan District Railway, get few and far between as the day closes.

We understand that the Trustees of the British Museum have determined to continue the use of the electric light *en permanence* in the Reading Room, and that the Royal Albert Hall Corporation have decided to re-introduce the Siemens light at the hall, with the improvements recently made by Dr. Siemens. The use of the electric light in large interiors seems likely to spread, more especially in such cases as where free ventilation cannot be effected, and we are not surprised to learn that the transformed tavern in the basement of the Royal Exchange is to be illuminated by its means.

The Hastings and St. Leonards Gas Company held their half-yearly meeting on the 4th inst. The report of the Directors necessarily showed a highly prosperous state of affairs. The working accounts for the past half year testify that the profits of the Company amounted to £4141. When full dividends on both classes of shares have been paid, there will remain a balance of £471 to be carried forward to the next account. Hastings, like every other south coast watering-place, grows, and larger demands are each year made upon the Gas Company. To meet these, the Directors and their indefatigable Manager, Mr. A. H. Wood, A.I.C.E., have decided to make considerable additions to their carbonizing plant. These, it is hoped, will be brought into use before the dark nights of next winter come on, and Hastings, with its extensions, will have the best gas supply the inhabitants could possibly obtain.

The Dover Gas Company held their half-yearly meeting on the 2nd inst. The Company, of course, pay their ordinary dividends, and, after adding to their reserve-fund, carry forward a considerable balance. In addition they also pay a bonus of one and a half per cent., in liquidation of the deficit of dividend in 1864. Better than this, the Directors are able to announce a reduction of threepence per thousand feet in price from July next, making the charge for the future 3s. 6d. instead of 3s. 9d. per thousand. The natural growth of the consumption of gas in Dover enables the Company to make this reduction without any risk to the dividends. There is, of course, the reserve-fund to fall back upon, and this will be sufficient to prevent any deficiency arising after the payment of full dividends.

The Directors report and statement of accounts of the Crystal Palace District Gas Company, issued in anticipation of the half-yearly meeting to be held on the 25th inst., are before us. The report of the Directors tells us in a succinct form the state of the balance-sheet for the past half year. The Company have made a profit during the half year to the amount of £11,986, which enables them, after clearing off all preference charges, to pay the ordinary Shareholders ten per cent., and to carry forward a balance of £1352. The report of the Gas Examiners shows, as usual, that the quality of their gas is well maintained, the illuminating power being above the standard; while sulphuretted hydrogen was entirely absent. In such well-managed works as those of the Crystal Palace District Gas Company, the absence of ammonia is not so much to be wondered at. Every grain of it is of value, and is fixed for the profit of the Company.

The Bromley Gas Consumers Company held their half-

yearly meeting on the 26th ult. The faces of the Directors did not look cheerful when they had to announce to the Shareholders that it was necessary to make a draw on the reserve-fund in order to pay their full statutory dividends. That fund, however, was more than sufficient for the emergency, and no doubt what has been abstracted this half year will be replaced in the next.

The Dewsbury Corporation seem to have been fairly successful with their gas undertaking during the past half year. They are dreadfully overloaded with capital; which, in fact, amounts at the present time to £34 8s. 5d. per ton of coal carbonized. As regards the working, we notice that during the past half year there have been obtained from a ton of coal, with the aid of 6.41 per cent. of cannel, 10,002 cubic feet of gas, of which 8941 feet are accounted for. The large leakage is occasioned by breakages in the pipes which pass through a portion of the district that is undermined. The rest of the details are equally in favour of the Manager (Mr. Charles Eastwood), and it may be said, to the credit of the Corporation of Dewsbury, that they only appear to make a profit of £942 upon a sale of 56,552,400 feet of gas. We purpose publishing an abstract of the accounts in next week's issue.

It is a gratifying fact that gas managers have turned their attention to the electric light, and have sought in what way to determine its advantages in regard to cost. The best opportunity which has yet been offered has been presented to Mr. W. Chew, of Blackpool, the Corporation of which borough a year ago determined to illuminate their Promenade with the electric light. A notice of the display was furnished to us at the time by a correspondent, but a more detailed account of the proceedings in connection therewith was given by Mr. Chew, in the paper he read at the recent meeting of the Manchester District Institution of Gas Engineers, and reported in another column. Of course, the Corporation discarded all consideration of cost. They knew very well that the gaping crowds who would come to view the new light would fill the publicans pockets, while the more tender sex would occupy apartments let at prices which would so far satisfy the proprietors that a little extra taxation would not be felt. We shall not go farther, or we might ask what the poor shopkeepers behind the Promenade, and not particularly interested in the display, felt. But, after all, according to Mr. Chew, the expense incurred in the installation of the light has not been large, seeing what the power of illumination is. The lights used in Blackpool differ from those employed in most exhibitions, being naked—that is to say, they are simply enclosed in plain glass lanterns, not opal or frosted. The intensity of these lights is most remarkable, Mr. Chew asserting that he could read his watch a mile and a half from the lights. But it must be observed here—and the fact is worthy of all recognition—that the electric light does not answer well in a fog. When Mr. Chew read his watch, heavy cumuli were floating about in the sky, reflecting every beam of light emitted from the electric lamps. After all Mr. Chew has said, we are not quite clear as to the cost of the electric light in comparison with gas. We gather most decidedly that in Blackpool it is not cheap, and the Corporation never meant it to be so. They had one object in setting up the lights, and that was to attract visitors. In this they succeeded well, and any additions to the rates which may be imposed in consequence will, no doubt, be cheerfully paid, at all events by those most directly benefited by the display.

The substitution of mechanical for manual labour in gas-works is to our mind highly desirable. We once heard a popular orator describe, by anticipation, the day when it should be the duty of the material world to do all the work, and the privilege of man to stand by and see it done. The orator did not speculate on what would be the circumstances of the man on Saturday night; but that is nothing to do with the question before us. We have here only to call attention to the comparative experiments recently made at the Rochdale Road gas-works of the Manchester Corporation, with the West and Foulis apparatus for drawing and charging retorts. It must be observed here that Mr. West's system includes more than a novel form of apparatus for charging, &c., the retorts. The principle of light charges and short high heats is introduced. In the trials at Manchester to which we allude, and a table of the results of which will be found on another page, both experimenters were placed under similar conditions. So far as we learn, the advantage lies with the West system, under which (without enumerating minor considerations) the make of gas per ton of coal carbonized was greater, the illuminating power of the gas produced was higher, and there was a considerable saving of labour. We shall return to this subject when the report of the Gas Committee to the City Council on the experiments is before us.

Water and Sanitary Notes.

It is all over with the Metropolis Water-Works Purchase Bill! Mr. Cross, apparently frightened at the opposition threatened, has withdrawn the Bill, and it no longer appears on the papers of the House of Commons. There is no doubt that if the Bill had gone on, an amount of opposition would have been raised which would in all probability have quite sufficed to ensure the defeat of the measure. The Home Secretary seems to have seen this clearly. He was mislead by his advisers in the first instance, and placed in a difficult position, from which he could hardly escape except by abandoning the Bill. He has done so, we have no doubt, with very great reluctance, for he started with an honest endeavour to serve, as he thought, the interests of the ratepayers, while he did justice to the Water Companies. Having satisfied the Companies, he, no doubt, indulged a hope that the Metropolitan public would be no less satisfied, and that the bargain made under his supervision would be at once accepted. How he was disappointed we all know. With one consent the Press and the Metropolitan Authorities repudiated the bargain, so there was nothing for it but to withdraw the measure, which Mr. Cross did in a somewhat petulant spirit. But now comes the most curious phase of the business. No sooner is the Bill withdrawn, than those who might be expected to be its most strenuous opponents, turn round and profess to find in the measure a sound basis for a settlement of the business. They, of course, protest that it is highly desirable that the water undertakings should be in the hands of the public authorities, which is freely admitted on all sides; but the conditions on which the undertakings are to become the property of the public form another part of the question, and on this matter there are two opinions. The valuers called in by the Home Secretary put upon the undertakings a certain price, which was embodied in the Bill we noticed last week—a Bill which was at first sight rejected by the Metropolitan Authorities. But, on reflection, the popular agitators seem to have discovered that, under the circumstances, the terms of purchase are as good as were to be expected. They were, but now comes the quinquennial Metropolitan valuation, under which the Companies will have it in their power to raise their rates according to the increased value; and it must be quite understood that the legal right of the Companies to do this is thoroughly assured. Under their special Acts they have power to charge water-rates upon the annual value of the premises supplied.

A great outcry is made against the assessment of water-rates according to the annual rateable value of the premises furnished with water. The Earl of Camperdown as well as Mr. Goschen are anxious to prevent any elevation of the rates in consequence of the new valuation. The question of the purchase of the Companies is, if we understand Mr. Cross's Bill, settled on a given basis; but supposing a new basis of rating be introduced, it seems to us clear that it would not affect the position of the Government measure. One thing remains to be settled, and that is the basis on which the Companies, which we hope will long continue to exist, shall fix their charges. To charge on annual value seems to many, and is, we admit, in a large number of cases, unjust; but what other system can be adopted? We have repeatedly endeavoured to show that charges by meter are at present impossible. Upon what principle, then, shall the Water Companies regulate their charges? There is but one that we know of, and it is the rateable value of the premises to which the water is supplied. A great many other suggestions have been made, as, for example, the number of rooms in the houses supplied; and, again, the number inhabiting the apartments of the houses. It will be perfectly clear to all who study this part of the question that any foundation for a charge on such basis would be perfectly untenable. There is thus nothing to fall back upon but rating according to annual value. Then comes the momentous question as to whether the Companies shall have the right to increase their rates according to the enhanced valuation of Metropolitan house property. It is contended that this must not be; but where are we to stop? When is the day to be fixed beyond which no further advance shall be made in the Water Companies rates? It is all very well to say that the Companies must have their legal rights, but these rights we may just as well admit ought to be defined.

Sir Charles Dilke very reasonably asks for a return of the financial statement on which the calculations are based of the payments to be made to the several Metropolitan Water Companies, as proposed in Mr. Cross's Bill. To this return the honourable baronet is perfectly entitled. It is not to be endured, on whatever side we look, that any secret proceeding shall influence the action of Government. The public are fully

entitled to know the exact worth which the valuers set upon the undertakings of the individual Companies; therefore we, having regard for the interests of all Companies, desire to be fully informed of the details upon which the Government assessors arrived at their conclusions. But now comes a curious question. What caused the sudden dissolution of Parliament? Politically, there was no reason why Parliament should not have gone on until the autumn, which, it may be, would not have been so convenient a period for the dissolution—that is, for the Government—but which would, if we may for one moment indulge in ordinary politics, have served the country much better. What, then, did it? The Metropolitan Water Bill, we are told. Perhaps it did. We are very sorry, however, that the arrangements which were made by the Home Secretary have fallen through; but nothing less was to have been expected when the terms of the bargain were made public. The extraordinary rise in the price of the shares of the Water Companies showed at once what financial speculators thought of the scheme. The shares of the Southwark and Vauxhall Company, who had been under a cloud, and whose dividends had been for some years exceedingly small, suddenly rose from 113 to 279, clearly showing that the Government bargain was fully appreciated on the Stock Exchange. The speculators, however, well know that the permanent interest of the Companies lies beyond their recognition. Already a considerable depreciation has been experienced, and we may anticipate that within a short period the shares of the Metropolitan Water Companies will have fallen to their normal values. What they will ultimately come to we cannot undertake to say; but this much may be averred, that for a considerable period to come the prices of shares in Metropolitan Water Companies will be settled by dividends rather than by any speculative opinions which may be formed as to a possible purchase.

It would seem, from the utterances of Mr. Gladstone and Mr. Fawcett, both of whom will be members of a Liberal Cabinet, if such a thing should ever be formed, that a Whig Government will not endorse the bargain made by the present Home Secretary. Mr. Cross, in one of his early addresses on the subject in the House of Commons, plaintively acknowledged that the terms, although not so good as he could wish, were the best that could be obtained from the Water Companies. The Metropolitan public—at all events, the few who have taken any notice of the matter—immediately repudiated the bargain; but no sooner is attention drawn to the probable effects of the coming new valuation, than the leading agitators against the Companies turn round and acknowledge that although the Government Bill is not all that could be desired for the ratepayer, it ought to be proceeded with, and thoroughly investigated before a Select Committee. We quite agree for once with the water agitators, and shall be glad if the Bill be proceeded with in the first session of a new Parliament. More than that it is hopeless to expect, for, recognizing the difficulties which surround legislation of this kind, we must admit that the chances of the Bill are not hopeful. What would be thought if we asked for a Home Rule Parliament for the Metropolis? One thing has to be said, and that is that the Shareholders in the Metropolitan Water Companies are scattered all over the world, and their interests must be attended to. It seems, however, perfectly clear that the whole business is at an end for the present session, and probably for the present year. The Water Companies will go on as they have been going, and the Shareholders will fare as well as they have fared, and that is extremely well. It is certain, then, that but little satisfaction will be gained, except by speculators, some of whom, perhaps, have not fared at all well.

We have been asked more than once what the Metropolitan Water Companies are to do under the changed aspect of affairs. We give but the one answer we have made for years, and that is, "Amalgamate." We have no particular love for the Southwark and Vauxhall Company, but we do admire their pluck in coming forward to effect the greatest boon that could be conferred upon the Metropolitan water consumers, and also to the interests of the united Companies. We do not want Government interference; we want freedom of action, and with that secured we feel certain that everything the Metropolitan water consumer may require will soon be settled.

The Trowbridge Water Company held their annual general meeting at Cambridge on the 28th ult. This Company, after a rather severe struggle during their short existence, have at last become fairly prosperous. In a town like Trowbridge, it is not likely that big dividends will ever be realized; but we have no doubt that as time moves on, and as the West of

England cloth trade revives, the Company will find themselves in circumstances to pay something approaching to their maximum dividends.

The Wakefield Corporation have carried their Bill through a Committee of the House of Lords, and Wakefield, it is to be hoped, will soon be supplied with something better than the filthy mixture hitherto extracted from the Calder. The old Company, we believe, did their best to make the mixture palatable and wholesome, and, so far as the rate of mortality goes, it seems to show that although the excreta of half a million of people and the refuse from numbers of dye-works were poured into the Calder, they had no deleterious effect on the health of the inhabitants. Perhaps, after all, there is some virtue in magnetic carbide. It is, however, a happy thing that Wakefield is to have a supply of water from a catchment system, the wholesomeness of which will be beyond suspicion. Probably we shall never again see a popular lecturer writing in visible bold text with the water from the intake of the Wakefield Corporation.

An interesting report recently presented to the Commissioners of Sewers by Lieut.-Col. Haywood, C.E., gives an account of what has been done for the City during the past year in the way of public water supply. We read that the whole fire hydrant system is now complete, and that 818 hydrants have been fixed in the City. A large number also have been placed to enable the streets to be washed by jet and hose. This system is extremely effective, and should be more largely employed. The stand-pipes which the Commission fixed, to afford a constant supply to the poor, are being rapidly rendered useless because there are so few poor to be supplied, their dwellings having been demolished under the powers conferred by the Artizans Dwellings Improvement Act. There is an evident desire on the part of the Commission to improve the poor out of the City, though they have not quite succeeded up to the present.

YESTERDAY'S PRICES OF GAS AND WATER SHARES.—Mr. A. G. Prater, Stock and Share Broker, of 23, Cornhill, gives the following as the closing prices yesterday of some of the principal gas and water shares:—

Gas Companies.		South Metropolitan "A"	
Brentford.	144—148	Do. "B."	178—182
Brighton . . . (ex. div.)	88—95		
Brighton and Hove . .	34—35		
British.	34—35		
Commercial.	185—187		
Continental Union . .	193—204		
Do. 7 per cent. Pref.	23½—24½		
Crystal Palace District.	173—176		
European.	18—19		
Gaslight and Coke "A"	176—178		
Imperial Continental .	179—181		
London	175—180		
Phoenix	35½—36½		
		Water Companies.	
		Chelsea	199—203
		East London	198—202
		Grand Junction . . .	113—115
		Kent	295—290
		Lambeth	203—206
		Do. 7½ per cent. . .	170—175
		New River "New" . .	355—365
		Southwark & Vauxhall.	204—207
		Do. "D"	168—173
		West Middlesex . . .	170—174

LEONISTON GAS COMPANY, LIMITED.—The Directors of this Company, in the report presented to the thirty-third half-yearly meeting of Shareholders on the 4th inst., state that the accounts for the year 1879 show a net profit of £617 18s. 4½d., while the balance brought forward from 1878 was £98 18s. 11d. A dividend at the usual rate was paid for the half year ending June 30, and the Directors recommended that a dividend at the same rate—viz., 10 per cent. per annum on the original shares, and 7 per cent. per annum on the B shares, be declared for the half year ending Dec. 31. The balance to be carried forward would then be £19 7s. 3½d. The consumption of gas by private consumers was 8,369,000 feet, an increase of 296,300 on that of 1878, or barely 4 per cent. An exhauster, a Kirkham, Hulett, and Chandler's patent washer-scrubber, driven by a gas-engine with Fison's regulator, and other apparatus, had been erected and brought into operation since the commencement of the present year. They appeared likely to realize the expectations formed of them. The sale of coke and other residuals continued good. The works were in a very complete position, and no further outlay of importance was likely to be required for some time to come.

ILFRACOMBE GAS COMPANY.—The annual general meeting of this Company was held on the 3rd inst.—Mr. Wivell in the chair—when the report presented stated that after allowing for interest on loans, Directors and Auditors fees, &c., there was a balance of £1551 9s. 1d., out of which the Directors recommended a dividend at the rate of 7 per cent., together with 3 per cent. back dividend (1874) on classes A and B, and 4 per cent. on class C shares, free of income-tax, leaving a balance to be carried to the current year. In moving the adoption of the report, the Chairman congratulated the Shareholders upon the nature of the balance-sheet, which, he said, must be highly satisfactory, considering that the last season in Ilfracombe was both wet and short. Notwithstanding this, the Company had an increased revenue of £221. The illuminating power of the gas had been kept far above the standard required by their Act of Parliament, by which they were compelled to give only 14-candle gas, whereas it had hardly ever been below 15½ or 16 candles. The public were, perhaps, not aware that this increase in the illuminating power was tantamount to a reduction in the price of gas; but it was so, as it enabled them to exercise greater economy in its consumption. Another thing which should be mentioned was that the Directors had determined to lay all pipes for consumers to the outside of their houses, provided the distance did not exceed 20 feet from the mains. During the year, the whole of the works were kept in a most efficient state, and when renewals had been required, they were done, and charged to revenue account. A large iron tank had been erected for storing tar and ammoniacal liquor, these products having now become very valuable, and the Directors hoped by another year to feel the benefit of this outlay. The report was adopted, and the retiring Director and Auditor were re-elected. On the motion of the Chairman, it was resolved to commence a reserve-fund, and £200 was set apart for the purpose. The proceedings closed with the usual votes of thanks to the Chairman, Directors, and Officers of the Company. At a subsequent meeting of the Directors, it was resolved to make a reduction in the rent charged to consumers for meters.

THE METROPOLITAN WATER QUESTION.

CALMER considerations may yet prevail with reference to Mr. Cross's Bill for the purchase of the Metropolitan Water-Works. Even Mr. E. J. Watherston, presiding at a meeting of Vestry delegates on Friday last, declared that the Government Bill "had not been properly understood," and he contended that though the terms of the Companies were "Shylock-like," yet they were "better than no terms at all." In harmony with the remarks of their Chairman, the Vestry delegates adopted a resolution moved by Mr. James Beal, declaring that although the Bill proposed "excessive terms of purchase," yet it was desirable that it should reappear in the next Parliament, and be referred to a Select Committee. The Home Secretary, in reply to Alderman Cotton in the House of Commons last Tuesday, announced that "the Bill would not appear on the paper again this session." "At present," said Mr. Cross, "the public are not willing to pay the price for which the Companies are willing to sell, and so ends the matter." But a desire manifests itself in certain quarters that the question, having been opened, should not be so speedily closed. It is thought—though we do not see the foundation for such a hope—that the selling price to which the Companies have consented might be reduced, should the Bill get before a Select Committee, despite the argument of the Marquis of Hartington to the contrary. Mr. Cross would, doubtless, like his Bill to undergo careful examination, so that the outside world might understand the financial part of the question better than it does at present. As it is, the public have taken fright at the wild speculations on the Stock Exchange, and have judged of the purchase clauses of the Bill solely by reference to the inflated quotations of the share market. The idea was thus conceived that the Water Companies had made a bargain by which the Shareholders would be enormously enriched, and for a while every other consideration was lost sight of, both by the Press generally and by the public.

On the whole, we are glad to find that the dread of Dr. Frankland's "living and moving organisms" has taken less hold on the popular imagination than might have been expected. Not germs, but gold, would seem to rule the question. "What have we got to pay?" is the burden of the appeal. The witchery of "*Sanitas sanitatum, omnia sanitas*," has failed. The Metropolitan ratepayers are not so much afraid of the water supply as they are of the Three-and-a-Half per Cent. Water Stock. The theme might suit the pen of the Sage of Chelsea. Mr. Cross has clearly over-estimated the extent to which the public have been educated to believe that the London water-mains are only modified duplicates of the sewers that lie beneath them. People are not so much alarmed, after all, but rather scout the notion that the question is actually "Your money or your life." They expect to live, even if the Water Companies remain in possession; and the Home Secretary must feel not a little disappointed at this issue of his well-meant endeavours. He proposed to "improve the supply" and "diminish the expense," and is met with a roar of derision, such as seems even to have disturbed the serenity of the Cabinet, and hastened the dissolution of Parliament. Every one of the Metropolitan seats was likely to be lost. Bulgarian atrocities were as nothing compared with the Metropolis Water-Works Purchase Bill; and a Government which could face the Zulu and the Afghan was unable to face the London ratepayer, excited to madness with the notion that the Water Companies were better diplomatists than Mr. Cross. The Press has raged, the Vestries have been perplexed, and the Water Question has fairly overwhelmed the Government. The history of this strange affair—as yet only half written—is so far instructive as showing that, while great Imperial questions affect the temper of politicians, local matters are apt to exercise a very practical influence on great masses of the people. We have reason to know that the Metropolis Water-Works Purchase Bill is viewed with a very lively interest far outside the area which it more immediately concerns, and that in some of the large towns of the kingdom the question is debated with singular keenness. The Czar and the Sultan are important personages; but the rate collector stands at our door.

The Purchase Bill being thus checked in its career, the parties who may be considered primarily antagonistic to the Water Companies are anxiously estimating the consequences of delay. They have been puzzled of late to know exactly where they were, and they are still more concerned as to where they will be. Mr. Goschen has asked Mr. Cross whether he can see any way by which to stop the Companies from raising their charges "pending further legislation on the subject;" and Mr. Cross has given an answer which practically amounts to a negative. A new assessment of the

Metropolis is about to take place under the Valuation Act of 1869, and it is apprehended that the Companies will levy their rates according to the enhanced value which may thus be given to house property. London is not a decaying city, otherwise the levying of the water charge on the basis of the annual value would be looked upon as a very just and proper thing. London is prosperous, but it is not considered desirable that the Water Companies should share in the prosperity. When the assessment goes up the Companies are to charge no more; when it goes down, they must, of course, charge less. Such is the doctrine which lies at the root of Mr. Goschen's philosophy on this subject, and the same is to be said of the Earl of Camperdown, who is to urge the question to-day in the House of Lords. Perhaps somebody will bring forward a Bill prohibiting the aristocratic owners of house property in the Metropolis from raising their rents when building leases fall in. The idea that the Water Companies are to remain *in statu quo* while Bills are tossed about in Parliament, is one which no Government will be able to entertain. Mr. Cross could go no farther than to say that if he found on the part of the Companies any intention of raising rents for the purpose of enhancing the price to be paid for their undertakings, he should recommend Parliament to pay no attention whatever to such augmentation. While Mr. Cross could say no more, perhaps he went a little beyond the mark in saying so much as he did. So long as the Companies act within the limit of their powers, they are not amenable to penalty, whether such is to be inflicted directly or indirectly, though it is to be hoped that they will exercise their privileges in future with the same amount of moderation as has hitherto characterized them.

Mr. Watherston is wiser than some who ought to be wiser than he. In his speech at St. Martin's we find him saying, "If the Bill be withdrawn as a result of opposition, factious or otherwise, the position of the ratepayers will be materially 'impaired.'" "Financially," he says, "this is certain to be the 'case,' and in proof he adverts to 'the prospect of the 'approaching assessment.'" We understand Mr. Watherston when he says these things, though we do not quite agree with him as to any actual damage which is to accrue to the ratepayers, unless it be after the undertakings have been transferred to a new authority. We agree with this gentleman so far as to admit that each year will add to the value of the undertakings of the Water Companies, and this is a very good reason, from the ratepayer's point of view, why the bargain should be quickly settled. It should, at the same time, be remembered that this perpetually growing value is an element in the entire calculation, and has its effect on the present market value of the interest which has to be purchased. Mr. Watherston is not far wrong. "The ratepayers have to consider," he says, "whether they or the Companies shall have 'the advantage of the unearned profits which, be they large or small, will accrue to the parties in possession when the 'assessment is raised.'"

All parties may rest assured that should the water supply pass into the hands of a public authority, the Metropolis Valuation Act will afford the basis for the charge to be made upon the occupiers of houses and premises supplied with water. If there be a public rate as well as a domestic rate, or if there be a domestic rate alone, the assessment will in all cases govern the charge, subject again to extra charges in special cases, as at the present time. As a general rule, the annual value of the property is the only practical basis on which to charge for a supply of water. Supply by meter is open to serious sanitary objections; and a charge which is founded on the number of rooms in a house is altogether mediæval and absurd, as shown by the fact that it was long ago discarded by Parliament in favour of the present method. The ratepayer may indulge the hope that when a public authority has possession of the water supply, an increased rateable value in the house property of the Metropolis will not lead to any increased charge. The public authority; it may be said, will rest satisfied with its former revenue, but it remains to be seen whether such a public authority will not be ambitious of "improvements," and whether it will at any time be at a loss for reasons why the rate in the pound should not be kept where it was. "Better this," some will say, "than pay dividends to shareholders." But it does not follow that every addition to the revenue of a Water Company goes to increase the old dividends. Much of it goes to pay dividends on new capital, expended on those improvements which are either forced on the Companies by Local and Imperial Authorities, or which, in the judgment of the Directors, are desirable for the satisfaction of the consumers. It may be that water is dearer now than it was formerly, but it is also much better, and the improvement

is not effected without outlay. When people hear of an intake being removed higher up the river, or a filter-bed enlarged, or a new impounding reservoir constructed, they possibly fail to consider that all this involves the expenditure of fresh capital, for which there must be a return. We are not speaking merely of the extension of the water-works which is rendered necessary by an enlarged demand for water, consequent on the increase of the population. That, at all events, would pay for itself, though it requires fresh capital. But we are adverting to the fact that the works of the London Water Companies, irrespective of the growth of the population, are much more costly now than in years gone by, and unless capital is to be had for nothing, a corresponding rise must take place in the charge for water. To say that there is no equivalent for such extra charge, is to speak in ignorance of the facts. The extra return is apparently found in the increasing rateable value of property, and it is far better for it to be found in this way than in an increased rating on the old assessment. As London grows in wealth it may very properly expend more money in improvements. Local rates do not shrink because the annual value of property goes up. The demands of the Metropolis are growing every year. Something more is wanted, and something better, and the growth of the outlay is found to keep pace, as near as can be, with the means of meeting it.

As a practical comment upon the remarks we have just penned, we would advert to a passage in the last Annual Report of the Local Government Board. We there find it stated by Colonel Bolton that subsequent to the passing of the Act of 1871, the Water Companies have, of their own accord, and in consequence of the recommendations of the Government authorities, incurred and undertaken an expenditure of two millions sterling "for the improvement of the "water supply both in quantity and quality." This, we would observe, can no more be done without payment of dividends by Water Companies than it could be effected without an equivalent in the rates levied by a public authority. It does not follow that a Company will in all cases pay a dividend of seven or ten per cent. on such outlay, though this is the popular notion. But a public authority might be expected to raise money on easier terms than a private company, and in this way the proposed Water Trust ought to effect a saving. The Water Companies are not to be blamed because they have not the power of pledging the municipal rates; but the parties who may have that power in the future ought to be able to show a corresponding pecuniary benefit. If the Metropolitan ratepayers would take a cheerful view of this prospect, they might the more readily reconcile themselves to the Purchase Bill. If the Bill finally falls to the ground, it is threatened by some parties that a competing scheme of supply shall be brought forward. Of all extravagant proposals, this would be the worst—the most hopeless in the first instance, and the most costly supposing the scheme to be put into practical operation. A project of this kind may be planned, but its doom is sealed from the commencement. The special supply proposed by the Metropolitan Board was perhaps the most economical plan that could have been devised; but the project was, nevertheless, felt to be intolerable, and the scheme for a "dual "supply" was decisively rejected as soon as its real nature became understood. What the Companies have most to dread is the introduction of some severe Regulations Bill, designed to operate in such a way as to depreciate their property. But Parliament is not likely to be a party to an obvious trick of this kind. Unfortunately, the whole subject is for the present affected by the element of political strife. The din of a general election is scarcely conducive to a clear judgment on a ministerial measure, even though the latter has reference to a matter which ought to be kept outside the arena of party politics. Mr. Gladstone is candid enough to say that he has not yet had time to examine the measure brought in by Mr. Cross, and therefore he cannot assume "that the Bill is a bad "Bill or a good Bill." But while Mr. Gladstone holds his judgment so far in suspense, he denounces the Government for having brought forward a measure which they fail to uphold. The defence of Mr. Cross is simply that, in respect to this Bill, it was not the intention of the Government "to "force any proposition on Parliament," and perhaps this may be taken as a very fair answer—given by anticipation—to the comment of Mr. Gladstone.

The present Home Secretary, whose general ability cannot be questioned, has thus learned of late, more fully than ever, how enormously difficult it is to satisfy the Metropolitan ratepayer, or those who venture to speak on his behalf. Yet it is not at all unlikely that if the present Bill fails to reappear in the next Parliament, there will be a general feeling that a

good opportunity for placing a great Metropolitan question on a new basis has been needlessly sacrificed. If the Bill really dies, it will have a fair epitaph, and we shall hear of its virtues when it is too late to benefit by them.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE USE OF THE FOUR-BUSHEL MEASURE IN THE SALE OF COKE.

SIR,—In the JOURNAL of the 9th inst., page 365, alluding to the new coke measure, you state as follows: "The only variation that is now necessary in the coke business is one of terms. The quotation of chaldron must be dropped, and 12 four-bushel measures substituted."

Allow me to ask why you state 12 four-bushel measures. Why not 9 four-bushel measures, equivalent to the chaldron of 36 bushels? A sack being 3 bushels, 12 sacks would be equal to 36 bushels.

Gas Office, Deal, March 11, 1880.

W. R. HAMMOND.

[The suggestion that "12 four-bushel measures" should in future be quoted, was made because of the evident convenience its adoption would be to the coke trade—indeed, in it lies the whole question. Nine sacks equal to 36 bushels would, it is true, constitute the new "chaldron;" but in bulk would be 25 per cent. less than the quantity hitherto comprising a chaldron. This is the very confusion which was sought to be avoided, and the suggestion referred to sets the matter straight.—Ed. J. G. L.]

THE ELECTRIC LIGHT IN AMERICA.—In the course of a letter, dated this day month, from Major G. Warren Dresser, Editor of the *American Gaslight Journal*, he says: "We still live, and are patiently waiting for some new *furor* on electric light, or something else. As it is, Mr. Edison has not yet established himself in New York, and the public are obliged to suffer the infliction of gas companies with their horrid bills, &c., &c. At various points in the city an electric light may be seen hung out from the top of a high building, as a sign that something or somebody is to be sold within. The practical applications in this city for any other than advertising purposes are very few. In some of the mills in New England the "Brush" light has been introduced with very good practical results. In fact, Mr. Brush has, I think, done more and better practical work with his system than any of the other American inventors. But their statements of cost of running may be taken *cum grano salis*, and I know of one case at least where this light is used quite extensively, in which the mill proprietors who use the light do not hesitate to buy gas stock in the Company supplying their town, when they get a chance. The statement that the electric light saved them several thousand dollars a year does not seem to be borne out by the fact that their gas bills for six months, while using the electric light, did not vary a hundred dollars from the corresponding six months when not using it."

ABINGDON GAS COMPANY.—The seventeenth annual meeting of this Company was held on Thursday, the 4th inst. Mr. F. S. Copeland in the chair—when the Directors reported that the balance of net profit for the past year amounted to £1287 11s. 9d. They recommended a dividend of 10 per cent. on the original shares, and 7 per cent. on the B shares, which would absorb £1047 14s. 2d., leaving £339 17s. 7d. to carry forward. During the year there was sold by auction £1000 of new capital. This realized a premium of £115 12s. 9d., which has been applied to reducing the cost of extensions. The Directors stated that they have reason to believe that the new system of charging retorts adopted by their Manager (Mr. John Ely) has greatly contributed to the increased make of gas per ton of coal carbonized during the last twelve months. The Company have issued £10,000 of 10 per cent., and £1500 of 7 per cent. capital; and have borrowed £3000 at 5 per cent. The unexpended capital amounts to £1230. The receipts for the year—including £2651 8s. 6d. from the sale of 10,695,700 cubic feet of gas at 5s. per 1000 feet; and £410 10s. for public lighting and under contracts—amounted to £4027, and the expenditure to £2622. The report was adopted, and the dividends agreed to. Votes of thanks were passed to the Chairman and Mr. Ely at the close of the meeting.

DOUGLAS (ISLE OF MAN) GASLIGHT COMPANY.—The nineteenth half-yearly meeting of this Company was held on Monday, the 23rd ult., when the Directors reported that the net profits for the half year ending Dec. 31, amounted to £2289 15s. 2½d. The profit, notwithstanding the reduction in the price of gas made on the 1st of July last, exceeded that of the corresponding period of 1878 by £115 10s. 3½d.; and the increase would have been considerably more, had not the reduction affected the full six months, while in 1878 the reduction then made affected only the three months from October to December. The Directors stated that the consumption of gas throughout the town showed a marked increase, as compared with the corresponding period of 1878. The quarter ending the 30th of September showed an increase of 10 per cent., and the quarter ending the 31st of December an increase of 16½ per cent. During the current half year the Directors would be compelled to make large and important additions to the general working plant. New condensers and scrubbers would have to be erected, and a new station-meter, as the present one was too small for the make of gas, and, therefore, unreliable in its registration. These extensions to plant it is estimated will cost about £2000. The Directors have made a contract for the renewal of two sets of retorts during the spring. Respecting the building of a new gas-holder and tank, the Directors reported that the concrete tank had been completed; but, acting under the advice of Messrs. C. and W. Walker, the contractors, the Directors had deferred erecting the holder until the spring opens. At the meeting of the Company held last August, it may be remembered the Directors informed the Shareholders that they would consider their interest with respect to the extension of the working plant made out of profits. They now recommended that a bonus of one-fifth of a share be allotted to each Shareholder; and that the dividend for the half year be £1 5s. per share. These recommendations were agreed to; after which a vote of thanks was passed to the Directors, and acknowledged by Mr. Naylor, who, in turn, proposed a vote of thanks to the Secretary, Manager, and the general staff of servants of the Company. Mr. Goldsmith seconded the motion, which was carried unanimously. Mr. Quinney (the Secretary) and Mr. Smith (the Manager) having returned thanks, the proceedings closed with a vote of thanks to the Chairman.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, MARCH 8.

The Select Committee on the Cardiff Water Bill reported that they had not proceeded with its consideration, no parties having appeared in opposition.

TUESDAY, MARCH 9.

METROPOLITAN WATER-RATES.

The Earl of CAMPERDOWN gave notice that he will this evening call attention to the present position of the metropolitan ratepayers who consume water, with reference to the charges which are and may be made by the Water Companies; and ask whether the Government will take steps to ascertain—(1) if the Companies are correct in law in interpreting "annual value" to mean "gross annual value;" and (2) if each successive re-valuation of the Metropolis under the Metropolis Valuation Act, 1869, will alter the rateable valuation of metropolitan property in respect of the water supplied by the Companies.

FRIDAY, MARCH 12.

A petition against the Rathmines and Rathgar Township (Vartrey Water Supply) Bill was presented from the Grand Canal Company.

HOUSE OF COMMONS.

MONDAY, MARCH 8.

METROPOLIS WATER-WORKS PURCHASE BILL.

The CHANCELLOR of the EXCHEQUER having made a statement to the House as to the early dissolution of the present Parliament, and mentioned what Government business would have to be got through,

Sir CHARLES DILKE said: The right honourable gentleman did not mention one very important measure which has been introduced by the Government—I mean the Metropolis Water-Works Purchase Bill. Some people seemed to think that this Bill was the subject on which Government were likely to dissolve, and therefore it would be desirable to know what is to be done with it.

Mr. CROSS: The honourable baronet must know perfectly well that I stated the other night that as far as any bargain with the London Water Companies was concerned, it was never the intention of the Government, in any form or shape, to force the bargain they had made upon the public. The only proposition which the Government has ever made in regard to the matter is this—that a measure should be introduced into the House and go before a Hybrid Committee, and if the Committee or the House thought the bargain would not be a beneficial one, there would then, of course, be an end to it. There was no intention on the part of the Government to force any proposition on Parliament.

PRIVATE BILLS AND THE IMPENDING DISSOLUTION.

Sir J. GOLDSMID subsequently said: I suppose the Chancellor of the Exchequer has considered the question with regard to private Bills which have been introduced. Some of the parties to those Bills will have been put to considerable trouble and expense.

The CHANCELLOR of the EXCHEQUER: It is a common practice, whenever there is a dissolution of Parliament in the spring, to pass a Standing Order which puts private Bills at the beginning of a new Parliament in the same position which they occupied in the old one.

TUESDAY, MARCH 9.

The Standing Orders Committee reported that, in the case of the Rathmines and Rathgar Township (Vartrey Water Supply) Bill (Lords), the Standing Orders ought to be dispensed with, and the parties allowed to proceed.

A petition in favour of the Hull Lighting Bill was presented from the Corporation of the Governor, Deputy-Governor, Assistant, and Guardians of the Poor of Kingston-upon-Hull.

The *locus standi* of the Midland Railway Company as petitioners against the Liverpool United Gas Bill was disallowed.

METROPOLIS WATER-WORKS PURCHASE BILL.

Mr. SAMUELSON asked the Secretary of State for the Home Department whether, before concluding his negotiations with the London Water Companies, he obtained reports and estimates, from competent Engineers, of the probable cost of extra works (if any) required to give an adequate constant supply of pure water, on the transfer of the various undertakings; a similar estimate for works having the same object, during the period covered by the proposed payments of deferred stock; and a report and estimate of the cost of establishing entirely new works adequate to afford such a supply over the area served by the existing Companies; and, if such reports and estimates had been obtained, whether he would lay them upon the table.

Mr. CROSS: Of course all these questions were matters which had to be very carefully considered, and if the Bill had gone into committee, I should then have been prepared with evidence to show actually what would have been the cost and expense of these matters. This evidence is not in a form to be laid on the table, nor at this time, in the present state of affairs, do I think it would be conducive to the public interest that it should be laid on the table; but whenever the Bill gets, if it does ever get, into committee, I will take care that these matters shall be laid before it.

Alderman COTTON asked whether it would not be better to withdraw the Bill at once, seeing that there was not any chance of its being passed before the dissolution of the present Parliament.

Mr. CROSS: I thought I explained last night, in answer to a question put by the honourable baronet, the member for Chelsea (Sir C. Dilke), that the Bill would not appear on the paper again this session. At present the public are not willing to pay the price for which alone at present the Companies are willing to sell, and so ends the matter. I wish, with the permission of the House, to correct two errors which appear to prevail as to what I said on two points connected with the Bill. First, I am reported to have said that there would be a saving of £50,000 in the year 1880-81 from the consolidation of the staff of the Companies and engineering operations. What I meant, and what I believe I did say, was that there would be a saving of £50,000, owing to the basis on which the income of the Companies for that year was calculated and the abolition of Directors fees, besides any saving from the consolidation of the staff and engineering operations, which matter has been variously computed at from £75,000 to £100,000. Secondly, as to the impression which apparently prevails from what I stated that the ratepayers would not be consulted, I do not understand how this matter could at all have got abroad. The whole object and end of the Bill was that the ratepayers should have every opportunity of pressing their views upon the Committee for the rejection of the Bill if they thought it would not be a beneficial bargain to make, and should the matter again come forward the ratepayers may rest assured that they will be duly consulted, and will have ample opportunity for stating their views on the subject.

Mr. GOSCHEN: May I ask a question also of the right honourable gentleman with regard to this Bill. It is, whether any steps could be taken, before any further legislation takes place with regard to the London Water Companies, to prevent any alteration of the relative positions of these Companies and the public in the interval. I mean, for instance, precautions that the Companies should not again raise their rates upon the public upon the next re-valuation, and then make that raising of the rates a further argument for an increase of the price when fresh negotiations are opened. I would ask the right honourable gentleman whether he can state anything now to the House, or whether he would on Thursday be able to make a statement, as to whether it is possible, by a short clause, or by any other means, to endeavour to maintain the *status quo* of the Companies.

Mr. CROSS: If the right honourable gentleman will ask that question on Thursday, I will be prepared to answer it.

WEDNESDAY, MARCH 10.

The return which Sir CHARLES DILKE, on Friday, the 5th inst., gave notice that he would move for, in reference to the Metropolis Water-Works Purchase Bill, was ordered.

THURSDAY, MARCH 11.

PRIVATE BILLS AND THE IMPENDING DISSOLUTION

Mr. RAIKES (Chairman of Ways and Means) proposed a series of resolutions, which were adopted as Standing Orders of the House, empowering the promoters of private Bills in this session of Parliament to introduce their Bills into the next Parliament at the stage they last reached in the present one.

METROPOLIS WATER-WORKS PURCHASE BILL.

The Examiners report, that the Standing Orders have been complied with in respect to this Bill, was presented.

METROPOLITAN WATER-RATES.

Mr. GOSCHEN had given notice to ask the Secretary of State for the Home Department whether he had considered the possibility of taking steps, by a Bill or otherwise, to prevent the Water Companies in the Metropolis from further raising their rates to the consumers on the strength of existing Acts of Parliament, pending further legislation on the subject. He added: Perhaps the House will allow me to explain what I mean when I speak of "existing Acts of Parliament." I am thinking of the Metropolis Valuation Act, 1869, under which the Water Companies raise their rates, but which certainly was not intended, either by the framers of the Act or by Parliament, to have that effect. It was not intended to meet the case of the London Water Companies at all.

Mr. CROSS: I was not aware, until the right honourable gentleman explained what the question was, whether he referred to the Metropolis Valuation Act, or to the Metropolis Local Management Act and the private Acts which regulate each Company. There can be no doubt that the Metropolis Valuation Act, which I am bound to say was a very useful measure, was passed for the purpose of getting a proper valuation of the Metropolis for the special purposes named in that Act of Parliament. There can equally be no doubt that, in considering what the annual value of the property supplied by the Water Companies was, they did take advantage of the Act, and when it was passed they did raise their rents considerably. Parliament took no notice of this matter, and it has gone on up to the present time. The water-rents, however, are not determined by statute, but by the Companies own Acts, and in the event of any dispute as to what really is the annual value of premises, the consumer has the same remedy as before the passing of the Act, by going before two justices. In the case of any Company—either railway, gas, or water works—where there has been a price fixed, or anything of that kind, Parliament never alters the price so fixed unless the Company applies for further parliamentary powers and the House assents. In the particular case of the Southwark and Vauxhall Water Company, they are at present applying for further powers, and the House may depend upon it I will take great care and ample precaution that they shall not have any additional rates; and I am also prepared to state this, that if I find on the part of any of the Companies any action for raising their rents for the purpose of enhancing the price to be paid for compensation, I for one shall certainly advise Parliament to pay no attention to the matter.

Legal Intelligence.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

THURSDAY, FEB. 4.

(Before Lord COLERIDGE, and Lords Justices BRAMWELL and BAGGALLAY.)

IN THE MATTER OF THE ARBITRATION BETWEEN

THE BIRMINGHAM CORPORATION AND THE WEST BROMWICH IMPROVEMENT COMMISSIONERS.

Sir HENRY JAMES, Q.C., and Mr. MICHAEL appeared for the appellants; Mr. H. MATHEWS, Q.C., Mr. R. E. WEBSTER, Q.C., and Mr. PEMBROKE STEPHENS for the respondents.

Sir HENRY JAMES, in opening the case for the appellants, said this was an appeal from a judgment delivered in the Queen's Bench Division on the 29th of May last [see JOURNAL, Vol. XXXIII., p. 895], by which a rule *nisi* for setting aside an award was discharged. The award was made by an Umpire (Sir Henry Hunt) and two Arbitrators, the question in dispute being the legal construction of certain statutes. By an Act of 1845, the Birmingham and Staffordshire Gas Company were formed, but it would be convenient throughout the argument to call this the Staffordshire Company, as there was another Birmingham Gas Company. By section 194 of that Act, power was given to the Company to sell the undertaking to the Birmingham Corporation. Subsequent Acts were passed in 1858 and 1864, but the original Act having been incorporated with them, they were all to be treated as one Act. The total capital of the Company was £670,000. Upon £320,000 of this sum there was a limit of 10 per cent. as to dividend, and on the remaining £350,000 a limit of 7½ per cent. The maximum price to be charged for gas was 4s. per 1000 cubic feet. Nothing seemed to have been done under the selling power of the Act until an agreement was entered into in 1874, by which the Corporation became the purchasers of everything belonging to the Staffordshire Company. Except for the purpose of raising money, he did not think it was necessary to have parliamentary sanction to this agreement; but it so happened that at the same time the Corporation were entering into negotiations for the purchase of the undertaking of the other Company—the Birmingham Gas Company—for which it was necessary to apply to Parliament, and the two things were combined in one Bill. By virtue of the Act of 1875 the purchase was carried into effect. The supply of gas was given first to Birmingham proper, and then to certain districts, twelve in number. There were three gas-works—two in Birmingham, and one called the Swan Village works—belonging to the Staffordshire Gas Company, and supplying, among other places, West Bromwich. By section 94 of the Act of 1875 the price to be charged for gas by the Corporation outside the borough of Birmingham, except in certain specified places, was to be the same as for the time being was charged within the borough.

Section 36 of the Act regulated the application by the Corporation of the moneys received from the sale of gas, and among other things it was enacted that they should, from time to time, carry to the borough improvement rate or fund the net surplus remaining after the fulfilment of their other duties. The most important section in the present case, however, was the 40th, which enacted that if any local or sanitary authority within the limits of supply of the Staffordshire Company should bring in a Bill during the two succeeding sessions of Parliament for the purchase of their portion of the gas undertaking, the Corporation should not oppose the application to Parliament except on clauses; and if the local or sanitary authority gave notice of their intention to purchase within two months of the passing of such Act, the price to be paid should be settled by arbitration, and one such arbitration should settle the principle of valuation as between the Corporation and any other authorities within the limits of supply. At the time when the Bill of 1875 was promoted, certain of the outlying districts, of which West Bromwich was one, opposed the Bill, and clause 40 was evidently inserted with two objects—one being to give the outlying districts the right to separate existence in respect to the supply of gas to their own consumers, and the second to prevent the necessity of having twelve separate arbitrations. The Birmingham Corporation had become the supplying Authority to all the districts, and the districts had derived from the Corporation management the benefit of a reduction in the price of gas to 2s. 7d. per 1000 feet, whereas the Staffordshire Company charged 3s. 3d. per 1000 feet. Notwithstanding this reduction, there was a margin of profit to be carried to the credit of the borough improvement-rate. West Bromwich took the lead in seeking to carry into effect the powers given by section 40 of the Act. Other districts appeared, as they were entitled to, at the arbitration, in order to obtain a declaration of the principle of valuation. Sir Henry Hunt was the Umpire, and Mr. F. J. Bramwell and Mr. T. Hawksley were the Arbitrators. There was a difference of opinion between the Arbitrators, and Sir Henry Hunt made his award, against which a rule nisi was obtained in the Queen's Bench Division. The amount of the award was £70,750. If the award had stopped there, however inadequate this sum might have appeared to the Corporation, of course no objection could be taken to it; but it so happened that in performing the second duty cast upon him, the Umpire disclosed how he arrived at the amount. It appeared that he arrived at it, not by the exercise of wrong discretion, but by dealing with the subject matter of the award as being one thing, whereas it was another. If it could be proved that this was so, there would be good ground for setting aside the award. His contention would be, first, that the Umpire had not stated a principle of valuation; and, secondly, that he had shown that he was mistaken as to the subject matter. He had given compensation for one thing, whereas he ought to have given it for another. The words of the award were: "I determine the principle of valuation to be as follows:—The sum fixed is the value to the seller at the date of the service of the notice to purchase, and the subject matter of purchase is the portion within the district of the purchasing body (with any exception or modification contained in the Special Act) of the undertaking late of the Staffordshire Company, as purchased by the Birmingham Corporation under the Act of 1875, unenhanced by the advantages resulting from the purchase by the Corporation under the Act of 1875 of that undertaking and the undertaking of the Birmingham Gas Company, or either of them, or by the consequences attached by that Act to the said undertaking." The Umpire, therefore, regarded the subject matter as the gas-works as they existed at the time of the notice to treat, less any value that might have accrued to them between the year 1875 and the notice to treat. The part of the award dealing with the principle of valuation was: "The value of the distributive plant purchased must be ascertained. To this must be added the value of the goodwill or exclusive right of supply of gas within the district. This may be ascertained by taking the relative proportion between the whole quantity of gas which, at the date of the notice to purchase, would have been sold by the undertaking late of the Staffordshire Gas Company, as purchased by the Corporation under the Act of 1875, and the quantity which at the same date would have been sold within the district of the purchasing body (the probable prospective increase in the quantity sold being taken into account), adjusted with reference to any special circumstances affecting the value of the right to supply within such district. The value of any extensions and additions must be added, and the value of mains retained by the Corporation deducted. No allowance should be made for compulsory sale." The only thing that was done towards laying down a principle of valuation, therefore, was that the Umpire said: "You are to take the whole quantity of gas which has been sold by the undertaking, and then you are to take the whole quantity sold in the district;" but he was quite silent about what was to be done with those two quantities, what deduction was to be made from them, or what comparison was to be made between them. He seemed to have made a rule-of-three sum with two quantities only.

Lord Justice BRAMWELL: You applied to the Queen's Bench Division to set this aside. What is their jurisdiction?

Sir H. JAMES said he thought the application was made under a statute of William and Mary. It was made a rule of court. The arbitration was under the Companies Clauses Act. His lordship would recollect that by the Act of 1845 power was given to the Corporation to purchase, and to the Staffordshire Company to sell only to the Corporation. The Corporation, therefore, not only had the right to purchase, but the only right.

Lord Justice BRAMWELL: Supposing we did agree with the arbitration so far as it fixes the price to be paid to you by the West Bromwich people, have we the right to interfere with the principle of the arbitration?

Sir H. JAMES said the Court had that right. Under the Act of 1875 the outlying districts were not entitled to take any part of the Swan Village works, because those works would be required to supply Birmingham proper, neither were they entitled to take any portion of the mains, or the means of carrying the gas, unless those mains supplied their districts only. Therefore the subject of purchase became a peculiar one. It was not a case of the ordinary purchase of gas-works, which could be settled in an easy way—namely, by finding the profit made by the gas company, and multiplying it by a certain number of years purchase; but only a portion of the Birmingham undertaking was to be taken over.

Lord Justice BRAMWELL: Was the manufactory in the West Bromwich district?

Sir H. JAMES said that it was, but they were not bound to give it over, because it was wanted for Birmingham proper as well as for other districts. The reason West Bromwich did not take it was that it was much larger than would be required for their district; it would have been a white elephant to them. Therefore, in settling the compensation, a certain amount had to be deducted from what otherwise would be paid by the purchasing authority. It was a difficult matter, no doubt, because there were different interests in relation to different districts; but, so far as one principle could be applied to all the districts, the first arbitration was to find it. The Court below had laid it down that the Birmingham Corporation, and all other governing bodies which became gas owners, had no right to make any profit at all, and that they were bound to make an exact return between the sum they received and the sum they expended,

so far as human power could produce that result. If a profit existed, it must be by force of accident, and not by force of intention. The Public Health Act of 1875 first gave governing bodies the power to supply gas, and a great many large towns had since that date availed themselves of the permission. Within the past four years 21 of these towns had made a profit of over £1,000,000, and applied it to the borough rates; but the decision of the Queen's Bench was that this money had been illegally taken, and that the price charged for gas should always be reduced, so as to make an equality between the amount received and the amount expended. If the principle of valuation was a matter of pure discretion for the Umpire, he (Sir H. James) did not think he could attempt to set the award aside; but it was the Umpire's duty to arrive at a principle of valuation, and he had not arrived at one. Therefore his duty had not been fulfilled, and on that ground the award would be bad. There was, of course, a great distinction between the supply of water and the supply of gas. In most general Acts referring to water supply there was a statement that the supplying body, being the governing body, should not make any profit; but this restriction did not exist with regard to the supply of gas, probably for the reason that water was a necessity, and the Legislature were anxious that nothing should be done to prevent everybody having a good supply. Gas, however, was not such a necessity. It was contended on the part of the Corporation of Birmingham that the duty of the Umpire was to take the value of that which West Bromwich was obtaining at the date of the notice to treat—viz., the 16th of August, 1876. At that time the Corporation had the Staffordshire Company's works in their hands. It was the duty of the Umpire to look at the value of the thing in the hands of the Corporation, and in one sense he had done so; but it was contended on the part of the West Bromwich Improvement Commissioners that this was not his duty—that he was to look, in point of time, at the date of the notice to treat, and to look at the value of the thing obtained by West Bromwich at the date of the notice to buy, but he was to treat that which was taken by West Bromwich as if it were not in the hands of the Corporation, but as if it had remained in the hands of the Staffordshire Company. This meant that he was to add to or take away from its value all incidents which would have existed if the Staffordshire Company had retained possession of the works, and to remove from its value all incidents which had existed by the fact of the Corporation coming into possession. What the Umpire said was, "I have not taken the value of that which has gone to West Bromwich at the time of the notice to treat, but I have substituted for it another thing." The Corporation of Birmingham presented this view—that it was the Umpire's duty to look at the value of that which was conveyed to West Bromwich at the time of the notice to treat—that he must look at it as a thing of value existing in the hands of the Corporation, and consider what was its value to the seller, and that would be the value the purchaser must pay. The Umpire had *prima facie* found that this was the duty cast upon him; but West Bromwich had taken another view, and said, "You are bound to look at the value of something else. You are not to take that which is given to West Bromwich as being in the hands of the Birmingham Corporation; you are not to take it with its incidents of value, but you are to treat it as if the Staffordshire Company had remained in existence, and as if all the advantages which had been brought into it by the Birmingham Corporation had never existed. You are thus to arrive at its real value in the hands of the seller, supposing, theoretically and constructively, deductions in consequence of its remaining with a body which at that time had ceased to exist."

Lord Justice BRAMWELL: Suppose the Birmingham works were worth £100,000 to them, and suppose they gave £100,000 for the Staffordshire works; suppose when they had the two they were together worth £200,000 each to them; West Bromwich says, "I do not care about that; you must sell me what I want of the Staffordshire works upon the footing that they are worth £100,000, although the Birmingham property would be diminished in value to the extent of £100,000."

Lord COLERIDGE: Does it come to the question as to whether the Birmingham Corporation have a right to make a profit?

Sir H. JAMES said substantially it did, because one of the enhancing incidents was that there had been an increase in value in the hands of the Birmingham Corporation. The view of the Queen's Bench was, "You gave to the Staffordshire Company the exact value of that which you bought, you have no business to say, 'This is of a certain value to us as a Corporation, because we are able to obtain so much profit; you ought never to have made any profit.'"

Lord Justice BRAMWELL: Supposing you put the two concerns together, and could sell your gas, say, at 2s. 6d. per 1000 feet; suppose these people take away from you what they want, and you are obliged to sell your gas at 3s. per 1000, then the Corporation and ratepayers of Birmingham lose 6d. upon every 1000 feet of gas. Why?

Sir H. JAMES said he could not answer that.

Lord Justice BRAMWELL said the Corporation and ratepayers might say they did not want to make a profit, but they objected to being unable to sell their gas at as low a price as they did before.

Sir H. JAMES said if the district supplied were diminished, there would be an absolute loss to Birmingham. Of course his friend's view was specifically that it was not a compensating price—that when the Act of 1875 was passed the Legislature intended that what was termed the supply should be divided, and that there should be an express declaration that the buying local authorities should not pay a compensating price, but should take the standard of value of the thing as it was in the hands of the Staffordshire Company.

Lord Justice BAGGALLAY asked if the provisions of the Act of Parliament in any way modified the provisions of the 40th section.

Sir H. JAMES said they did not in any way. The bulk of the argument must rest on the 40th section. His contention was that this was in the first instance an ordinary case of sale and purchase, and that unless something could be found that would destroy the general principles controlling such sale and purchase, the Umpire must look at the value to the seller, at the date of the notice to treat, of the thing sold, and if that was taken away from the seller by compulsory powers he must be compensated for his loss.

Lord Justice BRAMWELL: Is it worth while for the West Bromwich people to pay this sum of money for it? If it is, they ought to pay you; if it is not, they ought not to buy it.

Sir H. JAMES said West Bromwich had already obtained the advantages of the provisions of the Act of 1875. The Birmingham Corporation had reduced the price of the gas in consequence of that Act, and West Bromwich not being subject to the infliction of rates by the Birmingham Corporation, they had absolutely gained by the Birmingham Corporation acquiring the two undertakings. Having obtained that advantage, they now declined to remain as they were. They wanted to have a portion of the undertaking in their own hands, and yet they would not pay the value it possessed to the Birmingham Corporation.

Lord Justice BRAMWELL: Suppose a man buys two separate carriage horses for 100 guineas each, and they make an admirable pair for which he could get 300 guineas, and somebody claims to buy one at 100 guineas; is that an illustration?

Sir H. JAMES said it was. Unless there was some statutory enactment

to the effect, the principle which he had mentioned must prevail, that no deductions should be made from the value of that which was conveyed from the seller to the purchaser at the date of the notice to treat. In the present case the Umpire had made some deduction, and he must show that that deduction was rightly and legally made. He had no fountain to go to from which to draw any right to make such a deduction, except the Act. It was for his learned friend to show where such a power could be found within the terms of the Act, to enable the Umpire to make the deduction. The Umpire had to determine the principle of valuation, but he had no right to determine the subject matter. That which was the principle of valuation or the mode of valuation was perfectly distinct from the subject matter that had to be valued, and it was beyond the strength and power of the Umpire to determine what the subject matter of the valuation was. He had no more right to alter the subject matter than a surveyor had to value two houses when he was only instructed to value one.

Lord Justice BRAMWELL: You mean if the Act of Parliament provided that the Umpire should value as from the 1st of August, 1875, and on the face of his award he showed that he had valued as from the 1st of August, 1876, then he would not have valued that which he was told to value.

Sir H. JAMES said that was his view.

Lord COLERIDGE: Take it the other way—that what he has to value is at the date of August, 1876, but he really values, as appears on the face of the award, at the 1st of August, 1875, and says, “I have done that upon this principle, that I consider the difference in value between the 1st of August, 1875, and the 1st of August, 1876, ought not to be taken into account.”

Sir H. JAMES said if the statute in the case enacted that he should value as from the 1st of August, 1876, then he would not have valued the right subject matter.

Lord COLERIDGE asked if it might not be called a principle of valuation, that all which had been added to the subject matter within twelve months of the notice to treat was, in the Umpire's view, something which ought to be entirely rejected.

Sir H. JAMES said this was not a principle or mode of valuation; it was the valuation of something distinct from that which the Umpire was told to value.

FRIDAY, MARCH 5.

Sir H. JAMES continued his address on behalf of the appellants. He contended from the Acts that what had been made over to the West Bromwich Commissioners was not only that which had been in the hands of the Staffordshire Company without enhancement of value by anything that had been effected by the Birmingham Corporation, but whatever the Birmingham Corporation had done, whatever they had secured by way of advantage was to be made over to the West Bromwich Improvement Commissioners. The contention of the West Bromwich Commissioners was, “True, you, the Birmingham Corporation, brought capital to bear in producing the state of things which causes gas to be cheaper; yet we will not pay for it.” Suppose the Umpire said, “I will look at the value of that which is the subject matter physically at the time at which it was valued in 1830, when the district was much less than it is now;” he had no right at all to say this, because it was not the mode or principle of valuation.

Lord Justice BRAMWELL: The word “right” is equivocal. If “right” means power, he had the right to do it.

Sir H. JAMES said it was not within the discretion of the Umpire to say what concessions were to be made to the purchaser. Suppose he had said, “I think the value of these works is £70,000, but I choose to say they are only worth £30,000,” he had no right to do that. He could not take off a discount, as it were; he must perform his duty according as the statute had told him to perform it. He had to determine the sale; he had to value that which was there, and not take off anything.

Lord COLERIDGE: He has to value what is there, but he is to value it as between an ascertained purchaser and an ascertained buyer.

Sir H. JAMES said it was to be purchased according to the terms of the 40th section of the Act. He would submit that it was for his friend to show, on the part of West Bromwich, why the ordinary rule or mode of ascertaining the subject matter of the compensation did not apply here, and why the Umpire had a right to say, “I will take something off that which I have valued.” He (Sir H. James) did not for a moment contend that the appellants had a right to interfere with the manner in which the Umpire arrived at the value. He could give numerous instances by which the Umpire could arrive at the value in a certain way, but the objection he (Sir H. James) was taking was that the Umpire had admittedly not valued that which was put into the hands of the West Bromwich Commissioners, but had said, “Instead of valuing that which you, West Bromwich, will take, I will value that which, although you do take it, I will suppose you have not got. Then I will suppose it is in a different condition from that in which you do take it.” Supposing a man valued a house, and it was in good repair, what right had he to say, “I will not value it as in good repair, but I will value it as if the top storey was off—as if it had no roof on it.”

Lord COLERIDGE: Supposing a vendor buys a house by Act of Parliament, with a note in the Act that somebody shall have a right of compulsory entrance in two years. In this case the Corporation of Birmingham buy by Act of Parliament, and there is a note that in two years certain portions may, according to the Act, be taken from them.

Sir H. JAMES: Taking the case of a person buying a house, if there was a note that in two years a person might come in and buy it from him—

Lord COLERIDGE: It might determine the principle of valuation. It might be said, “You may turn this house into a palace.”

Sir H. JAMES: Suppose when he bought the house it was in bad repair, and that the person had expended a sum of money in putting it in good repair, or reasonable repair, is he to lose the benefit of that?

Lord COLERIDGE: It is for the arbitrator to say.

Sir H. JAMES said this was not the principle of valuation, because the arbitrator would have to deal with the house as he found it. Supposing that during the period the vendor held it there had been such an extension of a railway, or such a building of houses in the neighbourhood that the house had become of much greater value, was the arbitrator to say, “I will not value the house as it stands; but I will value the house as it would have been if these things had not taken place?” That was not the principle of valuation. It might be that the top storey of the house would be suitable for a conservatory, or something else that would make it peculiarly valuable. The arbitrator only valued a portion of the house, and not the whole of it. In the present case, the Umpire had chosen to value the undertaking when it was a different thing, and when it did not possess the value it then possessed in consequence of what the Corporation had done.

Lord Justice BRAMWELL: You argue that the Umpire has come to an arbitrary, if not an unjust conclusion. You say that he has, in truth, fixed a value upon a different thing. The only way in which you attempt to make that out is this: You say the thing in 1876, when the Umpire

published his award, is a different thing from what it was before it was enhanced in value?

Sir H. JAMES: I do.

Lord Justice BRAMWELL: Is it not the same thing? At first it was the thing, afterwards it is the thing enhanced in value. Take the case of a horse. He is of more value when he is entered for races, &c., and suppose a man says, “I will not pay you the enhanced value; the thing is the same.”

Sir H. JAMES: It is the same horse, I presume. I will assume that the horse at the time it was valued was well fed and well kept, and a horse of good action. The valuer says, “I shall take that horse as it was a year ago, when it had the glanders, had no action at all, and was on the point of death for want of being properly attended to.” No doubt it is the same horse, but it had not formerly the same quantity of flesh on it, or the same amount of blood, or the same action. You have brought it into an entirely different state and condition. It may be the same horse; but it is not the same subject matter of value. Again, if a man is asked to value a sheep, is he to value it according to what it was when it was a lamb? Its value is enhanced by the amount of wool that has grown on it. If a valuer said, “I will value a horse as if it were a foal, and I will value a sheep as if it were a lamb,” how could it be said that he valued a horse or a sheep? The duty of the Umpire was to abide by the words of the statute, and I submit that there is nothing to show he had the right to deal with that which was the subject matter of the compensation other than by taking the article at its value as it stood, and looking at it and seeing what value it had. There were peculiar circumstances in this case, and to some extent they were applicable to all the districts. The ordinary circumstances are that the governing body will take over the goodwill, the right to charge on the mains, the manufacturing, and the whole of the gas-works. In this case that would not be done, because none of these districts would be willing to take over the Swan Village works.

Lord Justice BAGGALLAY said that no other authority could acquire this portion of the West Bromwich works, as part of the borough of Birmingham was supplied by them.

Sir H. JAMES said that the nature of things was to let Birmingham proper keep the West Bromwich works. In this case there were special circumstances. They could not give over the means of producing the gas. That ought to be kept by the selling body, and, therefore, a new principle had come into operation. He contended that, on the face of the award, there had not been a valuation of the whole subject matter. This portion of the argument narrowed itself down to the small question, “Has the Umpire or has he not valued that which was the subject matter?” They had to look at what existed in the statute, to see whether that which had been deducted could rightly be deducted from the subject matter, and then they came to the more debatable ground, “Is it deducted from the subject matter, or is it simply a method, or mode, or principle of valuation?” First, was this a deduction from the subject matter? In the first place, the Umpire began by saying the subject matter of purchase was so-and-so, and, of course, the subject matter of purchase was identical with his valuation. If he had chosen to say, “I do not value that which is before me, but I value it unenhanced by something that has been added to it,” was not that word “unenhanced” identical with the words “deducted from”? Then he would say, “Having deducted that from it, I value it *minus* that which is there now existing.” Was that a principle of deduction, or was it not a dealing with the subject matter? Then the Umpire began to arrive at the principle of valuation, but it was not very clearly mentioned. He said, “The value of distributive plant must be ascertained. To this must be added the value of the goodwill or the exclusive right of the supply of gas within the district.” In one sense that was principle, and in another sense it was subject matter. The Umpire then proceeded to give the principle of valuation. “This,” he said, “may be ascertained by taking the relative proportion between the whole quantity of gas which, at the date of the notice to purchase, would have been sold by the undertaking late of the Staffordshire Gas Company, as purchased by the Corporation under the Act of 1875, and the quantity which at the same date would have been sold within the district of the purchasing body (the probable prospective increase in the quantity sold being taken into account), adjusted with reference to any special circumstances affecting the value of the right to supply within such district.” What was to be done with these two things the Umpire did not say. Two things were to be taken—namely, the proportion between the whole quantity of gas in the whole district, and that which was sold within the particular district taken.

Lord Justice BAGGALLAY: There are the words “relative proportion.” You are taking into consideration the whole amount and the relative proportion of what is supplied in each particular district and what is supplied in the whole.

Sir H. JAMES: What is the proportion?

Lord Justice BAGGALLAY: He is ascertaining as a valuer the value of the goodwill of the business. He says, “I shall not take the proportion with reference to this district alone, but I shall take it in proportion to what it bears to the whole.” You do not suppose that the Umpire has undertaken, in the principle upon which he acted, to show every detail?

Sir H. JAMES said in many things the Umpire was right enough.

Lord Justice BAGGALLAY: He says, “I shall not take what is the goodwill of the West Bromwich works alone, but I will take what is the fair proportion of it.”

Sir H. JAMES said the Umpire had first to find out what was the goodwill of the whole, then he was to take the West Bromwich goodwill, then he had to define the best means of arriving at the West Bromwich goodwill. What had he done? He said, “Take first the whole quantity of gas produced. Go to the books and find the whole quantity—we will say 10 million feet; go to West Bromwich and find out what they are consuming—say 1 million feet. Having found those two quantities, do something.” But he had not done anything.

Lord Justice BRAMWELL: What I suppose he means is this: Suppose West Bromwich will take one-tenth of the present production, now find the value of the goodwill of the whole that exists; then as ten is to one, so is the entire value of the whole of the goodwill to the value of West Bromwich.

Sir H. JAMES: If the Umpire had said that, I should not have been here criticizing what he said.

Lord Justice BRAMWELL: How do I find out he said that?

Sir H. JAMES: Your lordship guessed it. What he says is, “Find the goodwill of the whole.” If he had done that, I can understand that he would go by the rule of three; but he does not find the goodwill of the whole. All he says is, “Find the gross quantity of gas supplied, and then find the actual quantity supplied to West Bromwich.”

Lord Justice BRAMWELL: There is the word “relative.” That is a key to it.

Sir H. JAMES: The word “relative” is not sufficient for the finding of the goodwill.

Lord Justice BRAMWELL: What you say he ought to have done is this: This is to be ascertained by taking the goodwill as a whole as it exists, and by taking the relative proportion.

Sir H. JAMES said that if the Umpire had found the goodwill of the

whole, then there would have been great sense in saying, "In order to find the goodwill for West Bromwich, let the proportion of the goodwill be the same as the proportion of the production." The learned counsel then read the judgment of the Lord Chief Justice in the court below, and argued at some length against the view therein expressed as to the right of a corporation to make any profit out of the sale of gas.]

Mr. MICHAEL did not address their lordships.

After a few minutes consultation, they intimated that they did not consider it necessary to hear the other side.

Lord COLERIDGE said: I am of opinion the judgment of the Court below was right, and must be affirmed. We have to deal with an award made under section 40 of the 38 & 39 Vict., cap. 178, empowering an arbitrator to award, and in the course of his award to determine the principle of valuation for the further and other awards which the section contemplates being made between the Corporation of Birmingham and other purchasers. We have not heard of, and if we had we should not have thought it right to go into the facts as stated in the affidavits, in order to expound either the meaning of this clause in an Act of Parliament, or the meaning of the award framed under the clause. But looking at the Act by itself, it sufficiently appears that various interests were in the contemplation of Parliament when the clause was passed. The Act empowered the Corporation of Birmingham to buy a gas undertaking which had heretofore been carried on by the Staffordshire Company. It appears that in a portion of that undertaking the West Bromwich Local Authority was interested, and that, whether as a matter of compromise or not, the interests of the West Bromwich Local Authority were protected to a certain extent by this 40th section. *Inter alia*, this was provided, that in case the Act passed, and in case the Corporation of Birmingham purchased the large undertaking of the Staffordshire Company, which ranged over a variety of areas, in one of which the West Bromwich Local Authority was concerned, the other Authorities should, if they prosecuted them within two years, have rights as against the Corporation of Birmingham in respect to the purchase of such portions of the works of the Staffordshire Company, taken as a whole by the Corporation, as were within the respective areas of these Local Authorities. They were to purchase them, if possible, by agreement. If agreement failed, they were to purchase them by arbitration, under the Companies Clauses Consolidation Act, 1845. I may say, in passing, that I understand that to be a sufficiently clear parliamentary enactment that the arbitration, as a whole, should be capable of being made a rule of court. If there are, as appears to be the case, any provisions which make this arbitration and award differ from ordinary arbitrations and awards made under the Companies Clauses Consolidation Act, still the true effect of this clause is that the whole award shall be under that Act. Upon this arbitration the Corporation "shall sell, and the Local Authorities shall buy respectively the portion or portions of the undertaking" in the manner before mentioned—that is, they shall buy the respective portions within their local areas. Then some words follow, on which I will make a remark or two: "One such arbitrator shall determine the principle of valuation as between the Corporation and any other Authority or Authorities within the limits aforesaid." That is to say, the arbitrator shall do what, in point of fact, he has purported to do here. He shall not only award the price which is to be paid between the selling and purchasing parties—the Corporation of Birmingham on the one side, and the Local Authorities on the other—but he shall also set out and determine once for all the principle upon which he has arrived at his valuation; or, to put it otherwise, the conditions under or by which the price, as between the vendor and the purchaser, in all these arbitrations, is once for all to be ascertained. And it is to be observed that this is not an ordinary case of determining the principle of valuation between an ordinary vendor and an ordinary purchaser. It is determining what shall be the principle of valuation between a particular and ascertained purchaser from a particular and ascertained vendor of a particular and specific article. What I mean by that is that the Corporation of Birmingham could not sell to anybody except to this particular purchaser, and that this particular purchaser could not purchase anything but a certain specified portion of the whole undertaking. Therefore, it is not the ordinary case of ascertaining principles of valuation between a purchaser and all mankind; but the question to be settled was what is the true principle upon which a person interested in, or who might be interested in a portion of an undertaking which was to go as a whole to the Corporation of Birmingham should pay the Corporation of Birmingham for such part of that whole undertaking as he was interested in, and might within two years desire to buy. If I may say so, I always rather dissent from a tax on the phraseology of Acts of Parliament, knowing how extremely difficult it is, in the conflict of interests, which is keen enough in private Acts of Parliament as well as in public, to get exact, lucid, and clear words which shall express, without raising any further question, all the ideas that are floating in the minds of the parties. Their ideas, perhaps, may not at the time be particularly plain and definite, and the language, therefore, not inadequately represents the ideas present in their minds at the moment when the language was used. Having said this, if we bring a willing mind to the consideration of the 40th section of the Act of 1875, I think that the fair meaning of it is reasonably ascertainable without any very great trouble or much difficulty. Under those circumstances this arbitration takes place, and the West Bromwich Authority, whatever it may be, buys of the Corporation of Birmingham, under the authority of this 40th section, so much of the whole undertaking of the Staffordshire Gas Company as was contained within the local area of which they were the Authority, and which alone they were interested in, and it is referred to Sir Henry Hunt to say what price shall be paid under the Companies Clauses Consolidation Act. He ascertains the price at £70,750. Possibly a great master of style might be able to couch the decision in better language; but bringing, as I say, a willing mind to the construction of the document, it seems to me he has ascertained the principle of valuation with reasonable clearness. He has said this: "£70,750 is what you are to pay to the Corporation of Birmingham, and you are to pay it on this principle. You, the Corporation of Birmingham, have a large undertaking in your hands; it may be, and probably is the fact that between 1875, when the Act was passed, and August, 1878, when my award is made, you, the Corporation of Birmingham, dealing with the advantages you possess, from a variety of reasons, have made that undertaking in your hands worth, as a whole, more than you gave for it." From this expression, "Unenhanced by the advantages resulting from the purchase," &c., I infer that evidence had been given before him that certain advantages had been added to the undertaking between 1875 and 1878. Well, he says, "Looking at this 40th section in the Act of 1875, you, the West Bromwich Local Authority, were given a kind of interest in so much of this whole as was contained within your local area, and you were then given a right to purchase, within a definite time, so much of this whole, which the Corporation of Birmingham could not have obtained the right to purchase except by an Act of Parliament, and to the Corporation's right of purchasing this condition in your favour was appended. I therefore think that the true principle upon which you ought to pay is to ascertain, which I have done, what was the value or what would have been the value in 1875 if you had then been the purchaser from the Stafford-

shire Company of that portion of their whole which was included in the local area which, having passed to the Corporation, you now have a parliamentary right to purchase upon terms from them. That I have ascertained to be £70,750, and I have done so upon the principle that I have endeavoured to put into plain language." Now, I confess it appears to me to be a sufficiently intelligible principle, and I certainly think that not only am I not prepared to say it was wrong, but, as far as I can judge, it appears to me that it was right, and was a fair and just principle upon which he was to ascertain the valuation. But I go farther, and I think that, supposing the principle to be clearly ascertained, and supposing this to be the meaning of Sir Henry Hunt's award, which I think it is, even if the principle were as wrong as I think it right, and were as unjust as I think it just, it appears to me that, by the 40th section of the Act, the power of so adjudicating has been passed over to him, and that if it is fairly done we have no power to interfere. The only way in which, as it seems to me, this line of judgment could be impugned is the ingenious way in which Sir Henry James has tried to impugn it, and I quite agree that, if I could see that there was a foundation for the manner in which he has put his case, the judgment should be reversed, and the matter sent back to the Umpire. If I have been able to follow Sir Henry James's ingenious argument, it is this: "What the Court below and I have called the principle of valuation, has been misnamed by the Court below and by me. It is not, in truth, the principle of valuation, but a change of the subject matter." Sir Henry James says, in 1875 there was this portion of the undertaking in West Bromwich which the West Bromwich Improvement Commissioners might have had power to purchase from the Staffordshire Company if they had obtained an Act of Parliament. I will assume, for the purpose of Sir Henry James's argument, that if this purchase had taken place of this isolated portion of the whole undertaking in 1875, he would not have disputed that £70,750, or thereabout, would have been a fair price to pay. But, he says, in 1878 the conditions were changed, and that which was merely a portion of a whole in 1875, is now a portion of a whole which has been for three years under very different conditions, and the portion of the whole being now in other hands, and subject to a totally different set of laws, has become in the new hands a very much more valuable thing than it was in the old hands. All the conditions of occupation must be taken into the entity which has been adjudicated upon, and those conditions being incorporated, so to say, into the entity, have changed it, and it turns out that the entity which Sir Henry Hunt would have had to adjudicate upon in 1875 was a different and other entity from that which he had to adjudicate upon in 1878. I do not know whether I have rightly expressed the argument, but what seems to me the answer to it is this, that it is an ingenious mode of stating the case, but it is a fallacious one, because it is really incorporating into the same subject matter not things which make the subject matter itself different, but surrounding circumstances which may possibly have increased the value of the subject matter in the hands which now hold it, but which, as I think, and as Sir Henry Hunt has held, Parliament may have intended to exclude from the consideration of the arbitrator when he had to fix the price between this vendor and this purchaser under this particular 40th section. I think, therefore, it is not correct to say that Sir Henry Hunt has not adjudicated on the right subject matter, as if he had adjudicated on No. 1, Belgrave Square, whereas he had to adjudicate on No. 2. I do not think that this analogy is correct, or that such an argument will bear investigation. It is ingenious and verbal, no doubt; but, after all, the subject matter adjudicated upon is the same, and the principle of valuation ascertained by Sir Henry Hunt is that certain conditions, which may have altered the value of the same thing, are not to be taken into account as between this vendor and this purchaser under this Act of Parliament. The only other matter to which I need advert is that to which Sir Henry James has pointedly called our attention—namely, passages in the judgment of the Court below as to the right of this and other corporations to make profit out of their gas-works. Having already disposed of the case entirely, it is, in my judgment, unnecessary for me to express any opinion whatever, one way or the other, on that matter. Therefore I only say that I neither assent to nor dissent from the expressions used by the Lord Chief Justice in the court below.

Lord Justice BAGGALLAY concurred.

Lord Justice BRAMWELL also concurred. He said, even if the principle was shown to be a bad one, he very much doubted if it would have got rid of the award of the sum named.

The appeal was thereupon dismissed, with costs.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

THE PUBLIC LIGHTING OF THE CITY OF LONDON.

Lieut.-Col. Haywood, Engineer and Surveyor to the Commissioners of Sewers of the City of London, in his report for 1879 says, in reference to street lighting, that tenders were received from the Chartered Gas Company for lighting the public lamps, at £4 13s. 3d. per annum for square-shaped lamps, consuming 5 feet of gas an hour, and £4 17s. 6d. for those of a circular shape; the difference in the cost of the two being in consequence of the additional expense of cleaning and maintaining the latter lanterns. These prices were the same as those paid since 1877. The meters attached to 36 of the public lamps in various parts of the City showed that the full contract quantity of gas was there given; and the Inspectors of Pavements and the Inspector of Gas Lighting were of opinion that the full contract quantity of gas was given at all the lamps, and that the regulators were kept in proper condition by the Company.

As to the experiment with improved gas lanterns and burners in Queen Victoria Street, Mr. Haywood states that, from information and data supplied by the Chartered Gas Company, the general result appeared to be that the improved system of lighting (which was discontinued at the end of last year) gave about four and a half times as much light as the ordinary system, at about three times the cost; but the Commissioners came to no resolution respecting the value of the experiment.

In regard to the electric lighting of the Holborn Viaduct, which was terminated on the 9th of March last year, the report says that the 16 lamps employed in a length of 473 yards—an area of 14,200 superficial yards—of roadway was £5 per night, or 6s. 3d. per lamp. No photometrical observations of the light were made; but, from figures given in the report to the Metropolitan Board of Works upon the electric light on the Thames Embankment, it might be reckoned that the lamps on the Viaduct gave, when unenclosed, about five times the light of ordinary gas-lamps, and when enclosed in opal globes (as they were when in use), twice as much only, and that the actual cost was nearly four times that of gas.

PURTON (WILTS) GAS SUPPLY.—A Gas Company has just been formed at this place, under the Joint-Stock Companies Acts, with a capital of £2000 in £5 shares. The works are to be erected by Messrs. W. C. Holmes and Co., of Huddersfield and London.

EXPERIMENTS IN IMPROVED STREET LIGHTING AT BIRMINGHAM.

On Wednesday last, at the invitation of Mr. Charles Hunt, Engineer of the Birmingham Corporation Gas Department, a number of Gas Engineers, principally from the Midland Counties, and others interested in the subject of improved street lighting by means of gas, assembled at the Windsor Street works of the Corporation, for the purpose of viewing a collection of lanterns and burners of large power which had been got together by Mr. Hunt for the purposes of comparative trials of their efficiency. Among those who were present were Messrs. J. Annan, Wolverhampton; T. Arnold, Borough Surveyor's Office, Birmingham; J. C. Bent, Birmingham; G. Bray, Leeds; T. Collett, Dudley; W. Cross, Leamington; W. Davis, Hereford; J. Deakes, Worcester; A. Dougall, Kidderminster; H. Hack, Saltley; T. Jackson, Birmingham; C. E. Jones, Chesterfield; A. P. Ker, Birmingham; W. King, Liverpool;

T. Layton, Redditch; J. Mudie, Burton-on-Trent; W. North, Stourbridge; G. Parker, Oakengates; R. O. Paterson, Cheltenham; J. Peaty, Burslem; H. S. Pike, Hinckley; T. Proud, Birmingham; J. S. Reeves, Bilston; J. Reid, Derby; T. Roberts, Sheffield; P. Simpson, Rugby; S. Y. Shoubridge, Saltley; J. Slocombe, Birmingham; E. Smith, Secretary of the Corporation Gas Department; J. Storer, Stafford; W. Sugg, London; C. Taylor, Derby; J. Tindall, Walsall; W. Winstanley, Newcastle-under-Lyme; H. Woodall, Leeds; J. Wright, Birmingham, &c., &c.

The burners and lanterns were arranged in different parts of the works, the more important ones being placed at distances of about sixty yards from one another on a large tract of unoccupied land to be eventually used for extensions. By this means the effectiveness of the burners was easy of comparison, and much satisfaction was expressed at the completeness of the trials. The following is a list of the burners and lanterns used, showing the consumption of gas by each burner, the illuminating power afforded (when tested in the photometer-room), and the illuminating power obtained per foot of gas consumed:—

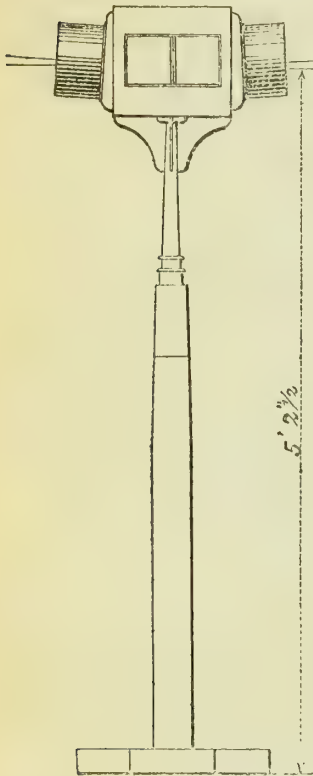


FIG. 1.

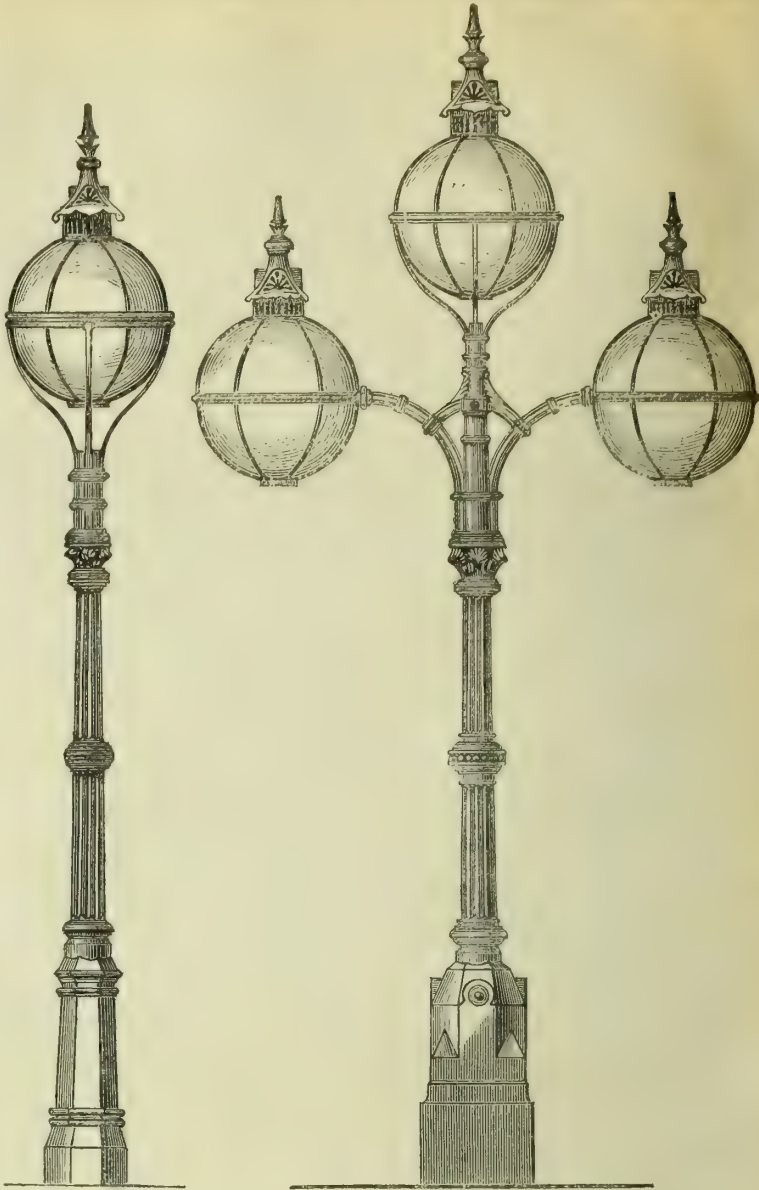


FIG. 3.

FIG. 4.

No. of Lamp.	Description of Burner.	Description of Lantern.	Consumption of Gas. Cubic Feet per Hour.	Illuminating Power in Candles, tested with 17-Candle Gas.	Illuminating Power per Foot.	Remarks.
1	Bat's-wing	Kitt's, fitted with Reflector . . .	2.5 } each	without { 4.62 each.	1.85	In direct line with reflectors, 54.4 candles. These globes diminish the light by 35 p. cent.
2	"	Collins's Patent "	6.0 } burner.	16.90 "	2.80	
3	"	Ordinary Street	5.0	11.00 "	2.80	
4	Sugg's 80-candle Argand	Sugg's Shadowless	22.8	74.55 "	3.26	
5	Bray's 60 " Triple Bat's-wing	3 Frosted Globes, 21 in. diameter .	26.4 } each	85.00 "	3.21	
6	" 60 " " " "	3 Clear " " " "	24.0 } globe.	73.00 "	3.04	
7	Sugg's 100 " Argand	3 Opal Top " 30 in. diameter .	27.0	101.70 "	3.77	
8	" 80 " " " " "	1 " " 26 in. diameter .	23.4	79.87 "	3.41	
9	" 200 " " " " "	1 " " " " " "	45.6	180.20 "	3.95	
10	Bray's 200 " Quadrup. Bat's-wing	Bray's Shadowless	41.4	134.40 "	3.02	
11	" 60 " Triple Bat's-wing	" " " " " " "	21.6	63.00 "	2.92	
12	Burner and Lantern used by the	Paris Gas Company, in the Rue du Quatre Septembre.	48.0	139.40 "	2.90	
13	Gaudet's, Paris	Gaudet's	52.8	158.10 "	2.99	
14	Mallet's, "	Mallet's	43.0	141.10 "	3.28	
15	Wigham's	Wigham's	60.0	150.00 "	2.50	
16	Sugg's 200-candle Hollow-top, Flat flame	Sugg's Octagon	66.0	201.00 "	3.04*	
17	Sugg's 100-candle Argand	Sugg's Octagon, new pattern . . .	30.60	96.15 "	3.11	
18	Bray's Quadruple	24-inch Circular				
19	" 400-candle	Bray's				Too recently erected to be tested.

* A better result—viz., 3.24—was obtained with a consumption of 45 cubic feet of gas per hour.

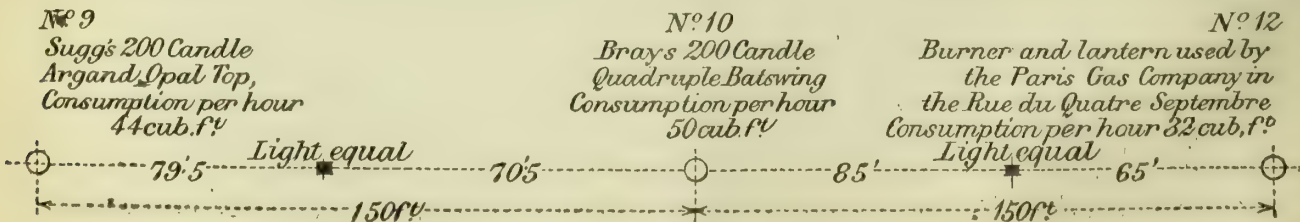


FIG. 2.

After a prolonged inspection of the various lanterns and burners, tests were made by a shadow meter [see sketch, fig. 1] between Sugg's 200-candle Argand (No. 9), Bray's 200-candle Quadruple Bat's-wing (No. 10), and the Burner and Lantern as used by the Paris Gas Company in the Rue du Quatre Septembre (No. 12), with the results shown on the diagram, fig. 2. These appear to agree pretty nearly with the photometrical results obtained from each burner, as shown in the preceding table.

On Thursday evening another trial was made between the burners Nos. 9 and 10 on the diagram. The consumption of gas in each was noted to exactly 46.75 feet per hour; and the lights were shown to be equal when the shadow meter was 73 ft. 2 in. from Bray's Quadruple Bat's-wing, and 76 ft. 10 in. from Sugg's Argand.

It should here be mentioned that the Superintendent of the works, Mr. Alfred Colson, rendered very efficient service in conducting these tests; in fact, to his able assistance Mr. Hunt is considerably indebted for the success which has attended the experiments all through.

In figs. 3 and 4 are shown the styles adopted by the Gas Committee for the new lamp-columns to be erected in various parts of the town. These pillars, which have been specially designed and made for the Corporation by Messrs. Hart, Sons, and Peard, of London and Birmingham, were much admired for their substantial, yet ornamental and effective appearance.

At the close of the inspection, refreshments were served; after which Mr. HENRY WOODALL proposed a vote of thanks to Mr. Hunt for affording those present an opportunity of witnessing the interesting experiments that had been carried through so successfully, remarking on the careful and judicious arrangements that had been made for a fair and equitable comparison to be instituted between the various systems for public gas illumination now before the public.

Mr. R. O. PATERSON seconded the proposal, which was carried by acclamation.

Mr. HUNT, in returning thanks, expressed the pleasure he felt at seeing so many present. It might, he said, be desirable that he should offer a word or two of explanation as to the circumstances under which the exhibition had been brought about. These experiments were initiated some fourteen months ago by the Chairman of the Gas Committee (Alderman Chamberlain, M.P.), who was desirous of showing in Birmingham what could be done with gas, in the way of street lighting, as compared with electricity. His (Mr. Hunt's) instructions were comprehensive and, he might say, liberal. He was to procure not only the most suitable burner, but also a lantern capable of diffusing the light to the greatest possible extent, and, at the same time, one that should, with the column, contribute rather to the ornamentation of the streets than otherwise. As they all knew, the question of the burner involved considerations apart from the illuminating power obtained; but his experience was that the proper form of lantern was a far more difficult matter. He might take this opportunity of acknowledging his obligation to the Gas Committee for the indulgence they had shown him with regard to the length of time that the experiments had taken. It was not contemplated by any one that they would last so long; but he felt, with the Committee, that they should, as far as possible under the circumstances, impress the character of permanence upon their work. How far they had succeeded in their aims was seen that night; but their experiments, at all events, proved one thing—that gas could hold its own for effectiveness with the electric or any other light.

THE PURIFICATION OF GAS.

By Mr. H. E. JONES, M. Inst. C.E.

At the Meeting of the Institution of Civil Engineers on Tuesday last—Mr. W. H. BARLOW, F.R.S., President, in the chair—a paper was read on "The Purification of Gas," by Mr. H. E. Jones, M. Inst., C.E., one of the Engineers of the Commercial Gas Company.

In dealing with the general subject, the Author placed the purification from bisulphide of carbon in the foreground. He said that the late Dr. Letheby, in 1860, was responsible for the introduction into an Act of Parliament of a limitation of this impurity to 20 grains per 100 cubic feet of gas. Until the year 1866, no such limitation had been put upon Companies outside the Metropolis, and since then it had only been imposed in important towns. Such limitations were nowhere enforced or respected. Dr. Letheby had an opinion that it was only necessary to resort to the exclusive use of lime as a purifying material; nevertheless it was unsuccessful when adopted in the works of the late Ratcliff Gas Company, an average for two years (1875-76) giving 28 grains per 100 cubic feet. In January, 1872, the Metropolitan Gas Referees reported the impossibility of fixing a limit. In 1877 the failure of the simple lime process led to the adoption of a different plan; the carbonic acid was carefully eliminated. Success was, however, only occasionally attained, and the condition of the gas at the outlet of each purifier in the series was, in consequence, carefully tested and recorded day by day. These tests would have been a formidable business but for the introduction at that time of Mr. A. G. Vernon Harcourt's colour tests. It was found that though carbonic acid was never allowed to pass the first purifier of a set of three vessels worked consecutively, it was only possible to keep the sulphur low when the third purifier was receiving a considerable quantity of sulphuretted hydrogen. Further, that so soon as the first vessel was taken off for the necessary replenishing, the sulphur rose many grains, and did not fall until the replenished purifier had been put to work again as the third vessel, and its contents had received more sulphuretted hydrogen. [This action was illustrated by a table and diagram, as was also the action of a series of four lime purifiers.] The advantage of further carbonating the lime, on works which were closely surrounded by dwelling houses, led to the adoption of the Beckton system. As it became unmistakable that sulphuretted hydrogen was mischievous when in excess, arrangements were made for abstracting it, as it left the carbonic acid system of purifiers, by interposing oxide of iron. This was carried out with marked improvement, and the effective life of the sulphide of lime was much prolonged. In practice, both for the relief of back pressure, and for facility in renewing a sulphide of lime purifier, the carbonic acid set of purifiers should yield the following results:—

	Crude Gas.	A.	B.	C.	D.	
Sulphur	40	52	45	30	23	} Grains per 100 cubic feet.
Carbonic acid	410	300	40	—	—	
Sulphuretted hydrogen	100	900	400	—	—	

In this state of things the sulphur was generally 25 per cent. below that in the crude gas.

There was great advantage, the Author stated, in exposing the material in the sulphide of lime purifiers to a current of air. Two purifiers at the Wapping works of the Commercial Gas Company, which had become ineffective, were opened, the lime examined, stirred up, and put back, and they afterwards worked for nine and eight months respectively, and did tenfold more work than previously.

The prejudicial effect of cold in the reduction of sulphur in the carbonic acid system of purifiers, and the beneficial effect of the application of heat from the exhaust steam of an engine, were then referred to. No advance, the paper said, had been made in the direction of purifying in closed vessels with liquid agents. Mr. G. T. Livesey had succeeded in

eliminating the carbonic acid to 0.5 per cent. in volume, by the use of rough caustic ammonia liquor. The tar should be separated from the gas immediately on leaving the hydraulic main. The Author, at his works, allowed the gas to leave the condensers in summer at no higher temperature than that of the atmosphere, and, in winter, than 40° Fahr. In the former case the scrubbers usually reduced the gas to the temperature of 55°, and in the latter raised it to 45°. From the Author's practice with water condensers he had found, in one type, that 1000 cubic feet of gas per day could be treated by 0.5 square foot of water.

The purification of crude gas from ammonia proper was next referred to. The process, he said, was easy. The essentials were contact with extended superficies of water, or such concentrated intimacy as involved frictional resistance to the gas, and the ultimate exposure of the gas to pure water. No sooner was lime substituted for oxide of iron in the scrubbers, than ammonia appeared in the clean gas; this had been lessened by the addition of oxide of iron catch purifiers, and removed by a small quantity of sulphuric acid and sawdust in the last catch purifier. The cost of ammonia purification was very small, the particulars of which were stated. Sulphuretted hydrogen was easily removed by lime, oxide of iron, peroxide of manganese, and sulphate of iron. Of these purifiers lime was the best, and oxide of iron the cheapest and least offensive. Oxide of iron, sulphate of iron, and manganese converted the sulphuretted hydrogen, on exposure to the air, into free sulphur, becoming oxides again, and being, as it was called, reactivated.

[The discussion on the paper will take place to-night, at 8 p.m.]

THE PUBLIC LIGHTING OF PARIS.

In reference to a paragraph which recently appeared in *Galvani's Messenger*, and which has been copied into and misled some of the English and Scotch papers, to the effect that the electric light was to have been discontinued in Paris in the end of last month, we learn that such is not the case. At the meeting of the Municipal Council on the 26th ult. a report was presented by M. Cernesson, on behalf of the Third (Streets and Lighting) Committee, recommending the continuance of the light for another twelve months; and, at the same time, suggesting the curtailment of the improved system of gas lighting at present in use in the Rue du Quatre Septembre. The following is a translation of portions of the report, which was adopted:—

Taking into consideration the fact that the electric light is paid for according to the amount of light furnished, and that the value of that light is estimated by taking as a basis the actual price of gas—in other words, the price of the cheapest kind of light—the majority of the Committee are of opinion that the electric lighting might be continued in the Avenue de l'Opéra, and in each of the two Places in which it terminates, for the period of one year (that is to say, until March 1, 1881) on the existing terms—viz., at the price of 30c. per burner per hour, the Jablochkoff Electric Light Company undertaking, as previously, to bear the expense of lighting and extinguishing.

The Committee think that one-half the burners in the Rue du Quatre Septembre might be dispensed with, and probably also their consumption reduced. They, however, ask the Council to allow them to further consider this matter in conjunction with the Administration, and they will shortly make known their proposals.

MELBOURNE METROPOLITAN GAS COMPANY.

The Fourth Ordinary General Meeting of this Company—which supplies the whole of the City of Melbourne, embracing as it does the amalgamated undertakings of the late City of Melbourne Gas and Coke Company, the Collingwood, Fitzroy, and District Gas Company, and the South Melbourne Gas Company—was held on Wednesday, Jan. 28, when the Directors reported that during the half year to Dec. 31, 1879, the operations of the Company had been conducted in every department with efficiency and regularity, and had resulted satisfactorily. In compliance with the desire of the Conference of Municipal Bodies, acting under the authority of the Company's Act, the gas from the respective works had been conducted to the testing-room of the official Gas Examiner, Town Hall, Melbourne, with very satisfactory results. To provide more effectually for the requirements of the districts of Richmond, Kew, and Hawthorn, arrangements had been made for the erection of an out-station gasholder at Richmond. The purchase from the Crown of an additional area of 4 acres 3 rods 16 perches at the South Melbourne works would provide for all probable requirements of the Company at these works for many years to come. From the sum at the credit of net revenue account of £50,036 7s. 6d.,

The Directors recommended a dividend at the rate of 10 per cent. per annum, which would absorb . . .	£27,860 10 0
To carry to a reserve-fund account	10,000 0 0
To carry forward to next account	12,175 17 6
	£50,036 7 6

The capital of the Company consists of £557,210 of shares, and £231,000 of debentures, £60,000 of which were issued last half year. The total expenditure on capital account to June last was £732,912, and during the past six months £18,895.

Dr.	Revenue Account, for the Half Year ending Dec. 31, 1879.	Cr.
Coals, including dues, &c.	£40,058 10 5	Sale of gas—
Purifying materials & labour	2,492 0 10	Consumed by meter
Salaries of Superintendents, Foremen, &c.	712 10 0	Public lighting and under contracts
Wages at works	7,554 6 3	13,638 14 0
Repairs and maintenance of works and plant, less old materials sold	4,089 7 7	Residual products—
Salaries and wages of Inspectors, &c.	1,847 1 0	Coke, less labour and cartage
Repairs, &c., to mains and services	1,508 15 7	Tar
Repairing & refixing meters	1,602 4 0	Ammoniacal liquor
Lighting and repairing public lamps	2,222 7 9	Other products
Rents	264 18 9	60 1 10
Rates and taxes	562 14 0	13,942 6 0
Directors' allowances	675 0 0	Certificate fees
Auditors' fees	42 0 0	10 8 0
Salaries of Secretary, &c.	2,901 13 8	
Salaries of Collectors	1,470 0 0	
Stationery and printing	539 6 10	
General establishment charges and incidentals	282 19 8	
Gas Examiners and Assistants	154 18 10	
Law charges	190 6 3	
Bad and doubtful debts	1,347 14 8	
Subscriptions, as per vote of Shareholders	300 0 0	
Balance	42,696 11 7	
	£113,515 4 8	£113,515 4 8

THE COMPARATIVE TRIAL
AT MANCHESTER OF WEST'S AND FOULIS'S SYSTEMS
OF DRAWING AND CHARGING RETORTS.

Our readers may remember, at the end of last year, we announced that the Corporation of Manchester, determining to leave no stone unturned to test the relative efficiency of West's system of drawing and charging retorts, as against the Foulis hydraulic machinery for the same purpose, which has been in use at their Rochdale Road works for five years past, removed the hydraulic stokers from one of the four retort-houses in which it was employed, and replaced it by complete sets of machinery for carrying out West's system. They also made alterations to, and isolated part of

the works, in order that the results obtained might be separately recorded. Among the alterations, 240 D-shaped retorts were substituted for the worn-out ones, and these, under Mr. West's directions, were fitted with Morton's mouthpieces and White's valves. In addition to this, two of Livesey's patent washers were erected to complete the arrangements on the separate system.

The following table shows the results of five days working of each system, West's being tested in one retort-house for the five days, while Foulis's was tested in three houses, the figures in the first column, "Make per House," in this case (9,105,716 cubic feet), representing the average production of the three houses for the five days:—

COMPARATIVE STATEMENT
Showing the Results of Working—under similar conditions—of Foulis's and West's Systems of Charging and Drawing Retorts.

	Gas Made.				Cannel and Coal Carbonized.				Wages Account.	Summary of Expenditure per 1000 Feet.			
	Make per House.	Illuminating Power.	Make per Ton.	Make per Mouth-piece, 24 Hours.	Quantity.	Percentage of Cannel.	Average Cost per Ton.	Average Cost per 1000 Feet.	Cost per 1000 Cubic Feet.	Cannel and Coal.	Wages Account.	Interest, Depreciation, and Wear and Tear.	Total Expenditure per 1000 Feet.
	Cubic Feet.	Candls.	Cub. Ft.	Cubic Feet.	Tons cwt		s. d.	s. d.	d.	s. d.	d.	d.	s. d.
FOULIS . . .	9,105,716	18·05	10,266	6695·4	886 18	66·75	12 9·6	1 2·97	Wages . . 2·905 * Ponies . . 0·105 3·01	1 2·97	3·01	0·383	1 6·36
WEST . . .	10,738,200	18·19	11,709·5	8948·5	917 1	68·45	12 11·2	1 1·25	. . . . 1·68	1 1·25	1·68	0·236	1 3·16

* The ponies are used to draw the scoops to the machines in Foulis's system.

In reference to this table, it should be stated that four-hour charges were worked throughout the trials. The experiments were conducted by two specially appointed gentlemen, who had sole charge of the whole of the operations; and all necessary precautions were taken to ensure the accuracy of the figures obtained. The coal and cannel used consisted of six different kinds, an equal proportion of each being delivered to each retort-house. To make certain of this being done, special arrangements were made by the Gas Committee with the colliery proprietors and railway companies concerned.

The figures, however, do not as clearly as they might show the full advantages which have been obtained by the use of West's system—the extra make of gas, and the consequent reduction that could be effected in plant. These will be seen from the subjoined calculations based on the figures given above:—

West's system.—Gas made in one house in 24 hours	Cubic Feet.	2,147,640
Foulis's machinery.—Do. do.		1,821,143
Extra quantity per day by West's system		326,497
West's system.—Gas made per week in one house		15,033,480
Foulis's machinery.—Do. do.		12,748,001
Extra quantity per week by West's system		2,285,479
West's system.—Gas made per week in four houses.		60,133,920
Foulis's machinery.—Do. do.		50,992,004
Extra quantity per week by West's system		9,141,916
or 17·92 per cent. increase.		
From the preceding figures we learn that the		
Total expenditure per million feet of gas made by Foulis's machinery is	£76 10 0	
Total expenditure per million feet of gas made by West's system	63 3 4	
Saving per million feet by West's system	£13 6 8	
The saving of 3·2d. per 1000 feet actually made in the trial at Manchester amounted, on the 2,147,000 cubic feet of gas made per day, on an average, to £28 12s. 6d.		
The total saving, per week, on the four houses, would be 60,133,920 × 3·2d., or	£801 10 0	
To which must be added (say) 1d. per 1000 feet for the extra volume of the gas	250 10 0	
	£1052 0 0	

In conclusion, we may congratulate the Gas Committee and their Superintendent (Mr. G. B. Jackson) on the admirable arrangements made for this most extended trial of the new machinery, and assure them their efforts in this direction are much appreciated by the gas world at large.

DOVER GAS COMPANY.

The Half-Yearly General Meeting of this Company was held on Tuesday, the 2nd inst.—Mr. W. R. MOWLL in the chair.

The SECRETARY (Mr. G. Fielding) having read the notice convening the meeting, the following report of the Directors was presented:—

In presenting our balance-sheet for the past half year, we again have the pleasure of congratulating you upon its satisfactory character. The consumption of gas continues to increase, and the general circumstances attending the manufacture of gas have been of a favourable character.

Owing to a very wet summer and autumn we were unable to get our new gasholder at Buckland into use as expected, which materially increased the difficulty of keeping up the heavy winter's supply; but by the exertions of those employed upon the works, this difficulty was satisfactorily surmounted.

The 230 new shares sold by auction on the 25th of September produced an average price of £14 13s. 3d. per share.

We recommend the declaration of the usual parliamentary dividend, the payment of the arrears of dividend for the year 1861, and the carrying of the balance of profit to the reserve-fund.

[The profit and loss account shows that the cost of coals during the half year was £5005 9s. 0d.; purifying, £168 7s. 7d.; repair and maintenance of works, £2117 19s. 8d.; wages, £803 6s. 7d.; the other items of expenditure making up a total of £9976 8s. 1d. Against this is credited the amount received from the sale of gas, £10,895 6s. 11d.; coke, tar, and other residuals, £2380 15s. 7d.; the remaining items making up a total of £13,677 5s. 4d., leaving available for dividend, £3700 17s. 3d. The balance-sheet shows the capital raised to be £60,500; on mortgage, £10,000; and the remaining items on the debtor side make a total of £89,417 19s. 1d. Against this there is credited for cost of works, £69,391 6s.; the book debts, amount received for coal, coke, &c., the sums invested in Consols and in bankers hands making up the total.]

The CHAIRMAN, in moving the adoption of the report, said the past half year had been the most successful the Company had passed through—a fact which should put the Shareholders on perfectly good terms with the value of their property. The balance-sheet was of the most gratifying character, there being £1022 9s. 2d. to carry to the reserve-fund, making

that fund something like £3300. The consumption of gas continued to increase steadily, but relatively it had not been so large as usual in the past half year, owing to the fact that during the winter the shops had closed earlier than in former winters. Notwithstanding this, the consumption had increased, and the increase was shown in this way—that whereas in the corresponding period of the previous year 6378 tons of coal were carbonized, during last half year 6895 tons were carbonized. The whole of the work connected with the Company had gone on satisfactorily. The leakage in the mains had been rather greater than usual, not from any want of vigilance on the part of the officials, but owing to the very heavy traffic that had lately passed through the streets, and also on account of the use of the steam roller. This kind of traffic had caused some of the pipes to break, and if there were breakages there must, of course, be leakage, which amounted to about 2 per cent. more than the corresponding period of the previous year. The Board would do their best to remedy the defect, and if they could find out who were responsible for the damage, such persons could be compelled to make that damage good; but, not wishing to have litigation, the Directors had not yet taken any proceedings in the matter. The past half year had been a most profitable one, and he saw no reason why the ensuing and succeeding half years should not be equally successful. At the Directors last meeting, after reviewing the past and looking also to the future, they came to the conclusion that, with perfect regard to the interests of the Shareholders, and still securing for them their full parliamentary dividend, they were able, from the 1st of July next, to reduce the price of gas 3d. per 1000 cubic feet, thus making the net price 3s. 6d. instead of 3s. 9d. per 1000 feet. He was sure this fact would be received with satisfaction by the consumers; but he would at the same time assure the Shareholders that the Directors had taken every care to secure the full parliamentary dividend. Three years ago the Company had no reserve-fund; now they had a fund amounting to £3300, and upon this they could fall back if they did not happen to make up the full dividend, though the Board would do all in their power to maintain the 7½ per cent. without having recourse to the fund. With regard to the electric light, six months ago he spoke at some length upon the probabilities of the introduction of that light, and put before the Shareholders several reasons why there was no possibility of it coming into successful competition with gas. He was happy to say that, although some of the keenest intellects were at work with a view to the further development of the light, yet there were certain difficulties which electricians were unable to master, and while these remained unmastered gas could snap its fingers at electricity. For his part he believed that until some means could be invented by which the electric light could manifest its power without continual personal attention, it could not affect gas property. Perhaps one of the best things that had happened for gas property was the electric light coming as a competitor, for it stirred the energies of the men who were interested in keeping gas to the front, and they set their wits to work for the continual improvement of the machinery and appliances by which gas was made. They, as a Board, endeavoured to keep on a level with these things, hence they had spent £2117 during the past half year in keeping the Company's property up to the mark.

Mr. BOTTLE seconded the motion, which was carried. The CHAIRMAN then moved that a dividend of 7½ per cent. be paid for the past half year, and that the dividend due for the year 1864, at the rate of £1 10s. per cent. on the Company's stock at that period, be also paid.

Mr. MANNERING seconded the motion, and it was carried. A vote of thanks was then unanimously accorded to the Chairman, who briefly acknowledged it, and the proceedings terminated.

BROMLEY GAS CONSUMERS COMPANY.

The Ordinary Half-Yearly Meeting of this Company was held on Thursday, the 26th ult.—Mr. ROBINSON LATTE in the chair.

The SECRETARY and MANAGER (Mr. G. H. Osborn) read the notice of meeting, and the following report of the Directors, for the six months ending Dec. 31, was presented:—

The increase of the year 1879 over 1878 in the make of gas is about 6½ million cubic feet, equal to about 9½ per cent.; and that of the gas-rental is about £1500, or nearly 10 per cent. On the other hand, the price of coke and tar has been considerably less than in the former year, and the cost of purification has been about doubled by the increased charge now made for the use of oxide, and the more liberal use of lime to secure a good quality of gas. The item also for rates and taxes has risen from about £530 in 1878 to £680 in 1879. This is due to a heavy increase during the past year in the rateable value of the Company's property.

The result of the whole year's accounts is that the net profits fall short by the sum of £121 3s. of the amount required to pay the maximum dividends on the old capital, and so much of the new capital as has been issued; and this small sum your Directors recommend should be taken from the reserve-fund (one of the objects of which, they may remind the Shareholders, is to equalize dividends), and that the usual dividend be declared at the rate of 10 per cent. per annum on the old capital, and 7 per cent. per annum on the new capital, including a proportionate dividend on such of the shares lately sold by auction as have been fully paid up, at the like rate, from Oct. 3 to the end of the year.

The Directors congratulate the Shareholders that the new works have been in the main completed during the period when iron was cheap, although it has not yet been found necessary to use the new retort-house, or the engine and boiler houses.

The retiring Directors are Mr. Dennis Adams and Mr. Jacob Usher, who are eligible for re-election. Mr. John Death retires in rotation as Auditor, and is eligible for re-election.

flyng-house. This is, no doubt, perfectly true, and I am convinced that with a proper-sized main from the hydraulic, together with sufficient condensing and scrubbing power, the only need we have of the oxide or lime purifiers at all is to give to the gas, if I may use the term, just a finishing touch.

Previous to the extensions that have been recently made at the Wigan Gas-Works, at a time when the annual make of gas was about 200 million feet, it was no uncommon thing for us to be compelled to change daily two and three purifiers, each 20 ft. square by 4 ft. 6 in. deep, and even then it often happened that our gas was anything but satisfactory. The fact was the purifiers were being called upon to do an immense amount of work that ought to have been done before the gas reached them at all, and in consequence of this they were rendered totally unfit to perform what I contend is their only duty—viz., to act as catch purifiers pure and simple. As soon as I had completed the extensions, a part of which consisted of larger mains from the hydraulics to the condenser, larger condensers, and two new scrubbers 60 ft. by 12 ft., it was found that instead of changing purifiers twice or three times a day, as we had been in the habit of doing, once every fortnight was quite sufficient. This caused me to proceed a little farther with my investigation. I first shut off one scrubber, and in a short time found that it gave the purifiers about 25 per cent. more work to do than before. I then shut off a portion of the condensers, which gave an additional 10 per cent., and so on; in proportion as I reduced or increased the amount of condensing and scrubbing power, so the amount of work thrown upon the purifiers varied.

Seeing, then, how very little the purifiers had to do when the scrubbers, condensers, &c., were in full work, I decided to pull a sufficient quantity of air at the inlet of the exhauster as would keep up a constant revivification of the oxide purifiers; but, owing to the deleterious effect it had on the illuminating power of the gas, it was discontinued. After a time, however, I tried the effect of pulling air at different points in the condensers, thinking perhaps it might take up and retain some of the naphtha vapours and light oils so abundant at that point. This, to my great satisfaction, proved to be the case; and it has been in this manner that the whole of the gas made at the Wigan works from the 7th of May last year to the present time has been purified. Not a single trace of SH_2 has there been in our gas during that period, except on two occasions, when we commenced to use a fresh supply of oxide of iron, and then it was only very temporary indeed; neither has the gas been below our parliamentary standard—viz., 18 candles—which I wish to state has been maintained from a mixture of ordinary Wigan Arley and four-foot gas coals exclusively.

On the 27th of October last, nearly six months from the time of its being first charged, I opened one of the purifiers to ascertain its condition, and to my astonishment I found that the oxide had become one solid mass. How the gas found its way through it I cannot imagine; suffice it to say that the aid of a pickaxe and heavy crowbars had to be brought into requisition before it could be taken out. This purifier was in due course re-charged with fresh oxide, and in turn the others were examined, cleaned out, and re-charged in a similar manner. On subjecting to analysis the material taken out of the purifiers, I found it contained no less than 72.20 per cent. by weight of sulphur, which has since been verified by another analysis made by Messrs. McDougall Brothers, of Manchester. I have brought a sample of the material with me, and it may be examined or tested by any person wishing to do so.

In order that I might be enabled to ascertain the exact quantity of air required to keep the oxide of iron in good working condition, I attached a small meter to the condensers, and by drawing the air through it I found that 4½ cubic feet per 1000 feet of gas, or 0.45 per cent., was sufficient.

This system of purification does not in the slightest degree affect the present method of taking out carbonic acid, bisulphide of carbon, or any of the other sulphur compounds, inasmuch as the combination of the oxygen with the oxide only takes place after the sulphuretted hydrogen has converted into sulphide of calcium the lime used for extracting these impurities.

In conclusion, I have to thank you for the kind attention you have given to my paper, and to express a hope that, if there are any points upon which you wish further information, you will kindly say what they are, and I will endeavour to explain them.

Discussion.

The VICE-PRESIDENT (Mr. J. Chew) said he wished to put a few questions to Mr. Hawkins. He should like to know, in the first place, whether he understood him to say that oxide of iron was exclusively used in the purifiers he had most recently constructed.

Mr. HAWKINS replied that they used nothing whatever but oxide of iron.

The VICE-PRESIDENT said, that being so, he should like to know what became of the fumes of sulphur, if there were any, during the process of revivification. Was the gas ever tested for sulphur other than sulphuretted hydrogen, and were the Corporation bound by their Act to remove any of the other sulphur compounds not removed by the oxide of iron? At the present time one of the most important matters in connection with gas manufacture was how to avoid causing a public nuisance. The presence of carbonic acid would reduce the quality of the gas. The London Companies had been tied down very strictly, and had been obliged to resort to lime purification. He should like to know whether Mr. Hawkins had tested for carbonic acid and bisulphide of carbon, and what was the outcome.

The PRESIDENT said all these queries might be put in the course of the discussion, and Mr. Hawkins would, no doubt, answer them.

Mr. PATERSON said the idea developed in the paper was certainly a new one, and, he thought, claimed very important consideration. If by the process adopted by Mr. Hawkins the expense attending the removal of oxide for the purpose of revivification could be avoided, and the same result be obtained by passing a current of air along with the gas, it certainly upset some of their previous notions. He did not know, however, whether it would not tend to destroy the illuminating power of the gas. They all knew very well that if they mixed air with gas they destroyed the illuminating power; but in this case the air had to pass through the oxide, and possibly the affinity they had for each other would keep up a system of oxidation. He did not see that any ill effects could be produced by liberating the sulphur. The question of carbonic acid was a different one. He believed they could not, by the ordinary process of purification by oxide, take out the carbonic acid. In order to do so they must pass it through some other purifier, because oxide had no action upon carbonic acid. If it was true that Mr. Hawkins's process produced the results claimed for it, he (Mr. Paterson) considered it a very important fact, and one that would result in a large saving of expense.

Mr. HUNTER (Salford) said the idea was certainly very striking, and they accepted Mr. Hawkins's statement that such was the fact. It seemed to surpass their chemistry for the present moment, and it was for them to dwell upon it, and work it out in experience; and, if they found it the same in practice, it would be a very important discovery for them. He agreed with Mr. Hawkins with respect to making the condensers and scrubbers do the work of purification, and it quite accorded with his own experience. They had heard a great deal about carburetted gas. This seemed to be carburetted in the other extreme—introducing the air to take up naphtha and other gases. He had been to see the apparatus at

Rochdale, and he thought it might be of some interest if he stated what had been his own experience. It happened that in the alteration of their Regent Road works he was able to pass the liquid products direct from the hydraulic main to the tar-well by the old pipes, while by the new pipes he allowed the products and the gas to pass together. He gained some new experience by these methods. By watching the temperature at which he kept the gas, tar, and liquor together, and taking great care that the separation took place at a given point, he found a certain increase in illuminating power. As to how Mr. R. H. Patterson arrived at the opposite result, he could not explain. He could only say what his experience was. He carefully watched the result himself, with the aid of his assistant. It was not hours, or even days of casual watching, but an elaborate test. It was a subject that would come to the front before long, and they would have to seriously consider it, and he believed they would find that the adoption of the Rochdale system or of Aitken and Young's process would be necessary. The idea in his mind was that if they could keep the gas from contact with the sooty matter in the tar, and simply carry the light oils, they would get a great increase in the illuminating power. If they only put in the naphtha and benzol, and left out the pitch or sooty matter, there was no fear of its being reduced—it became permanent gas.

Mr. NEWBIGGING said that a few months ago he had the pleasure of travelling some miles with Mr. Hawkins, who described this process of his. He (Mr. Newbigging) was very much struck with it, and strongly urged Mr. Hawkins to write a paper on the subject, and read it at one of their meetings. He therefore took some little credit to himself for having induced the author to prepare and read his most valuable communication. The idea of revivifying oxide of iron without changing the purifiers was not, however, a new idea. Most of them would remember that Mr. Fish, formerly of Hornsey, and now of Bucharest, in Roumania, discovered that by driving a jet of steam through the purifiers—the steam, of course, drawing a certain quantity of air with it—he was able to revivify the oxide of iron in the purifiers when it became foul. The steam was also found very useful in preventing the oxide from becoming unduly heated, and liable to fire, and it produced the degree of dampness required in the purifying material. It had also been attempted in some of the gas-works in the Metropolis to draw in air through the material *in situ*, by connecting the purifiers by means of a pipe with the chimney, the draught of which was sufficient to cause the air to enter the vessels by another opening, and permeate the mass of material, thus effecting the same object. In neither of the arrangements, however, was the air allowed to mix with the gas. The failure of these plans was due principally to two circumstances—viz., the liability to firing, thus destroying the wood grids, besides being otherwise highly dangerous; and also to the consolidation of the material, causing heavy back pressure. The difficulty in both cases arose from the large amount of air introduced. Mr. Hawkins had succeeded in discovering the right quantity of air necessary, and applying it at the right place, that was at the end of the condenser, mixing it with the gas. He thus introduced one impurity for the sake of eliminating another, and this was a well-understood principle; as, for instance, in the case of sulphide of calcium arresting the bisulphide of carbon. But the curious circumstance in connection with the process was that by the means described Mr. Hawkins was able to get a much larger proportion of free sulphur in his oxide of iron than it had been possible to obtain by the ordinary means of changing the purifiers. He believed about 56 per cent. was considered the limit that could be reached; but Mr. Hawkins had been able to put in 75 per cent., and it was a question whether even then the oxide could be considered fully saturated. Another remarkable thing was the consolidation of the material. Though the stuff was almost as hard as a piece of stone, yet it seemed to be quite efficient in purifying the gas. It was now well known, since Mr. Forstall had made it plain, that when lime in the form of nodules was used as a purifier, it was much more efficient than in the form of flour. The gas seemed to penetrate right to the centre of each lump, whilst it passed through the flour without being affected. Perhaps something of the same action resulted in the case of the oxide of iron by Mr. Hawkins's process. By the adoption of this method of revivifying, it might be possible to dispense with the fourth purifier in a series; or, at least, the whole four might be employed without any of them standing off, except on rare occasions.

Mr. T. O. PATERSON (Rochdale) considered this a great discovery, as it certainly was a most curious one. He had had some experience in trying to revivify the oxide at Rochdale by a steam blower; but they had the same difficulty to contend with that Mr. Newbigging spoke of—the heat. The oxide would not revivify with all their trials, and the wooden grids in one instance caught fire. He believed the blower was too small for the size of the purifiers.

Mr. HUNTER (Salford) suggested that it was perhaps too large, admitting too much air.

Mr. LEGGE (Ossett) would like to ask Mr. Hawkins what was the amount of back pressure that he had on his purifiers. He thought it must be very great.

Mr. W. BRIDGE wished to know whether this was not a similar system to that which had been in operation at Longton, in Staffordshire, for ten or a dozen years.

Mr. MITCHELL (President of the West of Scotland Association of Gas Managers) looked upon the subject as of very great importance to gas engineers, and he thought Mr. Hawkins had mentioned a fact which was worthy of their most serious consideration—which was, that the scrubber and condenser should be of sufficient area and capacity to treat the quantity of gas introduced. He could corroborate his statement as to the quantity of gas purified under these conditions. At the new works which he had recently erected, they had saved over 80 tons of lime in eight months, purifying about 28 million cubic feet of gas, as compared with the quantity which they used for a similar amount of gas at the old works. He did not think the pressure was increased in proportion to the depth of material employed. The lime was 32 inches deep, and he put it in one sieve, and did not find that there was above one-tenth or one-tenth and a half of extra pressure. The admission of air as a purifying agent was certainly a new feature. He had never imagined that air would have a beneficial effect upon oxide of iron in the way it was applied by Mr. Hawkins; but he thought there was something in it, because there was a possibility that in passing through the apparatus the air would become carburetted.

Mr. EASTWOOD (Batley) wished to ask Mr. Hawkins if he had tried the effect of drawing air in nearer the hydraulic main than the condenser. It seemed to him that if it were drawn in where the gas was hotter, it would have a better chance than at the condenser end.

Mr. STORER (Stafford) said that some years ago they altered their method, so that it enabled them to convey the gas and tar and the liquor together from the hydraulic main a considerable distance to the entrance to the condenser. Previous to that arrangement, with the same coal and the same setting of retorts, they were troubled with naphthaline to a great extent; but since then it had never troubled them. Their condensers were horizontal, and there were also a washer and scrubber—not very large, only about 30 feet high—and, with thorough condensing and washing and scrubbing, they had a very small quantity of carbonic acid, and could purify 2½ million feet of gas with the same material that they formerly used for 1 million feet. He thought the paper a very valuable

one. If notice were taken of the different temperatures of washing and scrubbing, and if there were only sufficient power, it would be found, even though it might not be possible to revivify the oxide in the purifiers, that there would not be so much required to purify. He used Arley coal with a mixture of North Staffordshire, and the illuminating power of the gas had not been below 16 candles.

The PRESIDENT regarded the paper as exceedingly suggestive. It took one a little by surprise as to the result, though he could not agree with the statement that it was new, because it was something he had tried several times, and it was not an original idea of his. He knew perfectly well that where oxide was used for purification, it was quite safe to draw in a portion of air if the oxide was good. Air was objectionable when mixed with gas, only on account of the oxygen it contained. They might have something like 3 per cent. of carbonic acid in the gas, and yet have comparatively little difficulty in maintaining the illuminating power at 17 or 18 candles. If they had 3 per cent. of air it would destroy nearly the whole of the illuminating power. They came to the conclusion, therefore, that it was objectionable, as increasing the combustion to such a rapid extent that the carbon had no chance to remain suspended sufficiently long to become luminous. Nitrogen had not the same effect, and if they extracted the oxygen, air became simply a diluent. They, however, had no idea of carburetting the air—although it was admitted at the hydraulic main—but did it simply for the purpose of prolonging the time that the oxide should remain in the purifiers. When the gas got above a certain standard, they, in order to sail as close to the wind as possible, reduced the illuminating power in this way, and at the same time, as they thought, prolonged the duration of the oxide by driving in the air. They, however, arrived at nothing like the result mentioned by Mr. Hawkins, and it was on this account, he thought, they were indebted to him, because it opened up the prospect of a large improvement in the manufacture of gas. As to the question asked by Mr. Chew with reference to sulphur compounds apart from sulphuretted hydrogen, Mr. Hawkins would have to admit that he did not test for these. There was no doubt at all that two things were required in order to accomplish such a result. One was that the purifiers must be very large, so that not only would purification go slowly on, but that the revivification might have plenty of time. The question asked by Mr. Legge was one that suggested itself to him. He very recently tried to get the oxide as dry as possible, and it became so dry that it was difficult to pass the gas through it, the back pressure was so great; but if the oxide were put in under ordinary conditions, light and moist and open, and began to petrify, if he might so term it, in that state, all the pores would be open, and would remain so until they became filled by the precipitated sulphur, and the oxide had to be replaced by other. In large purifiers the pores would take a long time to cake up, so as to give a large amount of back pressure. He did not know whether these suggestions could always be carried out. He should fancy that Mr. Hawkins's coal did not produce very much sulphuretted hydrogen, or he could not have kept the oxide in for so long a time. Mr. Paterson said it was very free from sulphur, and he (the President) should imagine that it was. Where there was a large quantity of sulphur in the coal, such a process could not be carried on; besides, they must have an exceedingly large area in order to reduce the flow of the gas to that degree of slowness at which it was necessary the work should be done.

Mr. HAWKINS, replying to the various points raised, said he did not quite catch the meaning of Mr. Chew's question with reference to the fumes of sulphur.

Mr. CHEW said his impression was that the air was not passed in along with the gas.

Mr. HAWKINS said it was allowed to pass in along with the gas. He did not profess to take out the bisulphide of carbon, but at Wigan they did more washing with ammoniacal liquor than formerly. They washed a great deal with this material, and they had one scrubber through which clean water was passing. They found great benefit from it in reducing the sulphuretted hydrogen and other impurities. There was certainly some little back pressure, and that was the reason why he looked into the purifier, and found the oxide in the state he had described.

Mr. NEWBIGGING: How long had it been at work?

Mr. HAWKINS: From the 7th of May last year to the 27th of October. They were now working on the same process, and had had no change for a long time.

Mr. PATERSON: What was about the back pressure you had?

Mr. HAWKINS: About 16 inches.

Mr. NEWBIGGING: What is about the normal pressure?

Mr. HAWKINS: Six inches.

Mr. CLARKE: Is the 16 inches on the purifier alone?

Mr. HAWKINS: Sixteen inches from the holder to the exhaustor.

Mr. W. CHEW (Blackpool) read the following paper:—

THREE MONTHS EXPERIENCE OF ELECTRIC LIGHTING AT BLACKPOOL.

Under this heading, I propose to place before you some particulars of the mode of laying down, together with the capital cost and the working expenses of the electric light plant erected last year in our town, feeling sure that it will be of interest not only to yourselves, but to the gas world generally, inasmuch as it is the only town in which electricity has been tried to the best advantage, and on a practical working scale.

In the beginning of August last year our Town Council unanimously agreed to light up the central portion of their extensive Promenade, which has a sea frontage of three miles, by means of the electric light, in a manner surpassing anything that had ever been attempted before; this system of lighting to be employed every season during the autumn months, and on days of festivity. The opening day was to be the 18th of September, and I may here say that they have accomplished their object of having created a sensational light.

The Committee appointed, together with my father, their Gas Engineer, they proceeded at once to inspect all the best-known systems, viewing, amongst others, the well-known Thames Embankment lights; but so thoroughly satisfied were they that in all these there was nothing but what some large gas-lamps would supersede, that they resolved to strike out the rather bold experiment of having large centres of lighting, and employing four naked lights of 6000-candle power on the Promenade, and one on the end of each of the two piers. The area to be illuminated was therefore a quadrangle, 1000 yards long and 400 yards wide. The four lights on the Promenade are 350 yards apart, and those on the piers about 400 yards from the shore. The whole are placed in plain glass lanterns 60 feet above the level of the roadway. This is necessary with naked lights, so as to remove the strong penetrating power from the eye when approaching the lamps, as well as to better distribute the light between them.

Having briefly described the object desired to be accomplished, I cannot do better than explain the mode of procedure adopted to produce the effect. Arrangements having been come to with Messrs. Siemens, of Charlton, near Woolwich, for the supply of the necessary electric apparatus, and with Messrs. Robey and Co., of Lincoln, for the engines, and the whole of the plant being under the control of the Gas Department, it

became part of my duty to superintend its erection, and to see to its working after the contractors had completed.

The site selected as being convenient for the machinery was the Corporation Dépôt, situated 400 yards from one end of the Promenade, and 250 yards inland. Here was put up a substantial timber building, 60 feet by 25 feet, and inside, on the ground, was laid a framing, which formed the foundations for the machinery, the interspaces between the timbers being filled in flush with concrete, and then boarded over to prevent dust rising. Upon this were fixed, as they arrived, two portable 16-horse power engines and boilers, and at the opposite end were the electric machines, of which there were seven, all being driven from a counter-shaft placed between them and the engines. From each of the six machines a distinct wire is led to its own lamp, and one common return wire, so to speak, answers for the whole. You will, no doubt, wonder what the odd machine was for. Well, at first, the whole of the six machines had to perform the duty of producing their own electricity, but that duty is now taken from them by specially devoting a dynamo-electric machine to that purpose solely, and this was found to be better for the lights.

The first difficulty we had to contend with was the laying of the wires inside the 2-in. and 3-in. cast-iron pipes, it having been decided to place them underground, hidden from view. This proved no easy matter, inasmuch as the wire was in 500-yard lengths, and it was desirable to have as few joints as possible. It therefore cost as much to put the wires through as it did to make the trenches, so careful had we to be in order not to damage the insulation, and to keep off the water. The weather happened unfortunately to be unfavourable for us, as, a day or two after commencing, a series of high winds set in, with their usual effect at Blackpool of forcing the water over the Promenade, to the amusement of visitors, but to the detriment of our work; for, at every tide, it filled the trenches and pipes with sea water. However, as there was no time to stop, we persevered, and completed the 1500 yards in the week allowed us, and were ready for the preliminary trial to take place on Saturday, the 13th; but, alas! all our efforts were unavailing, for the insulation of the wires had yielded to the water, and it was quite spoiled for the purpose, so there remained no alternative but to withdraw them. This we commenced on the Friday evening, and drew out the whole and laid them on the arms of the lamp-posts. By the Saturday night we had temporarily connected the wires, and had two of the most commanding lights at work with good effect. By the following Monday morning we had collected together the most suitable poles in the town, and immediately set to work and placed them up telegraph fashion, and secured the wires thereto with iron staples, there being no time to get insulators fixed. During the time the wires were being completed, experiments and trials were going on in the engine-room, and by Thursday, Sept. 18, all was finally ready, and the lights were lit at dusk with remarkable steadiness, considering the drawbacks we had to encounter for want of time.

I may tell you that it was with no small degree of pleasure I beheld, from an elevated position, the lights shedding down their bright white beams on the upturned faces of at least 70,000 persons who had come to Blackpool to witness the grand spectacle—to see the poor gas once for all annihilated. Well, I must say the gas cut a sorry figure when burning in the lamps when the electric lights were lit, of which a good many of you present were eye-witnesses; but it became very useful as the nights grew darker, and one of the new illuminants was suddenly extinguished, for it would have been unsafe to the public to have left all in darkness, which might have occurred at any moment. As we got more accustomed to its eccentricities and freaks of going out every now and then, we gained confidence, because we found out how to apply the remedy. In nine cases out of ten the cause was the rack holding the carbons getting fast, and a man was usually on the look-out to shake it with the line to the lamp. So frequently did this happen that ultimately the passing public and youths saved us the trouble by merely pulling the line as they went by. Sometimes, however, more serious mishaps would occur, owing to the exposed position of the lights, and to the strong gales of wind and rain. The delicate working parts were affected by corrosion and damp, and in such cases there was no alternative but to take the lamp in for readjustment; so it had to remain extinguished for the night, or if it was a very bad light, it was better policy to shut it off. One would naturally say, why not take out the spare lamp and substitute it for the other? This seems very simple until explained. The reason is this, that owing to all the circuits being of different lengths, and having different resistances, each lamp had to be accurately adjusted, and tried in the test-room, with the current flowing all through the wire. Thus, supposing No. 1 lamp went out, and could not be got to work again; it is 1400 yards away, and it would be necessary to send two men to lower it, couple the two wires together, bring the lamp back, and set to work adjusting the spare lamp to the circuit, which would require, say, half an hour; then to send it back and hoist it up, the whole occupying 1½ hours, during which the light would be out, and would need another attendant, who would afterwards have nothing to do, and some nights would never be wanted, although he must be always at hand.

The mode of working which we have found to be the most advantageous is the following:—One engineman and assistant look after the engines and boilers, which require very great attention in their stoking, for a variation of 5 lbs. pressure of steam will throw all the lights out of order. Another man is kept to oil the machines and keep all going right in that department, as well as to look for any light going out, which in some cases instantly shows itself at the machines, but always at a dial-board, on which all the connections are made, and on which we have suitable tell-tale appliances. The hour for starting work is one o'clock, p.m., and then the mode of procedure is as follows:—All three men start out and fix the carbons in the lamps, clean the same, and hoist them up again. To go the whole round occupies 2½ hours, if all is well. Occasionally a carbon-holder is burnt away, the lamp having burnt too hard on a windy night, and this the men generally refit with a spare holder they take with them. On these occasions three hours is about the proper time. They next return to the machine-room, clean the engines, and go carefully over the machines and belts, and then all is ready for lighting, which generally lasts five hours. We should have to go round the lamps a second time if we had to light all night; this would entail another staff, and be very expensive. I myself attend almost every evening at the Dépôt during the period of lighting, to see that all is kept right, and to put in proper order all the lamps brought in, as well as to instruct the man in any repairs and alterations to be made. It is also very requisite to go round two or three times a week to see the carbons fixed in the lamps, and to adjust them a little, and to see that the current is working the right way through the lamp.

Having given you a good idea of the work to be done, I think I could not do better than proceed to give you a few particulars of the cost of all this, and I will put our system in comparison with the others, so that you may see the proportion of the costliness between large lights and the small ones, comparatively speaking—those of the divided current, or Jablochhoff system. The following figures will show the amount of the capital account. Those of Westgate-on-Sea and the Thames Embankment are from the reports of Messrs. Bennett and Valon, and of the Metro-

politan Board last May, but to the latter I have added the apparatus which I find necessary to work their plant permanently, and this enhances the

capital. Each item that is added is marked with an asterisk (*). It must be noted that the apparatus at Westgate was only temporarily fixed:—

Capital Account.

BLACKPOOL. Six Lights = 36,000 Candles available.	WESTGATE. Six Lights = 1182 Candles available.	THAMES EMBANKMENT. Twenty Lights = 4000 Candles available.
Two 16-horse power engines and boiler, with reserved power £598 0 0	One 10-horse power engine and boiler £300 0 0	One 20-horse power engine and boiler, with reserved power £495 0 0
Counter-shaft 52 0 0		Counter-shaft 20 0 0*
Coating 13 0 0		
Seven machines (Siemens's) 800 0 0	Two Gramme machines 220 0 0	Two Gramme machines 360 0 0
Seven Siemens's lamps and six lanterns 143 0 0	Six Jablochkoff lamps, complete 60 0 0	Twenty Jablochkoff lamps, complete 200 0 0*
Terminals 12 0 0	Terminals, &c. 2 0 0	Terminals, &c. 5 0 0
Beltting 60 0 0	Beltting 4 0 0	Beltting 35 0 0
8800 yards of cable 556 0 0	1200 yards of cable 110 0 0	3900 yards of cable 390 0 0
Posts and poles 40 0 0	Six lamp-posts 12 0 0	Twenty lamp-posts 40 0 0*
Engine-house 200 0 0	Engine-house 200 0 0	Engine-house 360 0 0
Foundations 60 0 0	Foundations 10 0 0	Foundations 50 0 0*
Gas and water fittings 9 0 0	Gas and water fittings 9 0 0	Gas and water fittings 10 0 0*
Strophometer 10 0 0	Strophometer 10 0 0	Strophometer 2 0 0*
Velocimeter 2 0 0	Velocimeter 2 0 0	Velocimeter 10 0 0*
Tools 10 0 0	Tools 10 0 0	Tools 10 0 0*
Galvanometer battery and leclanche 5 0 0	Galvanometer battery and leclanche 5 0 0	Galvanometer battery and leclanche 5 0 0*
Ropes, tackle, stays, &c. 30 0 0		
Labour erecting, and sundry bills 200 0 0	Labour erecting, and sundry bills 46 0 0	Labour erecting, and sundry bills 69 0 0*
Total £2800 0 0	Total £1100 0 0	Total £2600 0 0

Below I will compare the working expenses we are now at, and those of the others for one night of 5½ hours:—

BLACKPOOL. 36,000 Candle Power.	WESTGATE. 1182 Candle Power—Four Hours Lighted.	THAMES EMBANKMENT. 4000 Candle Power.
One engineman £0 5 0	One engineman £0 5 0	One engineman £0 6 8
One assistant 0 3 4		One assistant 0 6 8
Attendant and supervision 0 7 0	Attendant and supervision 0 7 0	Two assistants 0 10 0
Oil, tallow, turps., &c. 0 1 6	Oil, tallow, turps., &c. 0 0 5	Oil, tallow, turps., &c. 0 1 7
Water for boiler and general use 0 0 6	Water for boiler and general use 0 0 2	Water for boiler and general use 0 0 2*
Gas 0 0 6	Gas 0 0 6*	Gas 0 0 6*
Carbon, with waste, 10 feet at 9d. 0 7 6	24 candles at 8d., 16s. 3d.; dropped to 2d. 0 4 0	20 candles, each lasting 1½ hours = 80 candles, at 2d. each 0 13 4*
Fuel, coke, and coal, 13 cwt. per night 0 6 6	Fuel, coke, and coal 0 6 0	Fuel, coke, and coal 0 4 9
Interest at 5 per cent. 0 11 8	Interest at 5 per cent. 0 4 7	Interest at 5 per cent. 0 8 4*
Repairs and maintenance, 10 per cent. 1 3 4	Repairs and maintenance, 10 per cent. 0 9 2*	Repairs and maintenance, 10 per cent. 0 16 8*
Total £3 6 10	Total £1 16 10	Total £3 8 8

Now, it is a very difficult matter to put the proper interest to these tables, inasmuch as the longer the lights are burned, the less is the cost per hour; but as I must compute it in some way, so as to arrive at the actual cost, I shall take our own as we intend to use it, or I will give it the benefit of being lighted every night during which our gas-lamps are alight—viz., 240 nights—and allow them to burn from 5 to 5½ hours. Any other deductions you wish can be made accordingly. In the preceding table you will note that we have two engines and boilers, and during the last week we kept the plant going with only one running; therefore, we shall compare favourably with the others in having reserve power, which is far better for working steadily and safely, and I may say it would be very necessary to have other parts of the plant in duplicate if we were working under penalties for not keeping up the illuminating power, and were fined heavily for occasionally leaving part of the town in darkness.

Before closing my paper, I will say a word or two on some of the effects which our lights have produced in different states of the atmosphere, and conclude with a few remarks on electric lighting generally as an illuminant for our cities. The four lights as now placed light up the Promenade at Blackpool very well for a length of 1500 yards, but not evenly, there being a flood of light directly under them, and not so much midway between them, though amply sufficient for any requirement. If there had been six lights on this length, the effect would have been uniform throughout. As comparing the diffusibility of the light under various conditions, the best result I have noticed particularly has been on some nights when I have been able to read the time very readily by my watch at a distance inland of about 1½ miles. This effect, I am of opinion, was caused by the reflection of some passing rain-clouds, which I noticed hanging about in large masses pretty low in the atmosphere. The same thing has been of particular benefit to some of the fishermen, who have had to go out on the sands about two miles away, at night time, to take fish, and they have many a time been able to see distinctly. The opposite effects are produced in a dense fog. I have only been able to see the lights at a distance of 100 yards, and I could see at the same distance one of the large 100-candle gas-lamps we have fixed in another part of the town, owing to the difference in the colour of the light.

The strong concentrated light of an electric lamp is very bad for the eyesight, and I would not recommend any one having a weakness in that direction to look at them. I myself, as well as the men employed, have had painful experiences of the result, although at the time we were unconscious we were being affected. While experimenting with the lamps it is not noticeable, but after leaving the room the effect is severely felt, and if badly affected there will be no sleep for you that night, but you will have to sit up and keep the eyes wide open, and shaded from light, as it is impossible to shut them, so painful are they. This result has been produced, though in a less degree, in the case of a great many who have visited the room to see the mysterious apparatus at work.

The grand idea of the divisibility and distribution of electricity in the same manner as gas or water—viz., having large leading wires or mains running through the principal streets, with small branches to each consumer—has not for a moment been entertained by any of the electricians, though this is the plan the anxious public are waiting for; the reason being that you cannot have a storage for your supply, as with gas, where you create a large reserve, and, charging all your pipes under pressure, leave those who require it to simply turn on an outlet for the supply, and, by the grand old law of gravitation, they get all they want from the stock, while a fresh supply would be making and storing for next day in the gasholders. Not so with electricity. As it is generated, so it must be consumed; for electricity must move in a circle, otherwise it cannot be created, and as it moves it disappears. The same electricity does not move round again; it never passes the starting-point, but as it comes it dies, and makes room for more. Now, as it is impossible to store electricity in any appreciable quantities, we see that the object must be to utilize its power as it is being generated; therefore the greatest difficulty is in the distribution as produced. This will be found a great disadvantage, assuming that a town is to be supplied, for it would mean that the apparatus would have to be constantly going in order to supply light when any consumer might at his option desire to avail himself of it during the day or night. It would be like working a gas-works without holders for storage, with the same disastrous results financially speaking—namely, increased capital, and wear and tear of retorts, plant, and now and then

all darkness for a short time in the town, if a sudden draught took place on the mains, owing to a large establishment lighting up without notice. This feature in electric lighting has not as yet shown itself, it being now at the will of the manufacturer of the light when the lamps shall be lighted and put out; but let the consumer have that power left to him, which he will claim as his right if he has to pay the bill, and another difficulty is once more placed in the way of electric lighting for towns.

I am, of course, presuming that there is no difficulty in generating electricity, for it is mere mechanical power that is required. Nothing is used in its manufacture, and, consequently, there is no end to its source. This leads me to the electric lighting systems of the present day, which are nearly all alike in their working, as regards divided lights. The plan adopted is to put from half a dozen up to, say, 20 lights on one circuit—that is to say, one machine has 20 lights put on its wire from leaving the machine to coming back. The distance may be no object, so long as your wire has conducting power sufficient; but here again you are met with a difficulty, otherwise you would increase the number of lamps indefinitely; that is to say, the limits of the power of the machine is soon reached, and the more breaks or resistances you put on the circuit, so each of the lights is less in proportion, for the law of the flow of electricity is inversely as the resistance. Thus, let us suppose the current is represented by 100; now add to the outside circuit a resistance of one lamp equal to the internal resistance of the machine, which is about the best result of the Siemens machines, and you have doubled the resistance to the current; therefore, the total current is reduced to 50, of which the outside circuit has 25 available; that is to say, double the resistance, and the current is halved; treble the resistance, and the current is one-third, and so on. Therefore, you will see how quickly the lights are reduced in power, and how soon the maximum is reached, so that you could not have small lights so economical as large ones. The same is the case with lamps burning by incandescence; you all know that it is only the resistance to the current-flow that converts electricity into heat.

I really cannot see the cause for gas directors becoming alarmed lest they should be driven out of the field for lighting our houses, for I am afraid that electricity, with its delicate working parts and complicated automatic cut-off arrangements—all which are claimed to be simple in action, but which I am certain would soon get out of order if left to take care of themselves in any ordinary house—I am afraid, I say, that the cut-off arrangements now in operation would be apt occasionally, under ordinary usage, to cut off all the supply on the circuits, instead of that to a single house. For public squares, large halls, and for lighting the main thoroughfares of large towns, where more light is wanted than is now thought necessary by most local authorities, there, I say, gas and electricity will come into competition; but I am of opinion that our main thoroughfares are well illuminated during business hours by the shop lights, almost without the gas in the street-lamps; so that to employ electricity on a large scale would be a waste of money, just as much as lamps of 200-candle power being placed every 60 yards or so apart. After business hours there is, comparatively speaking, not anybody out of doors, and gas-lamps are ample for the purpose of giving light. The scope which electricity has is necessarily very limited, there not being so very many large spaces that will need to be lighted up so brightly as to justify recourse being had to it in preference to gas. There is a larger field open for it in the transmission of motive power, in which electricians may reap more remunerative employment for their labours if they will accomplish their grand idea of utilizing the tides, and the Falls of Niagara, in supplanting the present method of supplying motive power for the great industries of the world.

Discussion.

Mr. NEWBIGGING said that his previously expressed opinion regarding electricity as a source of lighting had not undergone any change. Lighting by means of electricity was simply an expensive luxury so far. It was not a new light, as some people imagined. The electric light was about as old as gas lighting; but whereas the one had been found thoroughly practicable, and had been made subservient to our daily wants—had, in short, become an absolute necessity—the other still remained in embryo, having scarcely advanced a step towards meeting our requirements in that respect. He spoke, of course, more particularly as to the application of the light, because, without question, the means for its production had been much improved of late years. There could be no doubt that most of the

glowing reports of the past two years of its triumphant success, and its application to the general purposes of life, were concocted with an object, such object being to depreciate gas property. Unfortunately, these exaggerated reports were only too successful, and the concoctors, or many of them, had been enabled to pocket money as the result. The electric light agitation had been initiated and kept alive by dreamers and schemers. Gas engineers had no desire to minimize the singular beauty and even value, in some respects, of the electric light; they simply desired that a modicum of common sense should be brought to bear in comparing it with work-a-day gaslight. He had had the pleasure of witnessing the first electric light display that took place at Blackpool in September last. The general effect was something magnificent, but one instinctively felt that it could scarcely last. He never saw the electric light but the lines of Wordsworth occurred to his memory:—

"It was a phantom of delight
When first it beamed upon my sight;
A lovely apparition, sent
To be a moment's ornament."

He believed, however, that their Blackpool neighbours, assisted by their shrewd Gas Manager, had contrived to make the electric light not only ornamental but highly useful and remunerative. It was the only place he had heard of where it had been made to pay. These far-seeing town councillors at Blackpool kept the homely gaslight for their own use on ordinary occasions, and on *fête* days they gulled—well, he would not use exactly that word, though it was well known that gulls were plentiful enough at the sea-side, but certainly they drew no end of visitors—he could not remember how many tens of thousands—to their very delightful watering-place. It might be looked upon as a case of magnetic or electrical attraction, and from personal experience he knew they (the visitors) were galvanized in the prices they had to pay for board and lodging on the special occasion to which he referred. Referring to Mr. Chew's paper, he said that it was a valuable contribution to the subject of electric *versus* gas lighting, and would command attention throughout the country, and he congratulated Mr. Chew on the able manner in which he had arranged his information and given his practical experience.

The VICE-PRESIDENT said when this subject was first brought under his notice by the Mayor and one or two of the Aldermen of Blackpool, he told them that the public had a bias against gas managers having anything to do with the electric light. The number of articles which had appeared in various newspapers and magazines in all parts of the country against manufacturers of gas had led the public to the conclusion that electric lighting could not receive justice at the hands of gas managers. This was what he told the Mayor and other gentlemen, but they were determined to go on with the thing, and "gull" the public by offering them one more attraction than the place afforded. It therefore became his duty to advise the Corporation to use the light which appeared to have given the best result up to that time. It was known to scientific men that electricity used in large quantities, as in lamps of 6000-candle power, was the best way. He and some members of the Town Council visited several places, and witnessed the various lights which were in use. They examined the Jablochkoff system, and amongst other places visited Birmingham and saw the large public gardens there lighted up by 60 lamps on the divided principle. They also visited the Thames Embankment and Siemens's manufactory at Charlton. They found that these latter were the people to go to if they wanted to have the best results. The particulars as to what they had done had been laid before the meeting in the paper, and those gentlemen who had seen the electric light must know that the idea of adapting it to thoroughfares was altogether out of the question. It would not be a light that would supersede gas on the score of cost, so far as he could ascertain; but although the figures given in the paper were arrived at as carefully as possible, they could not tell the exact cost until the apparatus had been working for some years.

Mr. HUNTER (Salford) remarked that for the past two years some people had been frightened by the electric light, and it had often been described to them as "the light of the future." Its advocates had had on their side nearly the whole of the newspapers, who had written up the light. No doubt it was to some extent what people said it was. It was good under certain circumstances, but these circumstances were very prescribed. It was very costly—more costly than gas. If they took 100 yards of street, he did not suppose the cost of lighting with gas would be more than 3d. per hour, and electricity could not, he thought, be cheaper than this. He should have liked to hear from Mr. Chew what was the cost per hour of every light they had at Blackpool; but it was easy to perceive that it bore no comparison, under the most favourable circumstances, with gas, so far as the cost was concerned.

Mr. FRITH (Runcorn) said a good deal of interest had been taken in the electric light in Liverpool. Living as he did a short distance from that town, he had felt interested in this matter, and had frequently seen the light in operation. The people of Liverpool were the first to obtain an Act of Parliament enabling them to spend money on the electric light. It had been introduced into a large reading-room, where it was turned on every night at half-past six. He had seen it there, but the light was flickering and pulsating all the time he remained in the room, and they could imagine how pleasant it was to sit down and read by a light like that. Another place in Liverpool where it was exhibited was in one of the large tradesmen's shops, where there was one light in the roof and another over the doorway. It was an excellent advertising medium, and from the crowds of people who went in, it would seem that the advantages to some persons were very great. It had been remarked that the electric light was not dangerous, but he knew that on one occasion a piece of the red-hot carbon which had fallen off one of the lamps set fire to some hundreds of balloons which were hung inside the building, and had well-nigh produced a catastrophe.

Mr. MITCHELL (Coatbridge) observed that the electric light scare had not been confined to England. They had had a sharp attack of it in Scotland some months ago, when it was reported that Mr. Edison had discovered the method of subdividing the electric light. A practical experiment was being made with the light at St. Enoch's Railway Station, Glasgow, but it was not altogether a success, and everybody and everything about the place presented a ghastly, sickly appearance. The gas had to be kept lighted, but turned down very low, to be used when the electric light went out, as it frequently did. The use of the light had been discontinued there now, and they had fallen back upon the old system of lighting as the more preferable. One result of the experiment was that a number of improved gas-lamps were brought to Glasgow for the purpose of reasoning with the public, and convincing them that there was a future for gas lighting even yet. He did not see that the electric light offered any advantages over gas in the newest and most approved lamps, and he believed it could never be used with any advantage for street lighting.

The PRESIDENT wished to make some remarks before Mr. Chew replied, because he thought he could say something, which would be an addendum to the paper, with regard to another electric light which had not come in for any consideration either in the paper or in the discussion. In describing the lamp, Mr. Chew spoke of the difficulty of supplying lamps at some distance from the source of supply. This was a difficulty which had in a great measure been overcome by electricians, as had been shown in the

extension of the circle on the Thames Embankment, and by other systems brought out, notably by one to which he should allude by-and-by. One remark of Mr. Chew's to which he wished to call attention had reference to the resistance which he described. He gave them the axiom that the resistance was inversely as the distance. That was a point not admitted in the evidence given before the House of Commons Committee on the question of electric lighting. The electricians stated, in fact, that they did not know what the resistance was. Further, Mr. Chew, sen., stated in his remarks that street lighting by electricity was an entire fallacy. He (the President) did not wish them to come too hastily to that conclusion because Blackpool was not successful, and the cost was enormous. He did not think the Blackpool authorities were fortunate in getting the best system of electric lighting; indeed, the best had not been brought out at that time. Since then there had come out a system of lighting by electricity, known as the "Brush" system, worked in this country by the Anglo-American Electric Light Company. This had been put in operation in a large combing-shed in Messrs. Crossley and Sons mills, at Halifax. There they turned off the gas, and had no fear that it would be required to supplement or take the place of the electric light. The light was very steady. Sometimes there was a slight flicker, owing to the point of the carbon falling off, but there was no rising, or falling, or jumping experienced in the light. He had been down on two occasions, and had spent some time looking at it. They had in this shed 16 lamps, all supplied by one machine and on one circuit. They said each lamp was capable of giving a light of 2000 candles; but, of course, this was a matter of speculation, and it was difficult for an ordinary observer to say whether it did or did not. All he could say with reference to the illumination was that it could not be obtained with gas, except, perhaps, at a very large cost indeed. One machine of 14-horse power supplied all the 16 lamps. It would work 18 lamps, and could be bought for about £400. With the exception of the machine, there was very little required in this system. There was nothing like that formidable strength of cable shown in the Siemens system, necessary; the machine was what was called a high-intensity machine, and the wires were of very moderate strength. The 16 lamps displaced about 200 gas-jets, and he assumed that the lamps and the machine, together with the cost of fixing, would be something like £750. This was the calculation which he made in his own mind. The proprietors were not willing to give very much information about it at present, but he was allowed the full privilege of making any observation he pleased, and whatever questions he put to the workmen, that they could answer, were freely answered. With regard to the lamp itself, the arrangement was most beautiful indeed. The carbons were adjusted in much the same manner as in Siemens's lamp, with the exception that the frame was double, and the rod which held the carbon was fixed to a cross-bar above, the adjusting apparatus being situated above the cross-bar. The arrangement to allow the carbons to come down gradually was very effective. There was glycerine, or some similar substance, in the top, which formed a sort of cushion, and regulated the apparatus, giving it a certain distance to travel so that the carbon came down very gradually. The lamps were also effective in another way. If one of them went out, the circuit was not broken, and there was no alteration in the light afforded by the other lamps. One might break the carbon in two and extinguish the light, but all the other lamps went on, and were not affected in the least, and one or more of them would go out in that way without disturbing the remainder. This he considered a very great step in advance. Now he would come to the cost. Taking the power at 14-horse, and the cost of the whole, as he assumed it, at about £750, interest and depreciation would amount to £75 per annum, and allowing for attendance £25, the total fixed cost per annum would amount to £100. There was in addition to this fixed cost the cost of the carbons, which they admitted to be at the rate of 1s. per hour for the 16 lamps. Then he assumed the cost of power at 3d. per horse, or for the 14-horse power 3½d. per hour. This gave a cost of 1s. 3½d. per hour for lights to take the place of 200 gas-jets, consuming, say, 1000 feet of gas at a cost of 8s. In the case of ordinary working in winter time, the number of hours for a mill to burn artificial light was 306. This, with the electric light, cost £119, being at the rate of 1s. 3½d. per hour for ordinary expenditure, which amounted to £19, and, in addition, £100 for the fixed charges. The cost of gas, at 3s. per 1000 feet, for the same time would be £45. Now, this was really the most perfect system of electric lighting which had been introduced, and he thought it would be worth their while to consider it. There could be no doubt that in cases where particular work had to be performed, as in wool-combing, and where there were delicate colours to be manipulated, as in dyeing, this would become a most useful light; but, as would be seen, it would be more costly than gas. The advantages which it offered would, in fact, have to be purchased at a higher rate, the comparison between the electric light and gas being about 120 to 45. But as most of this was fixed cost, in cases where they could work overtime the fixed cost would be reduced, and the light might become cheaper than gas.

Mr. CHEW, in reply, said that, in answer to Mr. Hunter's question, the cost of electric lighting at Blackpool was £3 6s. 10d. per night for each lamp of 6000-candle power. Referring to the "Brush" light, of which the President had spoken, he said it had been fully described in the *Electrician*. That journal some time ago contained a comparative table which showed that while the Brush light worked at an expenditure of 31 per cent. of electricity, the Wallace-Farmer machine required only 14 per cent., and the Gramme machine 38 per cent. Unfortunately the Siemens machine was not down in the table, and he could not carry the comparison so far as he should like, but he thought it was equal to the best known.

The PRESIDENT: No, no.

Mr. CHEW said one point referred to was the extinguishing of the lights. They were not so much troubled with that as formerly, but it was due to the delicate apparatus being exposed to the weather and refusing to act. Financially, he thought gas-lamps would be more economical than the electric light. Another point mentioned was that they could not distribute the current over long distances. He did not say it could not be done. They could take the lamps ten miles from the source of supply, providing they had wires sufficient to carry the electricity.

VOTES OF THANKS.

Mr. HUNTER then moved a vote of thanks to the ex-President (Mr. Newbigging) for the very able manner in which he had discharged the duties of the office which he held during the past year. He thought they were all indebted to Mr. Newbigging for the manner in which he had conducted the business, and for the thoughtful care he had bestowed on the arrangement of every detail connected with the work of the Institution during the past year, and also for the trouble he had taken in the preparation of papers and addresses. During the past year he had raised the Institution to a position it had never before attained. He was one of the leading gas engineers, and they were proud to number him amongst their Past-Presidents.

Mr. CLARKE (Ashton-under-Lyne) had very great pleasure in seconding the resolution. When they elected Mr. Newbigging twelve months ago they expected great things from him. They had more than had their

expectations fulfilled, and the least they could do was to accord him their very warmest thanks.

The resolution was carried by acclamation.

Mr. NEWBING, in reply, said that it was in no mere formal manner that he rose to acknowledge the vote of thanks that had just been passed to him, and the complimentary and kind words that the mover and seconder had used in speaking of his humble efforts to maintain the character of usefulness which the Institution had acquired. It was generally the case that one's best efforts came short of his aspirations, and he was quite aware that had it not been for the encouragement and assistance of the office-bearers and members during his term of office, he might have acquitted himself with less of credit than had fallen to his share. He could safely declare, however, that in whatever he had endeavoured to do, he had had the interest of the Institution and the advancement of the individual members of the profession strongly at heart. However much the responsible officers of an association might strive to do their duty, unless they were seconded in their efforts by the members generally, the association would be wanting in the power to confer that amount of benefit which it otherwise would. He had been fortunate in this respect during his term of office, for there had been a wealth of useful papers presented at the meetings, and every individual member present at the meetings had interested himself in the proceedings. He hoped they would each endeavour to make the term of Mr. Carr's presidency even more useful and agreeable, and they might rest assured that in so doing they would each add to their personal reputation.

Mr. FRASER moved, and Mr. BRADDOCK seconded, a vote of thanks to the gentlemen who had contributed papers to this meeting, which was carried unanimously.

On the motion of the PRESIDENT, seconded by the VICE-PRESIDENT, a vote of thanks was also accorded to the Committee, the Secretary, and the other Officers, for their services during the past year.

A vote of thanks to the President for his services in the chair, passed on the motion of Mr. PATERSON, terminated the business of the meeting.

The members subsequently spent some time in an examination of the following, viz.:—Section cut from a pipe-socket, showing Painter's hydrostatic joint, described in the JOURNAL of Feb. 17; a sample of Spence's metal—a new metallic compound for pipe-joints, &c.; a model of Holman's patent dip; and a Siemens electric lamp as used at Blackpool; all of which were placed for inspection on the table.

The members afterwards partook of tea together.

OFFICE-BEARERS FOR 1880-81.

The following are the Officers of the Institution for the current year:—
 President Mr. William Carr Halifax.
 Vice-President Mr. John Chew Blackpool.
 Treasurer Mr. James Paterson, F.G.S. Warrington.
 Honorary Secretary Mr. Robert Hunter Stalybridge.

Members of Committee.

Mr. Samuel Barratt, Manchester.
 Mr. Henry A. Coles, Todmorden.
 Mr. J. G. Hawkins, Wigan.
 Mr. Wm. Littlewood, Manchester.
 Mr. G. E. Saville, Sowerby Bridge.
 Mr. Harrison Veevers, Assoc. Mem. I.C.E., Dukinfield.

Ex-officio Members of Committee.

Mr. David Clarke, President, 1878, Ashton-under-Lyne.
 Mr. Thos. Newbicing, M. Inst. C.E., President, 1879, Manchester.
 Auditors.—Mr. G. Smalley, Buxton; Mr. Edmund Lord, Whitworth.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The supplies of all descriptions of round coal in this district continue much in excess of the demand, and the heavy stocks held by colliery proprietors are naturally tending to force down prices. Good round coal is now offering in the market at quite as low figures as at any time last summer, and there is every indication that, with the exception of good hard forge coal, for which a fair demand is anticipated for iron-making purposes, all classes of round coal will be very weak in price during the ensuing summer. Of the better classes, for house-fire purposes, heavy stocks are already held, and common round coals are also plentiful. So far as gas coals are concerned, there is so very little inquiry that the market has scarcely yet been tested; but it seems scarcely likely that colliery proprietors will be able to command any materially better prices than last summer, although they may not care to quote for any very long forward deliveries, as was the case last year, when many consumers were able to cover their requirements for two years ahead. In the market during the past week prices have shown a great want of firmness; sellers, in order to move away stocks, being generally willing to make concessions upon late rates. There has been no difficulty in buying best Wigan Arley coals at from 8s. to 8s. 6d. per ton at the pit, whilst inferior sorts could in some cases be bought under 6s. per ton, with prices ranging up to 7s. per ton; Pemberton four-feet averaging about 6s. 6d. per ton, and common Wigan mines about 5s. to 5s. 6d. per ton. With regard to engine classes of fuel, there is generally a firmer tone in the market, the lessened production of slack causing this description of fuel to be rather scarce. The better qualities of slack cannot now be bought under about 3s. 6d. per ton at the pit, and common sorts range from about 2s. 6d. to 3s. per ton.

The shipping trade continues dull, and it is only in exceptional cases where any improvement is reported. Steam coals delivered at the High Level, Liverpool, are being offered at from 6s. 6d. to 7s. per ton.

The heavy accumulation of stocks is compelling most of the colliery proprietors throughout Lancashire to resort to short time, and many of the pits are not now being worked more than three to four days a week.

In the iron trade there is also a dull tone, and although makers as a rule are firm, buyers have no difficulty in getting second-hand iron at under late rates. Lancashire makers of pig iron, having very little to offer, are firm at about 70s. per ton, less 2s. per cent. for delivery into the Manchester district. Finished iron makers are quoting £8 10s. to £9 per ton for bars, but merchants are offering pretty freely at about £8 5s. per ton for delivery equal to Manchester or Liverpool.

Local works in the foundry, machine-making, and engineering trades are getting rather busier, but low prices have to be quoted to secure orders.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

There has been a considerable shrinkage of business on the Tyne and Wear, and in the counties of Durham and Northumberland, within the few days of March which have elapsed. Whether it arises from over-speculation amongst our own merchants, or from political disturbances in such countries as Russia, or from a combination of causes of which these are only part, which is quite probable, business has been going back over the past fortnight. That is undoubted. The gas coal trade even has been quiet since the incoming of March. This week, however, the shipments from the Tyne are improving somewhat. The steam coal trade is in

pretty much the same position as the gas coal trade. It is now admitted on all sides that what has been reported in these columns over the past two months is true. From 1s. to 1s. 6d. per ton advance over the lowest rates of last year is all that can be achieved on best gas and steam coals in the first half of 1880; 7s. per ton best gas, and from 9s. 6d. to 10s. very best steam, with 6d. per ton and less for seconds, being taken as the ruling rates. The price of coke and small coals used for manufacturing purposes in the locality is, however, very well upheld.

The coasting demand for coals is backward. There are few orders in the market, and freights remain low. There is absolutely no inquiry for sailing ships to load coals to any part of the United Kingdom. Two-thirds of the sailing ships and steamers engaged in the coasting coal carrying are regular traders which are employed by the gas companies or coal merchants in the South for a series of voyages. Merchants on the Baltic have now commenced to ship gas coals here, which were contracted for shipment from the Tyne at the first open water. Freights at the time some of these large contracts were made threatened to advance in the spring months. Instead of that, Baltic quotations which were current in January for steamers to load at the first open water are rather in excess of those current for the same trade in the middle of March. Coasting freights are very low.

The manufacturing iron trade of the Tyne is rather brisk; but the orders on hand were given out in December last. Since the middle of February there have not been many orders added to the books of the manufacturers.

The fire-brick trade is very strong. Continental manufacturers are evidently extending their works, and the shipments thence are, to a large extent, of material to be used for such purposes.

The chemical trade has been extremely dull over a fortnight. Orders have been scarce. Prices are perceptibly lower.

The price of lead has been, and is receding from the extreme quotation of a month ago. It was stated in these columns at the time that the feverish state of the market showed that, to some extent at least, it had got into the hands of operators. Subsequent events have verified this conjecture.

Since the recent advance in the value of metals, the demand for gas and water pipes has fallen off. This branch of foundry work, as reported a fortnight ago, is comparatively dull.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

In anticipation of the early opening of the railway to Oban, the Callendar and Oban Railway Company are about to erect new gas-works beside the station in that town. Pipes and other materials have already arrived, and the erection of the works will be proceeded with at once.

There has, for some time back, been an increase in the consumption of gas in Rothesay, and in consequence there have arisen a number of complaints of want of pressure. The matter was under consideration at the last meeting of the Town Council, and the result of the discussion was that the Gas Manager was instructed to prepare a report in regard to the condition of the entire works and plant.

At a meeting of the Police Commissioners of Montrose held on Monday, the 8th inst., a report was submitted by Mr. Reid, Convener of the Streets and Roads Committee, in reference to the amount of damage done to the streets by the Gas Company, and as to what ought to be charged for way-leave and damage. The practice in a number of other towns was mentioned, which was of a very varied character, and a long discussion took place on the subject, in the course of which one of the speakers urged that the question might be allowed to rest, as before the lapse of another year the gas supply undertaking would doubtless be in the hands of the municipal authorities. In the meantime, matters are to be left unchanged.

The interesting ceremony of cutting the first turf for the new gas-works at Thurso was performed on Thursday week, by Mr. Fox, Chairman of the Company, when several toasts suitable to the occasion were proposed and duly honoured and responded to. The speakers all wished a prosperous career to the undertaking. Nothing is more required in Thurso than a well-equipped gas-works, capable of supplying the town with good and cheap light, and this is now in a fair way of being provided. The Company have secured an excellent site for the works, and it is hoped that the undertaking will be pushed forward with all due speed, of which there cannot be any doubt, considering the complete preparations that have been made.

Of late there has been such an increase in the consumption of gas in Perth that the Gas Commissioners have felt it most desirable to make important extensions to their plant, one addition to which is not unlikely to be a new double exhauster of large size.

On Monday, the 8th inst., an ordinary meeting of the Broughty Ferry Police Commissioners was held, when, in reference to the proposed extension and improvement of the gas-works, the Sub-Committee reported that on the 19th ult. they had, in conjunction with Mr. James Anderson, gas engineer, Leven, examined the plans and specifications; and having heard that gentleman give full explanations in regard to the works, they agreed to instruct him to revise the same. At this meeting the Manager reported that the average illuminating power of the gas supplied during the past month was equal to 30.34 candles, which is certainly a very high standard of quality.

On Tuesday last 261 £1 shares of the Crief Gaslight Company were offered for sale by public auction in the Drummond Arms Hotel. They were put up in 13 lots, and after some spirited bidding the whole were sold at prices ranging from 35s. to 38s. per share. The last dividend of the Company was at the rate of 10 per cent.

The Prestonpans Gaslight Company have just completed arrangements for the supply of gas from their works to the important mining village of Tranent, which lies about two or three miles inland, while Prestonpans lies upon the coast some few miles from Edinburgh.

It is satisfactory to know that the Knowes Dean reservoir, an important portion of the new water-works for the town of Galashiels, is beginning to show decided evidences of the power to retain the water that is allowed to run into it; indeed, the water is reported to be standing at a higher level now than it ever did before. Of course, this result has only been attained after the application of effort and skill extending over many months.

Mr. James M. Gale, C.E., of Glasgow, visited Dumfries on Thursday week, and, in company with some of the Water Commissioners, inspected the Loch and other matters in connection with the water supply of the town, which is believed to be far from satisfactory. His report will in due course be laid before the Commission.

Last week's pig iron warrant market was very irregular, and a large amount of business was done, in which the fluctuations were rapid and violent. Down to 58s. 1½d. cash was paid on Monday, as high as 61s. 6d. on Tuesday and Wednesday, and down to 59s. on Friday. Buying for America is now reduced to a very low level.

No change of any importance can be reported in the coal market. Prices have been slightly lowered in order to induce business.

MILNROW GAS COMPANY.—The half-yearly meeting of this Company was held on Monday, the 1st inst., when the Secretary and Manager (Mr. Benjamin Turner) read the notice convening the meeting, after which the Directors report, recommending a dividend of 8 per cent. per annum, free of income-tax, was adopted. An amount of £150 was placed to the contingencies reserve-fund.

THE EXTENDED USE OF WATER GAS IN AMERICA.—Our readers may remember that about the middle of last year we announced that Mr. T. F. Rowland, of the Continental Iron-Works, Green Point, Long Island, N.Y., had received instructions to alter the works of the New York Gaslight Company—the oldest but one of any incorporated gas company in the United States—so as to manufacture water gas according to his patented method. We have just heard that the alterations are so nearly completed that it is fully expected the works will be in operation and supplying the new gas in the course of next month.

THE MAIDSTONE GAS COMPANY'S BILL.—Last Tuesday a meeting of owners and ratepayers of Maidstone was held to consider the propriety or otherwise of the Corporation opposing the Gas Company's Bill in Parliament. The Corporation have already petitioned in favour of a reduction of the initial price proposed by the Bill, a restriction of the amount of sulphur to 20 grains per 100 feet, and an increase of the illuminating power to 16 candles. At the meeting, the Chairman and several Directors of the Company attended, and strongly protested against the measures taken by the Corporation, and objected to the money of the town being wasted in opposing the Bill. A resolution, however, proposed by Alderman Ellis, and seconded by Mr. Page, authorizing the Corporation to oppose the Bill in its present form, was passed with two dissentients.

STOURPORT WATER SUPPLY.—This town has just provided itself with a public water supply, and the ceremony of turning on the water took place on Saturday, the 6th inst. Mr. E. Baldwin, the Chairman of the Local Board, who turned on the water, mentioned that his father 60 years ago first turned gas into the town, at a time when London Bridge was still hung with oil-lamps. Hitherto the supply of water for domestic purposes has been obtained from shallow wells; but it is now furnished by the Kidderminster Corporation, at a rate of 6d. per 1000 gallons, the contract being for 33 years, with the option of a renewal at the end of

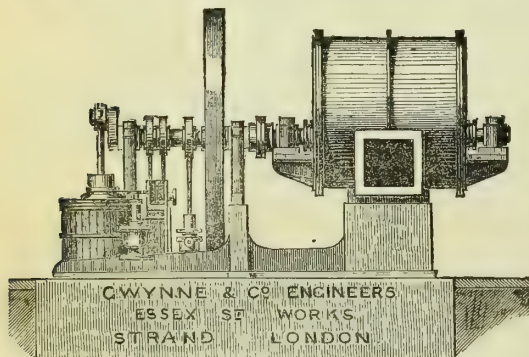
that period. This price to be paid until the population require over 20 million gallons per year, and then the Kidderminster Corporation undertake to revise the charge, with a view to some reduction.

CHESTERFIELD WATER-WORKS AND GASLIGHT COMPANY.—The half-yearly meeting of this Company was held on Wednesday, Feb. 25, when the report presented by the Directors stated: "The revival in trade generally has not at present affected materially the revenue of the Company, and the sales of gas and water have been retarded by the large number of vacant houses and shops." The balance of revenue account was £364 15s. 11d. less than for the corresponding period of the previous year, though the profit for the whole year was £11,701 6s. 8d., or £559 17s. 2d. more than was necessary to pay interest and maximum dividends. The total paid-up capital of the Company is £178,108, and miscellaneous receipts on capital account bring the total up to £180,210, of which amount £86,214 has been expended on the water-works, and £89,670 on the gas-works. The net income from the sale of water last half year was £3248 14s. 10d.; from gas, £5790 19s. 10d.; from residuals, £827 19s. 11d.; and from rents and sundries, £16 3s. 6d. The expenditure was £3585 3s., which left £6298 15s. 1d. to be carried to net revenue account.

WOOLWICH, PLUMSTEAD, AND CHARLTON CONSUMERS GAS COMPANY.—The half-yearly meeting of this Company was held on Wednesday, Feb. 25—Mr. J. Henderson presiding. A very favourable balance-sheet was presented, and the reduction made last year in the price of gas enabled the Directors, under the sliding scale, to distribute an increased percentage of profits. The highest possible dividends on the several kinds of stock were declared, and general satisfaction was expressed at the progress and position of the Company. The choice of Mr. J. R. Jolly to fill the vacancy on the Board caused by the death of Mr. John Hammond, the late Chairman, was confirmed; and he was re-elected for three years, together with Mr. Tongue, Mr. Blanchett, and Mr. James Blest. It was also resolved, as a recognition of the valuable services so long rendered to the Company by the late Mr. John Hammond, to vote the sum of £100 to his family. In connection with the meeting, we may mention that both this Company and their neighbours, the Woolwich Equitable Gas Company, have given notice of another reduction in price, from Jan. 1 last, of 3d. per 1000 feet. The present price in the two Companies districts is now 3s. 3d. per 1000 feet.

The **GRAND MEDAL of MERIT** at the **VIENNA EXHIBITION**, **TWO MEDALS** at the **PHILADELPHIA EXHIBITION** and **TWO MEDALS** at the **PARIS EXHIBITION**, have been **AWARDED** to **GWYNNE & CO.** for **GAS-EXHAUSTERS, ENGINES, and PUMPS**; Also **27 OTHER MEDALS AWARDED** at all the **GREAT INTERNATIONAL EXHIBITIONS.**

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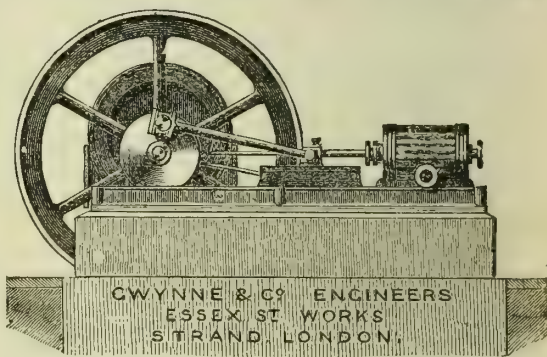
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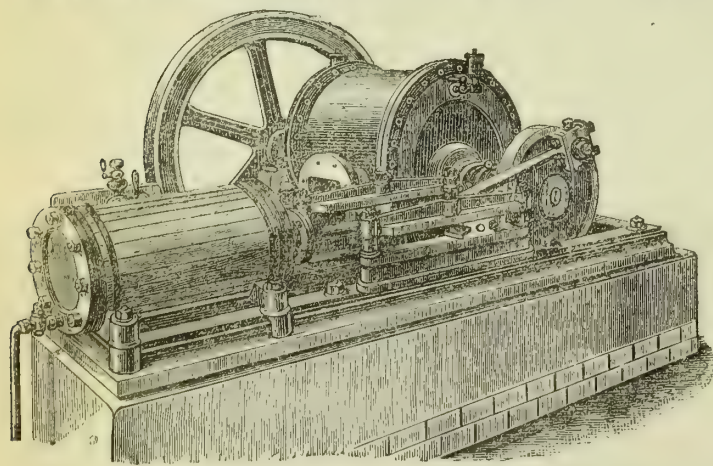
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[SEE ALSO ADVERTISEMENT, PAGE 422.]

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TO SUBSCRIBERS.

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THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 23, 1880.

Circular to Gas Companies.

AFTER a delay which is unaccountable to us, the scheme for the amalgamation of the South Metropolitan and the Phoenix Gas Company has received the sanction of Her Majesty in Council, and all, so far, is now settled. The delay of which we complain has, however, put the South Metropolitan Company to some inconvenience, inasmuch as the Bill they are promoting in Parliament this session, and which is highly necessary to them, still lingers at its second stage; though the Parliament which will break up to-morrow, and will be scattered the day after, might just as well have had the opportunity of passing this Bill. The duty of considering it is consequently relegated to the new Parliament about to be elected, it being understood that the measure will be taken up at the point at which it stands to-day. The importance of the combination just sanctioned can hardly be exaggerated. Nearly the whole of London south of the Thames will, for the future, be supplied with gas by one Company, whose interests will be at once to maintain the quality of the gas and reduce the price to the lowest possible figure. The arrangements as to the charge will be found in the copy of the scheme which we publish in another column; but we have referred to these in former issues, and need not here recapitulate them. It is sufficient to say that the consumers in the late Phoenix Company's district will reap an immediate benefit, and in the course of twelve months will share the complete advantages of the alliance with the South Metropolitan Company.

The Bill of the South Metropolitan Company, which may be called the Bill of the United Company, has been proceeded with as far as it could in the present Parliament. There is really no opposition to it, and but for the delay caused by the Board of Trade it might by this time have passed its third reading in the Commons. As matters stand, however, we must wait to see how it will fare in the new Parliament. We do not expect to see any great changes in the personnel of the representation in the south of London; but if any should occur, local influences could hardly affect the fate of this measure. All who are in any way acquainted with the position of the United Company will see how essential it is to them that the Bill should become law as speedily as possible. It is no wonder, then, that at the South Metropolitan Company's Wharnccliffe meeting, held last Friday, a resolution of the Shareholders, consenting to the promotion of the measure, was passed unanimously. Some matters were pressed upon the attention of the meeting which really did not concern it. One of the Shareholders, for example, wished to know what the Directors were about to pay for the land they have engaged to purchase. We are astonished that any question should have been raised as to the necessity for the quantity of land, or as to the price it is proposed to pay for it. It seems to be forgotten that the Metropolis grows, and that the gas-works supplying it remain stationary, being in some instances utterly incapable of extension. The case of the late Surrey Consumers Company is almost one in point. They had space for small additions to retort-houses, but no possibility of making further storage arrangements. The area occupied by the original South Metropolitan Company is extremely valuable, and offers peculiar facilities as a site for gasholders. Under these circumstances, it seems highly desirable that additional manufacturing power should be furnished in one quarter, while further storage should be provided in another. We gather that the present works of the Phoenix Company are almost incapable of extension. It will thus be seen how urgently needed are the powers which the South Metropolitan Company's Bill proposes to confer. It is extremely unfortunate that a dissolution steps in before the completion of the work which had been cut out for the present Parliament. However, we are all victims of political vagaries; but in the present case we cannot help thinking that a few weeks will find this Bill far advanced towards receiving Royal Assent.

We are very glad to say that the Metropolitan Board of Works have withdrawn all opposition to the Bill of the London Gaslight Company. The objection raised by the Board to the Bill was of a most puerile character. It simply concerned the amount of capital which the Company should be allowed to employ in the new branch of their business which they are about to undertake—that of supplying cooking and heating stoves, and apparatus for the use of gas for other than lighting purposes. The Metropolitan Board were willing to sanction the use of £25,000 in conferring what we must regard prospectively as a great benefit to gas consumers; but the Company, very properly reviewing all the circumstances, found that they could carry on their stove business with less, and so have agreed that only £20,000 shall be engaged in it. This amount of capital is small enough, and we are almost astonished that the Company should have proposed so low a figure. We have said before that for a business like the one projected, to be successful, it must be carried on in a most liberal spirit. There is a great future in store for any Gas Company who will enter upon the business of supplying gas-fittings, &c., on hire, and at the same time of furnishing gas at a fairly low price. We could point to many gas undertakings in the kingdom which have largely profited by taking up the supply of gas stoves and apparatus for other than illuminating purposes; and the London Gaslight Company will, no doubt, be as successful as the rest, but the business must be carried on in no niggardly spirit. Of course, gas will be supplied at the customary rate; but, for the cooking and heating utensils, we should hope that the minimum price for sale and hire will be charged.

The Bristol United Gaslight Company held their half-yearly meeting on the 15th inst., at which, it is scarcely necessary to say, maximum dividends were declared. The new works of the Company at Stapleton are now in full operation, and the greatly increased demand for gas during the past dark winter has been fully satisfied. This is extremely gratifying, both to the Bristol and Clifton public, who will now find themselves fully assured of having an efficient supply of gas for some years to come, without further calls for capital and land. We can hardly say that we entirely agree with Mr. Fiddes's determinations of light

given off by burners of different consumption. We know perfectly well that the larger the consumption of gas—always assuming properly-made burners are used—the higher, proportionately, is the power of the light. This is now an acknowledged fact upon which we need not dwell. But the differences with small good burners, say, from 2½ feet to 5 feet, we can hardly suppose are so great as was stated at the meeting—namely, 35 per cent. We are quite aware that ordinary gas consumed by means of the burners commonly used will give results like those stated by Mr. Fiddes, and even worse, as the tables published by the Metropolitan Gas Referees show; but such tables must always be taken with a reservation. The fact is we are at the present moment in want of the data which will enable us to fix the illuminating power of a gas upon consumption, without reference to a number of conditions as to which ordinary Gas Examiners are ignorant.

The Harrow District Gas Company held their half-yearly meeting on the 10th inst. They pay a dividend which now, as before, amounts to six per cent. (free of income-tax), and carry forward a small balance. It is almost to be regretted that this Company, with such a promising future, are not more alive to the advisability of reducing the price of gas. The Pinner Company are pushing them very close, and the time is probably not far distant when a collision between the two Companies will result in a change of price. The Harrow Company must provide for this contingency. They have a district which may be worked to excellent advantage. It grows day by day in importance, and will, before many years are over, realize a large profit to the Shareholders of the Gas Company; but, to ensure this, the Directors must bear in mind that the one thing necessary is a reduction of price.

We may congratulate the Lancaster Gas Company on the settlement of the bargain they have made with the Corporation for the disposal of their works. The price they have obtained for the undertaking and for its prospective value must be considered liberal. The undertaking is of a most substantial and promising character, and one which is certain, under competent management, to ensure large gains in the future. But the Corporation should remember this before all things that when the question of the price of gas is considered, it must be arranged to meet the convenience of consumers, and not be calculated simply to bring a large profit to the Gas Committee, for application in the relief of rates.

Great discontent is expressed in Cardiff at the quality of the gas supplied to the borough and district. It makes a great noise in South Wales, but passes without much notice beyond the district. The Cardiff Town Council and the Directors of the Gas Company are still at loggerheads, and if the Company take our advice they will hold their present position, unless matters are settled to their satisfaction. The Cardiff Corporation are not disposed to be generous, nor even just; they want to obtain everything they possibly can from the Gas Company, and to give nothing in return. It may be that the Corporation will one day have gas-works of their own, and we hope the ratepayers will at that time be perfectly satisfied with the change.

The Corporation of Norwich, too, and the British Gaslight Company will never agree unless the Gas Company accede, which they will not, to the desire of the Corporation that gas shall be supplied as cheaply in Norwich as at Hull. The fact is that, taking everything into consideration, gas can never be produced and distributed as cheaply in the former as in the latter place. A little thought on the questions concerned in this dispute would at once convince the members of the Town Council that the position they have taken up is untenable. The standing of the British Company is as secure in Hull as at their other stations. The Corporation of Norwich should years ago have taken steps to fulfil what we candidly admit is a duty, and that is, supply the inhabitants of their district with what are called the necessities of life. They took no steps to do anything of the kind. Norwich is still supplied well both with water and with gas by private Companies, who naturally expect to make a profit, and who are not likely to part with their property without receiving full and adequate compensation.

In referring, in last week's "Circular," to the working details, for the past half year, of the Dewsbury Corporation Gas-Works, it was inadvertently stated that Mr. Charles Eastwood was the Engineer and Manager of the works. This gentleman is still at Batley, occupying a similar position to that of Mr. Charles Armitage, at Dewsbury. We might have added to the remarks then made, that the net cost of gas per thousand feet sold, as will be seen from the figures published in another column, was only 10·19d., a result which is certainly very low, and will compare favourably with many others.

Water and Sanitary Notes.

As a matter of course, we have not yet heard the last of the Metropolitan Water Question. Mr. Cross promises that, if in the next Parliament he finds himself in the position he now occupies, he will bring in a Bill which he believes will be satisfactory to both the ratepayers and the Water Companies. For our own part, we shall not attempt to predict the provisions of the Bill which is now foreshadowed with an uncertainty, but which may in a short time be developed into a measure presentable to the House of Commons and to the general public. If we surmised that the Bill recently brought in by the Home Secretary, and so quickly withdrawn, would meet the views of the London ratepayers, it would have our very heartiest acceptance. The measure so incontinently withdrawn was simply to give to the Metropolitan Water Companies the rights which competent valuers had assigned to their property. The amount of the valuation astonished a good many people, but when the particulars recently asked for by Sir Charles Dilke are furnished, we have no doubt it will be shown that a sound commercial basis was fixed upon in valuing the property and the prospects of the Companies. These consist of two items. There is, first of all, the capital, which is represented by works executed and in execution; then come the prospects of a Company which is every day advancing; and, further, there is the consideration that in time each Company must so far prosper that its profits will yield maximum dividends. All of these things have to be taken into consideration when the value of an undertaking has to be assessed, and we feel quite satisfied that the valuers selected by the Home Secretary did no more than take them into full and fair consideration. But for the dissolution, we have no doubt the Bill would have gone on, and, in spite of parochial and corporate remonstrances, have passed into law. There were undoubtedly the elements of popular success in the measure. It proposed to effect no great revolution in the Metropolitan Water Supply, further than the gradual introduction of the constant system. In the absence of knowledge as to the officials who would have been entrusted with the administration of the affairs of the Water Trust, we may reasonably assume that a year or two would have been allowed to elapse before a constant supply would have been forced on the inhabitants all over the Metropolis. However desirable such a supply may be, it would necessarily take time before habitations could receive it; and there is this further to be said, that only a few Metropolitan Water Companies are in a position to afford a constant supply at *high pressure*.

The question as to whether "annual value" or "gross annual value" shall be taken as the basis of rating for a domestic supply of water, was brought before the House of Lords by Earl Camperdown last Tuesday. In all the Metropolitan Water Acts we know of, "annual value" is specified. It is, of course, open to argument whether this shall mean "gross annual value," or the value after all the usual deductions have been made. On this point we shall not express an opinion, because in all probability the question will come up for argument in a court of law. But this we may put fairly before the public, that not a single Water Company has charged fully up to its statutory rights. Whether "annual value" be taken to mean "gross annual value" or not, only in a few instances has either of these bases been made the standard of charge. The Metropolitan Water Companies exercise a very wise discretion, and, as a matter of fact, the Directors, on the report of their inspectors, charge, to a certain extent, according to estimated consumption. There are cases, of course, in which no other rule can be laid down for the imposition of water-rates than that which is specified in the Acts of the Companies. If we take, for example, a moderate-sized dwelling-house inhabited by a large family, it is clear that the consumption of water would greatly exceed that in a larger house tenanted but by a few inhabitants. It may appear at first sight hard that the two habitations should be assessed for a water-rate on the same basis; but there is nothing for it but to adopt the rule laid down by Parliament, and, until now, generally accepted with satisfaction. What at present causes discontent is the quinquennial revision of the value of Metropolitan property, which it is supposed enables the Water Companies to increase their charges according as the annual value of the property is raised. This prospect frightens the London ratepayers. When it is proved that the Companies insist on enforcing their legal privileges up to the hilt, we shall have no hesitation in questioning the policy of their actions; but at the present moment there is no proof that a single Company has charged full statutory rates.

Whatever may be the result of the general election, the future Home Secretary will find in the pigeon-holes of the Home Office Mr. Cross's abortive Water Bill. Whether it will be proceeded with, will, of course, depend on the individual proclivities of the future Home Secretary and the Cabinet. Our own opinion is that the question must come up for early solution. For the moment, the Metropolis is quiet on the subject; but agitation is certain to commence when opportunity occurs. Such opportunity will arrive when the new Parliament meets, and then we expect the Metropolitan Vestries will bestir themselves. It seems to be a foregone conclusion that the Water Companies must pass into the hands of some public "Trust," as we call it to-day, there being no popular authority at present constituted which can take them over. A powerful Liberal Government might reconstruct the municipal arrangements of the Metropolis, and found upon the ruins of the old a superstructure which would comprise in its authority the whole vestrydom of London. It is quite certain that at present but one course lies open to the Government, and that is, to constitute such a Trust as Mr. Cross has proposed. Something more, however, must be done for the Metropolis before the Water Companies succumb to a purchase. We must have a complete Municipality for London, and then the Water Companies undertakings may be transferred with a possible advantage to the inhabitants.

Few questions more interesting to Water Companies and Sanitary Authorities have been discussed than that introduced by Dr. C. M. Tidy, at the meeting of the Chemical Society on Thursday last. Broadly speaking, the lecturer dwelt on the oxidation of organic matter, both vegetable and animal, in running waters. There are authorities who assert that oxidation in water takes place with extreme slowness, and that nothing can be done to improve the condition of water which has once been contaminated with sewage, except by passing it through land. There are others who, like Dr. Tidy and the late Dr. Letheby, assert that if organic matter, whether of vegetable or animal origin, be poured into a stream, a few miles flow ensures the removal of the matter. Two agencies may, perhaps, contribute to effect this. There is, in the first place, the dissolved oxygen, which immediately seizes on organic matter; and there is, besides, the purification effected by the weeds in the river, and by the fish that thrive on the organic matter which nature and art have kindly provided for them. Dr. Tidy's illustrations were drawn mainly from these sources. He took for example the Shannon, the water of which issues from Lough Derg highly coloured with peaty matter, and followed it down to Limerick, where, having passed the Falls of Doonas and Castle Connell, it becomes perfectly colourless, and in that condition flows into the City of the Violated Treaty. Other illustrations were adduced to show that animal organic matter was even more readily destroyed than peaty matter in running water. Some confusion is caused by the fact that peaty matter is easily bleached without being destroyed. The two-foot tube which so clearly indicates the quality and quantity of organic matter is somewhat at fault. As regards animal matter, the indications of the colour of the water which is in the tube are certain, so far as colour is concerned. We know that a sample of water taken near the outfall of a town sewer has a representative colour which disappears as the mixture of sewage and river water flows on to its destination; but this is not exactly the case with peaty matter, which, as we have said, is sometimes rather bleached than completely oxidized. All this will be made clear when we have the opportunity of presenting to our readers a report of Dr. Tidy's lecture, with the elaborate tables with which it was illustrated. This much, however, may be said at once, the discourse did equal credit to the Author and the subject with which he dealt. By-and-by, when the question of the Water Supply of the Metropolis comes again under revision, Dr. Tidy's lecture will be of use in showing that the river waters are, after all, the best for the Metropolis. The deep-well waters may be preferred by some people, but at present they are inaccessible to the bulk of the inhabitants of the Metropolis. The time will come when these waters will be actually required for the necessary supply of London, and possibly the day will not be far distant.

The health of the Metropolis has been continually improving now for several weeks past; but the water supply, according to Dr. Frankland's last report, has been going utterly to the bad. "Living and moving organisms" are afloat everywhere in the water supplied, but much more in the air than in the water. The inference is natural. Mortality depends upon atmospheric poisons and changes of temperature rather than upon anything which can by any possibility be connected with the drinking of water.

The Corporation of Birmingham are very successful in the management of their water undertaking. They appear actually to make a considerable profit, which it is perhaps wrong to do. It is continually thrown in our teeth, when we advocate the claims of Companies, that water is a necessary of life which should be dispensed cheaply and profusely. The supply of the Birmingham Corporation is certainly ample, and their charges are not exorbitant. The matter last before the Town Council was the expediency of extending the works at Aston, so as to provide for the growing wants of the population. Of course this will be done promptly, as everything undertaken by the Corporation is.

NATURAL SOURCES OF WATER SUPPLY TO LARGE TOWNS.

THE recent repetition in Parliament, during the discussion on the Liverpool Corporation Water Bill, of the fallacy that "towns should look for their water supply to the drainage area of the river on which they happen to be situated," renders it desirable that some attention should be directed to the subject, and some trouble taken to prove its eminent inapplicability, not only in the case under discussion, but in almost every part of our own country. We are not aware that the idea has ever been mooted in any other country, and it is certainly not likely to be listened to if put forward. It may be assumed that the authority on which this notion is based is the last section but one in the report of the Duke of Richmond's Water Commission of 1869, drawn up by Dr. Pole, and signed by all the six Commissioners. It is worded as follows:—"That no town or district should be allowed to appropriate a source of supply which naturally and geographically belongs to a town or district nearer to such source, unless under special circumstances which justify the appropriation."

There are in England and Wales fourteen towns with populations exceeding 100,000, and twenty others between 50,000 and 100,000. Of these thirty-four towns, eight are in Lancashire, in the drainage area of the Mersey and the Ribble; six in Yorkshire, in the drainage area of the Ouse and the Humber; and six in Midland counties, in the drainage area of the Trent; three others are in the drainage area of the Severn; two are in that of the Thames, regarding the Metropolis and the outlying towns as one; and the rest are on small, unimportant catchments. In the first group there is a population of 700 to every square mile of drainage area; in the second, 250; in the third, 320; in the fourth, 120; and in the fifth group nearly 1000. On the other hand, in the Lake district, in the catchment areas of the Severn and the Welsh rivers, and in those of the East of England, the population to the square mile of drainage area is little above 60, and in the South-West of England is about 100. The greatest sources of supply, however, are well known to be in the Welsh mountains, the Lake district of Cumberland and Westmoreland, and in Devonshire. It is evident, therefore, that the largest populations are congregated where the natural water supply is smallest, and the supply of water is greatest where the population is least dense. This rule, which is true for the largest towns and great groups of thickly-peopled towns, is equally true in special cases. The Metropolis, it is true, is situated on one of the chief rivers of England, and the water from the Thames which is supplied to its vast population may be regarded as sufficient and satisfactory; but how is it with the great towns of Lancashire and Yorkshire? Liverpool and Manchester, with their population of a million; Bolton and Oldham, Rochdale and Bury, Stockport and Macclesfield, St. Helens, Warrington, and Birkenhead, containing together another half million; and many other large towns, are all in the drainage area of the Mersey, a small river with many small tributaries, the upper valleys of which are almost all utilized for the storage of water. Preston, Blackburn, Burnley, Wigan, and many other towns, are on the Ribble, a still smaller river. Birmingham, Wolverhampton, Wednesbury, Walsall, Nottingham, Leicester, Stoke, Derby, and other important towns, are within the drainage area of the Trent. With regard to these, they are for the most part supplied with water from wells; but in the North of England this is generally impossible and undesirable, except where the new red sandstone or magnesian limestone affords exceptional opportunities for well-sinking.

For the supply of the great towns of the North of England the rivers flowing past them must, under any circumstances, be altogether unavailable. These streams may, and ought to be kept free from gross impurities, but they can never be fit for use as potable waters. There remain only the catchments at the head of the various tributaries, and distant sources out

of the watershed. It is well known that all the good reservoir sites in the Pennine chain are already taken up and utilized, but many of the large towns are imperfectly supplied, and many of the small ones left without any supply at all. It is also true that the water abstracted for supply produces a sensible reduction of the water passing these towns. If we carry the system of limiting the rights of towns to their natural catchment areas to its logical result, we shall find that while almost all the great Yorkshire towns are on the rivers Aire, Calder, or Don, many of their reservoir sites are near the sources of the Wharfe. With regard to the Nidd, the Swale, and the Ure, there are hardly any towns needing water situated in their valleys. So also in Cumberland and in the Lake district, where the rainfall is greatest, the local requirements for water are at a minimum. The same may be said of the upper waters of the Severn. The small rivers of the Lake district and the mountain streams that are the early feeders of the Severn afford, however, vast and never-failing sources of pure water, a large proportion of which always did and always must in flood run off to the sea. Floods from these streams have but one result, and that is mischievous. They disturb the beds of the rivers, frequently overflow the river banks, and constantly injure the adjacent lands. Everything that can be done or is done by art or nature to reduce this sudden and rapid flow to the sea must be a benefit to every one. Any such proceeding equalizes the water-flow in the summer and winter, and if of the nature of a reservoir sufficiently capacious and under control, the regular supply of water sent down from this store not only assists navigation, but improves the condition of the river for all purposes. Lakes, which have been called flood-regulators, and reservoirs, which are artificial lakes under more complete control, are the natural and legitimate means of taking advantage of the rainfall of mountain districts, and exchanging a risk and source of mischief for a real and permanent benefit.

It was argued by the honourable member who moved the rejection of the Liverpool Water Bill, that the taking away of the head waters of the Vyrnwy would be a great injury, inasmuch as these were the only uncontaminated waters of the Severn. This assertion is not supported by facts. The thousand square miles of drainage area above the confluence of the Vyrnwy (which river has a catchment of only one-third that amount) carry down water collected from the same sources, and flowing over similar rocks. There is no contamination of these waters, and analyses made of them long ago by Dr. Frankland have shown them to be of unexceptionable purity and excellence. But, in any event, the mixture of the compensation water proposed to be sent down and supplied regularly during the only season when there can be any objection taken to Severn water could only add to its purity and improve its condition. This is the invariable result of retaining storm waters, and it is a result more important by far in torrential than in more evenly-flowing streams. As a matter of fact, it is altogether unreasonable and practically impossible to limit the water supply of large towns to their natural and geographical sources. It is clearly only justifiable when the population within a drainage area has such a relation to the catchment area as to ensure a sufficient quantity, when the rivers are of such magnitude and so situated as to permit the abstraction of water from their sources without sensibly reducing the flow past the towns, when the natural supply is so distributed through the season as to justify the storage of the storm waters, and when the physical conditions of the river are such that reservoirs of sufficient containing power can be safely constructed in the valleys of the upper feeders. It is also highly necessary that the sources of the rivers should be in mountain land which is little cultivated, and upon which there are sparse populations. Such conditions have been found to exist for Leeds and Sheffield, for Huddersfield, Halifax, Rochdale, Bury, Bradford, Bolton, Preston, and other places in Yorkshire and Lancashire; for Leicester; for Neath, Swansea, and Merthyr, in South Wales, and for some few other large towns. They obtain only imperfectly for Manchester, and not at all for Liverpool. The latter town has really no available supply within its watershed, and no place in England can claim more emphatically to be forced to obtain water from distant sources with which it has no natural relation. But we maintain that the suggestion of the Royal Commission of 1869 was wrong in principle, and ought never to have been enunciated. Large towns should obtain their water supply from distant and little inhabited districts, or from unpolluted streams, wherever they can be conveniently tapped. Large populations are not necessarily accumulated on the banks of great rivers in proportion to the volume of water collected in the uplands, and carried down the stream. Their growth depends on conditions totally

different, and if in former times navigable waters might be regarded as necessary for the rapid growth of populations, there can be no doubt that mineral wealth and facility of communication by roads and railways have for a long time superseded such necessity. Most of the flourishing towns of England are on small tributaries or second-class rivers, and in all these cases the water supply for the growing town must be sought at a distance, and quite independently of geographical considerations.

It would be well if our legislators, and those who attempt to influence the management of public affairs, would study such matters more closely before expressing opinions. As a matter of principle, the needs of large towns are, and must be imperative, and in this respect Liverpool has an undoubted claim to be heard. Practically, the scheme now projected is one to improve the condition of the Severn by retaining in the valley of one of the upper feeders storm waters that are otherwise injurious, and sending down a regulated supply of pure water at all seasons. The costly engineering operations necessary for converting parts of these valleys into lakes would never be constructed by the dwellers in the Severn Valley. They are to be undertaken by one of the largest and wealthiest Corporations in the kingdom, and the surplus only, after a large and regular quantity of the impounded water is daily sent down to the sea, will be conveyed, at great expense, for the use of the half million of human beings congregated at the mouth of the Mersey. At present Liverpool, though in the basin of the Mersey, receives good water in insufficient quantity from the upper waters of one of the tributaries of the Ribble, supplemented by a bad and also insufficient supply from wells sunk into the new red sandstone. The additional quantity required it is proposed to fetch from the Severn basin, and there is no good reason why this should not be permitted. It cannot be obtained from the Mersey; it would not be desirable, if it were possible, to abstract more from the Ribble; it would be at once expensive, uncertain, and unsatisfactory to attempt to obtain more from wells. As there is no alternative project presented, and no good reason to the contrary has been given, there can be little doubt that the Vyrnwy scheme will be authorized by Parliament. We hope this will be the last attempt at enforcing the mistaken recommendation to which we have alluded. Originally, perhaps, put forth to support the argument that the Thames was the proper source of supply for London, it has been used over and over again to prevent excellent and reasonable schemes from being sanctioned by Parliament, and has done much more mischief than good. We trust we have shown its unreasonableness generally, and its special inapplicability in the case of Liverpool.

YESTERDAY'S PRICES OF GAS AND WATER SHARES.—The following were the closing prices yesterday of some of the principal gas and water shares:—

Gas Companies.		Water Companies.	
Brentford	144 —148	Chelsea	209 —214
Commercial	188 —192	East London	206 —209
Continental Union	19½ — 20	Grand Junction	116 —118
Crystal Palace District.	175 —180	Kent	290 —295
European	18 — 19	Lambeth	211 —214
Gaslight and Coke "A"	176 —178	New River "New"	370 —380
Imperial Continental	180 —182	Southwark & Vauxhall.	210 —215
London	175 —180	West Middlesex	174 —178
Phoenix	35½ — 36½		
South Metropolitan	198 —202		

ACIORTH, FEATHERSTONE, AND PURSTON GAS COMPANY, LIMITED.—The half-yearly meeting of this Company was held on Monday, the 8th inst. —Mr. A. Wardman in the chair. The Secretary (Mr. J. Watson) read the notice convening the meeting, also various particulars from the balance-sheet, which was unanimously adopted. A dividend of 2½ per cent. for the past half year was declared, making a total of 5 per cent. for the year. The retiring Directors, Messrs. E. Andrew and W. Shaw, were re-elected, and a vote of thanks to the Chairman and Directors was passed.

THE USE OF PRESSURE-REDUCING WATER-VALVES AT GLASGOW.—At a meeting of the Glasgow Water Commission on Thursday, the 11th inst., it was stated that the Sub-Committee on Works had received a report from the Water Engineer with reference to the working of one of Foulis's pressure-reducing valves. This was placed on a district containing a population of 2971 persons. The ordinary variation in the pressure on the water-main in this district was from 40 lbs. on the square inch, during the day, to 85 lbs. at night. The valve was adjusted so that the pressure would not at any time rise above 45 lbs. on the square inch, which was equal to a column of water 103·7 feet high. The total saving from 4 p.m. on Oct. 14 till 8 a.m. on Oct. 15 was 12,600 gallons, or a saving of 4½ gallons per head per day. This saving was due to the lessened pressure causing a less waste of water from imperfect fittings. The Engineer added:—"The pressure-reducing valve, however, had to be removed, as two bakers in the district have hydraulic engines for mixing dough, which had been constructed to work during the early hours of the morning, and, of course, with the greater pressure, and did not give out sufficient power when the pressure was reduced to 45 lbs. on the square inch. These two engines were consuming together 8700 gallons a day, so that to maintain the supply to them the saving of 12,600 gallons a day had to be abandoned. In other words, these two engines are supplied with 8700 gallons a day for nothing, and the Commissioners lose other 3900 gallons a day." It was agreed to refer the report to the Finance Committee, to be considered by them when adjusting the table of rates and charges for next year.

THE METROPOLITAN WATER QUESTION.

THE Metropolitan Water Companies are now holding meetings for the purpose of ratifying the terms set forth in the Metropolitan Water-Works Purchase Bill. The measure is one which has excited an extraordinary amount of public attention, and despite the opposition which the Bill has encountered, the Companies are distinctly warranted in going on with their arrangements as if the scheme were likely to receive adoption. The general tone of opinion on this subject indicates a very strong desire throughout the Metropolis that the water-works shall be purchased, and the supply handed over to a public authority. The protest which has been urged against the terms of purchase connected with the Bill has served to alarm, or at least to discourage the Government; but the Companies know the strength of their position, and are content to wait until the subject is better understood. That the Government scheme is of necessity to be totally abandoned is what nobody believes who understands the merits of the case. What tactics may be dictated by the exigencies of party is, of course, out of the range of our calculations; but the aspect of affairs seems to indicate that the Water Question will not be allowed to subside into its former position. There is a prevailing expectation that the question will receive a settlement, and although that expectation is not based altogether upon a right apprehension of the case, yet its existence shows a state of public feeling which will operate powerfully towards some practical result. A fresh Regulation Bill might possibly satisfy the popular demand, but not until the question of purchase has been thoroughly fought out and found to be hopeless.

Disappointed in the terms of the Purchase Bill, the Metropolitan ratepayers might be disposed to let the question of buying the water-works stand over indefinitely, were it not for the continued increase in the value of that which has to be bought. The business of the Water Companies increases with the population, and there is the prospect of higher dividends among those Companies who have not yet reached their statutory maximum. But the point on which the public seem most sensitive is that which has relation to the periodical assessments under the Metropolitan Valuation Act. The Earl of Camperdown has taken this part of the subject under his own special care, bringing it before the notice of the House of Lords—not for the first time—on Tuesday last. Earl Beauchamp replied to the remarks of Lord Camperdown, and cited the plain facts of the case. The Metropolitan Valuation Act of 1869 gives the Water Companies no fresh powers. The operation of the Act may, and doubtless does, furnish the Companies with evidence as to the annual value of property, and thereby affords them a basis on which to fix their charges. But the charges must be regulated according to the several Acts under which the Companies levy their rates. The argument that the Metropolitan Valuation Act was never intended to apply to the Water Companies amounts to nothing. If the premises which are supplied with water are found to be of a certain annual value, the charge for the water supply is regulated accordingly, and it matters not by what means the annual value has been discovered. The outcry on this subject simply means—if it means anything at all—that the Companies shall not charge on the annual value of the premises which they supply, but on a basis representing something less than that value. The change demanded is a partial abrogation of those powers which Parliament has granted, and on the exercise of which the Companies rely for their revenue and their profits. Earl Camperdown is, in effect, asking that Parliament shall break faith with the Water Companies, and confiscate a portion of their revenues. Such a proceeding, could it ever come to pass, would depreciate the value of the water-works; but we venture to say it would lessen quite as much the value of other undertakings as well.

The fear of a rise in the assessments thus gives impetus to the movement for the purchase of the water-works; but a little consideration may moderate the fever thus excited. It may be doubted whether house property in the Metropolis has undergone any marked increase in value within the last five years. New buildings are, of course, springing up continually, and these speedily figure in the rate-book. The growth in the Metropolitan assessment is due, in a great degree, to the enormous increase in population, and the immense spread of building operations. A few years back there was doubtless a large addition to the value of house property in many parts of London; but the last five years can have witnessed only a very moderate advance of this kind. On the whole, we do not see that the Metropolitan Valuation Act need precipitate the purchase of the London water-works. In times of great national prosperity, a fresh

valuation may lead to a decided advance in the assessments of existing properties; but the present period is not of that nature, and if Mr. Goschen's Act of 1869 is all that has to be dreaded, the ratepayers may take their leisure in dealing with the London Water Companies.

Last week we held a brief argument on the increasing costliness of the works necessary to keep pace with the demand for an improved supply. We submitted that with this process going on, water must of necessity become dearer, and that it was well if the increased charge could be met by a rise in the value of house property. It may be of service if we cite some figures on this point. Thus, in 1867, the capital of the London Water Companies was £8,769,514, and the average daily supply of water to the Metropolis was 98,600,000 gallons. In 1878 the capital was £12,070,000, and the daily supply 130,393,000 gallons. It will be seen that the capital per thousand gallons supplied daily at the former date was rather less than £89, while at the latter date it was over £92 10s. It is not to the Companies interest to increase the expense of their operations; but they have augmented their outlay in order to improve the quality of the supply, as also in some cases to increase the pressure and afford a constant service. It is further worth noticing that whereas the average daily consumption of water by the inhabitants of the Metropolis in the year 1867 was under 32 gallons per head, in 1878 it had become more than 33 gallons. If no extraordinary expenditure is forced on the Water Companies, it is possible that the capital now expended will become more productive, so that in a very few years we may see a decline in the ratio of capital to quantity. But this will depend, as already intimated, on the kind of service which the public desire.

The attitude of the Government in reference to the Water Bill was made tolerably clear last week. Mr. Cross in the Commons, and Earl Beauchamp in the Lords, said enough to show that although the Bill was for the present withdrawn, the matter would be taken in hand in the new Parliament. We may as well point at once to the fact that no alteration in the terms of purchase can be effected this year. A provisional bargain has been entered into, and any alteration is impracticable. What might happen next year, supposing the matter to stand over, is more than we need undertake to say, except that as the value of the property will be increased, the price will rise proportionately, unless the Companies choose to yield. That they will lower their terms is hardly likely, seeing that they have no particular desire to sell. A high price is necessary in order to induce the Companies to part with their property, and if the ratepayers object to that price, the Companies ought not to be considered blameworthy. So far as the present Government is concerned, Mr. Cross made the explicit statement that if he and his friends found themselves in power in the next Parliament, they would address themselves at once "to the great question of supplying London with pure water, and," said Mr. Cross, "we shall hope to put before Parliament such a scheme as will secure the confidence of all parties concerned."

A phrase employed by Mr. Munro, of the Metropolitan Board, when addressing the District Board of Whitechapel a few days ago, very well describes the present position of the Government Bill. This gentleman said, "The Bill is not dead, but only in a state of suspended animation." Higher authorities than Mr. Munro take a similar view of the case. Mr. Gladstone, when addressing the electors of Marylebone, referred to the Water Bill at some length, and observed: "The Government have not said that they have done with it; there is nothing whatever to prevent them from continuing it in the next Parliament, and if they have a majority there is nothing to prevent them pressing it to an extremity, and passing it into law." This was said before the recent statements by Mr. Cross and Earl Beauchamp. *The Times*, in its City article, interprets the reply of Mr. Cross to Mr. Edward Jenkins as signifying the Home Secretary's "intention to reintroduce the Water Bill in the new Parliament should his party return to power." Mr. Gladstone argues that if the present Government obtain a majority in the new Parliament, "they can perfectly well afford to allow the Metropolitan members to vote against the Water Bill, intending to carry it by the votes of the majority gathered from other parts of the country." It is a noteworthy point that Mr. Gladstone abstains from employing his skill as a financier to attack the Bill. He has not yet had time to examine the question fully, and therefore "will not commit himself to any plan." But he complains that the Government ought either to have stood by the Bill or else have acknowledged that they made a mistake. The Marquis of Hartington adopts a similar line of argument, though using

somewhat stronger language. "I must say," were the words of the noble Marquis at Accrington, "that if the Government had in their mind any intention of dissolution at the moment when they introduced the Bill, they lent themselves, by its introduction, to a most gigantic gambling job."

Judging by the remarks of the Opposition leaders, we should say that their contention is not directed so much against the Bill, as against the untimely or unexpected dissolution of Parliament which the Bill appears to have occasioned. Contemplating the possibility of being themselves in the uppermost places in the new Parliament, the great Liberal leaders are a little cautious how they handle the Bill itself, being shrewdly aware of the difficulties which attend any attempt to legislate on such a subject. That such an attempt will have to be made when the present political crisis has passed, appears to be the conviction of all parties. But the financial difficulty is a serious one. Could the terms of purchase be revised and the price lowered, the prospect of settlement would be much nearer than it is. If that settlement is postponed, we shall probably hear something more concerning the assessment question. The *Pall Mall Gazette* coolly declares that in authorizing the Companies, by their special Acts, to rate each house upon its annual value, the Legislature "clearly intended to confine them to the 'then annual value.'" This is admirable. Is our contemporary persuaded that the water-rates should remain unaltered, even though the value of property declined? For how long a period is the old original value to be retained? Is it to be so for all time, or for a century, or for some less period? In the interval, where would be the equity of charging a new house according to its existing annual value, and an old one according to its value some years before? The idea of perpetuating an obsolete assessment is absurd, and would be unjust to the owners and occupiers of property. The *Pall Mall Gazette* chafes at the idea of having the rating question settled by an appeal to the law courts. A demand is set up for a new law. "Parliament itself ought to interfere," we are told, and any unwillingness to take such a course is stigmatized as "mere legislative prudery."

The Water Companies at present exercise their rating powers with moderation; but the gentlemen who are busying themselves with this question have need to ask what will be the system adopted by the "responsible public authority" to which they would transfer the undertakings of the Metropolitan Water Companies. Such an "authority" will most assuredly adopt the current assessment, and will not abate anything at all from it. Let the question be asked in the provinces, and let the reply be given by those public authorities which already have charge of the water supply. Do they levy their water-rates on the basis of an assessment ten or twenty years old? If not, why should the London Water Companies be expected to do so? But the Companies are to be coerced. The law being on their side, Parliament is to interfere and make fresh law. Such is the demand of the *Pall Mall Gazette*; and in like manner we find the *Saturday Review* advising the Government to threaten the Companies with a rival scheme, in order to "bring them to their knees." Had Mr. Cross acted in this way, we are told, he would have made much better terms with the Companies. A mere "hint," it is said, would have been enough; but we apprehend that the potency of the "hint" would depend very much on the character of the scheme to which it referred. If any plan could be shown by which the London Water Companies could be superseded with advantage to the ratepayers and consumers, a "hint" that it was likely to be adopted might cause some anxiety among the Companies; but hitherto any scheme intended to compete with the present supply has generally excited most anxiety among the ratepayers.

If it were shown that the London Companies had placed themselves beyond all control, and obstinately rejected all suggestions of improvement, it might be proposed, as a last resource, that the work should be confided to other hands. But no such charge can be established against the Companies. Government documents prove that the Companies have, on the whole, been attentive to official recommendations, and have carried out many expensive measures in order that the water supply might be as pure and abundant as possible. If more is wanted, the reasonable and honest course is to specify the requirements, and to see whether or not they can be fulfilled. It may be thought a popular line of argument to say that the Companies ought to be threatened, in order that they may come down in their terms. But the Companies have as much right as anybody else to make a good bargain; neither can it be shown that they have so failed in their duty to the public as to render it necessary that they should be set aside. It may be, in respect to certain matters, that a

public authority is better than a private Company; but that is no reason why the said Company should be threatened, made to go down upon its knees, and forced to sell its all at a price set by somebody else. We hope the language used goes a little beyond what is intended. There is a constant avowal of a willingness to give the Companies fair terms. In the present instance there is a serious difference of opinion as to what the terms ought to be, and, so far as this year is concerned, we see no possibility of having the terms revised. Neither on the part of the Companies is there any apparent disposition to make any abatement. Whether another year might bring a different disposition is more than we can say. In the interests of the Companies we should like to see the terms made as moderate as possible, for there is some force in one appeal which has been put forth—that if the public get angry over this question, mixed up as it is with another sore point, that of the assessment, Parliament and the Government may be carried away with the popular excitement, and some legislative action may be taken in a spirit of direct hostility to the Companies. The bare right may not be relied upon, when its exercise creates a feeling of irritation.

THE RATING AND VALUATION OF GAS AND WATER WORKS.

Mr. Joseph Quick, jun., has just written a small *brochure** on the above subject, which will prove of service to those desiring, without diving into the intricacies of a lengthy legal treatise, to learn upon what principle such undertakings are assessed and valued. Divested of legal technicalities, the broad principles of rating are easily comprehended. An intimate knowledge, however, of established decisions is required in any one attempting to teach those principles, and the Author has explained and defined them as only one fully conversant with the subject is able to do.

The work is divided into two parts, with an addendum. Part I. deals with the question of rating; Part II., with that of compensation by Local Authorities for works transferred; and the addendum is devoted to an examination of the proposed purchase of the Metropolitan Water Companies by the Government. Mr. Quick argues the various points, on which there is room for considerable difference of opinion, with commendable fairness; and although we might dispute the assertion that in large provincial towns "the rateable value [of gas and water works], as assessed by the parishes separately, falls far short of the rateable value of the whole undertaking," we entirely coincide in the opinion, having constant proof of the fact, that "in the case of small gas and water undertakings, the rateable value is fixed at much too high a figure, mainly in consequence of the very prevalent, but altogether incorrect notion, that the rateable value should be assessed according to the profits divided amongst shareholders, on whom an undue share of taxation consequently falls."

The growing value of water-works as an investment is pointed out by Mr. Quick. The same may be said of gas-works; and this is doubtless due, in addition to the valid reasons adduced by him, to the further circumstance of the decreased purchasing power of money, and the proved worthlessness of many, especially the foreign, investments of recent years.

The withdrawal of the Government Bill for the transfer of the water-works of the Metropolis, renders unnecessary, for the present at least, any comments on the concluding portion of the book; but we may remark that the chapter contains an important contribution to the discussion of a subject which will command the attention of the next or some future Parliament.

A general acquaintance with the details conveyed in this little work will awaken the reader's interest in the subjects of which it treats; and should he determine to pursue them further, the larger treatises on rating and valuation will be pleasanter and easier reading in consequence of his previously acquired knowledge.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE RECENT TRIAL AT MANCHESTER OF WEST'S AND FOULIS'S SYSTEMS OF DRAWING AND CHARGING RETORTS.

SIR,—In the last number of the JOURNAL I notice a report of what is said to be a comparative trial of West's and Foulis's systems of charging retorts, in which the former system is shown not only to effect a very surprising saving in labour, but also to produce more gas from each retort, and a larger yield per ton of coal.

Now, I have at no time professed that I could with machinery produce more gas from the retorts, nor have I claimed to be able to increase the yield of gas per ton of coal. Increased make per retort and per ton depend on the quantity of coal put into the retort, and the heat at which the retort is kept; and also on the condition of the retort. It cannot be affected to any great extent by mere machinery for drawing and charging. I have only endeavoured to do by machinery part of the heavy work of gas-making, so as to save both labour and money.

The so-called "trial" was made entirely without my knowledge. I have been at some pains to ascertain what it means, and under what

* "Remarks on the Rating of Gas and Water Works, and on the Principles of Compensation involved in the Transfer of Water Undertakings from Private to Public Authorities." By Joseph Quick, jun., M.Inst.C.E. London: E. and F. N. Spon. 1880.

conditions it was made; and while I have been unable to learn any particulars as to number of men employed, coals used, &c., further than those given in the JOURNAL, the following seem to be the facts of the case. Towards the end of last year one of the retort-houses at the Rochdale Road Gas-Works was completely cleared out, and refitted with 240 new retorts, new pipes, anti-dip valves, &c.; there were also erected machines for breaking the cannel, an overhead railway to tip coal direct into the breakers, and Mr. West's apparatus for drawing and charging. The portion of the apparatus through which the gas from this house passed was put in thorough repair, and supplemented by two of Livesey's washers; and 16 feet was added to the height of each of six scrubbers. Whether any addition was made to the purifiers I do not know; but certainly the additional washing power would be a great advantage, as the washing and purifying plant at those works is rather weak.

The remaining three retort-houses are fitted with hydraulic stoking machinery. They are not provided with cannel breakers, nor an overhead railway; the cannel has, therefore, to be broken and brought to the machines by hand labour. No change was made in the retorts (which are all more or less worn), or in the apparatus connected with these three houses.

A so-called trial was made for five days, a few weeks ago, between the portion of the works fitted with new retorts and enlarged apparatus, with West's machines for drawing and charging, and the other portion of the works with old retorts and imperfect apparatus, in which hydraulic machinery was at work. What took place during those five days trial I do not know. As I have already said, I knew nothing of what was going on; but I have been told that Mr. West was there with a large staff of assistants during the whole time. What I think about the matter is that it would have been rather discreditable if, after spending £15,000 or £16,000 in renewing retorts and apparatus, there had been no improvement in the manufacture; but it does seem to me strange that only the five days results are taken, when the works were under the personal supervision of Mr. West. Have similar results been obtained since?

As to the results, I will only say that, after a long experience in the manufacture of gas, I do not believe that 1500 cubic feet more gas can be obtained from a ton of coal by any mere change in the mode of charging the retorts, without deteriorating the quality of the gas. Of the accuracy of the statements I have no means of judging; but it must be evident to all impartial minds, that if two machines are to be compared for efficiency, they ought to be compared under similar conditions. The retorts and apparatus should be in the same condition, not new in the one case and worn in the other. Machinery should be provided in both cases for breaking coal and bringing it to the machines, or else these costs should be eliminated; and one portion of the works should not be under the supervision of an interested party, with a gang of picked men, while the other is working in the ordinary routine; and, lastly, five days trial is far too short a time to test the efficiency of such machinery. We all know how possible it is to put on pressure for a day or two, and largely increase the make of gas. We also know how difficult it is to maintain this; while all questions of durability of machinery can only be tested by time.

Glasgow, March 19, 1880.

W. FOULIS.

SIR,—In perusing your issue of the 16th inst., we observe an account is given of a comparative trial at the Rochdale Road Gas-Works, Manchester, of West's charging and drawing machines just introduced there, and the Foulis stoking machinery at work there for the last five years, stating that during the trial both sets of machines were worked under similar conditions; also, in allusion to this, in your "Circular to Gas Companies," it is stated that both experimenters were placed under similar conditions. Now, as representatives of Mr. Foulis, and makers of his machines, we beg to say that the statement that the conditions of trial were similar is most incorrect, and very misleading to your readers, as the following explanation will, no doubt, prove.

In the first place, as regards the "experimenters" being placed under similar conditions, we have to say that during the trial Mr. West and 15 or 16 of his own employés from Maidstone were present assisting thereat, and had charge and superintendence (along with some of the Gas Committee's servants) of all weighing and testing apparatus, and, at the same time, were closely watching and daily recording the number and names of men employed, and the repairs made in the three houses worked by the Foulis machinery; whilst one of our firm, as Mr. Foulis's representative, unaccompanied by any assistants, had permission to enter the three Foulis machine houses, but not the West house, and had no means whatever at hand of checking and proving the accuracy of the figures registered during the trial.

As to equality of conditions with respect to apparatus worked in connection with the machines, let the following explain:—During the time occupied in fixing the West drawing and charging machines in the house set apart for them, additions and alterations were made to the plant worked in connection with them, in order to increase the yield of gas per ton of cannel carbonized, to raise the illuminating power of the gas, and to reduce the number of hands employed. These alterations, costing about £15,000, consisted of 240 new retorts, 240 new retort-lids, 240 of White's patent anti-dip valves, two of Livesey's patent washers, six scrubbers lengthened each 16 feet, four powerful cannel breakers with steam-engine attached to each, 240 new and larger ascension-pipes, one 40-horse boiler, and overhead railways laid down to tip the coal and cannel direct into the breakers; while for the Foulis machines no alterations or additions to plant were made or extra expenditure incurred in preparation for the trial—everything was taken just as it stood, but saddled with the great disadvantage of a large number of the retorts being in a burnt-out condition, and within a month of their being taken out as done, with the heavy expense of breaking cannel by hand labour, and the great cost of carrying coal and cannel from the stores to the machines, requiring for the purpose 12 horses and drivers. Yet it is stated that the conditions of working were similar in both cases; and, by omitting to name the costly alterations made, the reader is led to believe that the advantages claimed are entirely due to the introduction of the West machines, whereas they are, if correct, due to the additions and alterations before named.

We can only further state that had such additions and alterations as those named been permitted in connection with the Foulis machines, thereby rendering the conditions really similar, and the trial fair, the results would have proved greatly in favour of the Foulis machines.

Now, what we desire is a fair and impartial trial, carried on under the ordinary state of working—all conditions being similar—with the representatives of either Mr. West or Mr. Foulis rendered conspicuous by their absence; and until this is granted, we trust your readers will withhold their judgment. We may add that we have requested the Manchester Gas Committee to grant a new and impartial trial, and should receive a reply to our request at their next general meeting, and no doubt the request will be willingly granted, as we know their desire is to arrive at the truth.

ADAM WOODWARD AND SONS.

Manchester, March 17, 1880.

[With reference to the above letter, it is right to point out that we did notice most of the alterations made in the retort-house worked under West's system. We stated that, among the alterations, 240 D-shaped retorts were substituted for the worn-out ones, and these were fitted with Morton's mouthpieces and White's valves, in addition to which two of Livesey's patent washers were erected. Excepting the lengthening of the scrubbers, the other alterations, or rather additions our correspondents state were made, were necessary to the working of West's system in its entirety. We trust, however, the Manchester Gas Committee will be able to accede to Messrs. Woodward and Son's request, and grant a further trial of the two systems, the results of which we shall await with much interest.—Ed. J. G. L.]

GAS-LAMP TESTS AT BIRMINGHAM.

SIR,—In order that a proper conception may be formed of the instructive experiments that were recently made at Birmingham, and reported in the last issue of the JOURNAL, we ask to be allowed to make the following brief additions.

In accordance with the principle adopted by us with our burners for general use, we make the burners for our street lanterns to yield a medium lighting power; or, in other words, to develop from 6 to about 12 per cent. less light than the gas can be made to yield by our flat-flame burners. We do this because the burners so made are better adapted to the work they have to perform than when made of the highest lighting power class. This we pointed out to Mr. Hunt; and, in order that he should be fully satisfied on the point, we sent an 80-candle highest lighting power burner to be tested; and he has obliged by giving us the result, which, calculated to the quality of gas used in the published tests, is 3.51 candles per foot of gas consumed. We, of course, accept the consequences of having tests made with lanterns fitted with our burners of the medium lighting power class.

As the tests, hurriedly made on Wednesday night, the 10th inst., with the two 200-candle power burners and lanterns, were not in accordance with several previous tests made with the same lanterns, the experimenters appear to have gone into the subject again on the following night, with the result that, with both apparatus rated to exactly 46.75 feet per hour, the lights were shown to be equal when the shadow meter was 73 ft. 2 in. from Bray's flat-flame lantern, and 76 ft. 10 in. from Sugg's Argand. This result was in close correspondence with the several previous tests; and our reason for here referring to it is that the Wednesday night's error was much more prominently stated than the Thursday's correction.

Perhaps it is as well to state, for the information of those who were not present, that the lateral light only is tested in these experiments.

Blackman Lane, Leeds, March 20, 1880.

GEO. BRAY AND CO.

THE REVIVIFICATION OF SPENT OXIDE OF IRON.

SIR,—I should feel much obliged if any of your readers would give me some information, *re* oxide of iron. I have had about 600 bushels of it in use for some nine months, and I use it just as it was received from London, not mixing it with sawdust or water, as recommended on page 427 of "King's Treatise on Coal Gas." When first used the oxide was very damp, and was of little or no use; now it is dry, and does its work well, my only difficulty being in its liability to heat and take fire. I expected this when the oxide was new, but now, after nine months work, it is just the same. When taken out of the purifiers it is damp and very hot—so hot, indeed, that it could not be held in the hand, and often it is burning in several places. When spread out it cools in about three days; but, if left on the floor, it again heats and fires. I cannot heap it up, even a foot thick, or it is sure to heat. Our purifier-shed is open all round, and a good current of air circulates through it, though the air, especially at this season, is often 120° Fahr. Can this aid the chemical action that causes the fire? Or is it a chemical action after the oxide is revived? I may say that the oxide is very dry and fine. I often have it for a week in a purifier before the gas is turned in, and with the cover on can notice no rise in temperature, though it lies 15 inches thick.

THOS. D. HALL, Superintendent.

Brampton Gas-Works, Adelaide, South Australia, Jan. 24, 1880.

FOLKESTONE GAS COMPANY.—The half-yearly general meeting of this Company was held on the 3rd inst.—Mr. R. Hart in the chair. The revenue account showed a balance carried to profit and loss account of £3590 19s. 7d. for the half year. A special meeting was subsequently held, at which it was decided to increase the capital of the Company by the issue of new shares to the amount of £12,000.

MAIDSTONE WATER-WORKS COMPANY.—The half-yearly meeting of this Company was held on Thursday, the 4th inst.—Mr. J. B. Green in the chair. The report, which was adopted, showed that for the quarter ended on March 31 last year the Company received for water-rents £1284 10s. 5d.; for the quarter ended June 30, £1271 6s. 2d.; and for that which ended on Sept. 30, £1288 12s. 2d. The rents for the quarter which ended on Dec. 31 were estimated to produce about £1260. The amount of water-rents for the year would therefore be about £5100. The Directors estimated that there was a profit for the year of about £2000, being equal to 6 per cent. upon the share capital of the Company, and they recommended the payment of a dividend of 5 per cent. free of income-tax. The Directors say they had received tenders for the new shares, and up to Dec. 31, 235 of the £10 shares had been taken up, a premium of £344 10s. having been paid upon them. Since then 90 more shares had been taken up. There was thus a sum of about £2000 still to be raised on capital account.

Parliamentary Intelligence.

PRIVATE BILLS RELATING TO GAS, WATER, ETC.

SESSION 1880.

PROGRESS MADE TO SATURDAY, MARCH 20.

Title of Bill.		Petition for Bill Presented.	Bill Read the First Time.	Bill Read a Second Time.	Bill Reported.	Bill Read the Third Time.	Bill Received Royal Assent.
Ackworth, Featherstone, Purston, and Sharlston Gas Bill	Lords	Feb. 9	Feb. 10	March 8	..	..	..
Birkenhead Borough " " " "	Commons	..	..	..	..	..	..
British Gaslight Company, Limited (Staffordshire Potteries), Bill	Lords	Feb. 10	Feb. 10	Feb. 23	..	..	..
Burton-upon-Trent Corporation Bill	Commons	..	..	..	..	..	..
Cardiff Water Bill " " " "	Lords	Feb. 9	Feb. 10	Feb. 16	March 11	..	..
Chester Gas Bill	Commons	Feb. 10	Feb. 10	Feb. 20	March 8	March 11	..
Cork Gas Bill	Lords	Feb. 9	Feb. 10	Feb. 24	March 2	March 11	..
Cork Improvement Bill	Commons	Feb. 9	Feb. 10	March 1	..	..	..
Dagenham and District Farmers (Optional) Sewage Utili- zation Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Dartford Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 17	..	..	..
Dearne Valley Water Bill	Lords	Feb. 9	Feb. 10	March 15	..	..	..
Denton and Haughton Gas Bill	Commons	Feb. 10	Feb. 10	Feb. 16	March 16	..	..
Doncaster Corporation Water Bill	Lords	..	..	..	..	..	..
Eastbourne Gas Bill " " " "	Commons	Feb. 9	Feb. 10	Feb. 16	March 17	..	..
Edinburgh and District Water Bill	Lords	Feb. 10	Feb. 10	Feb. 16	March 16	..	..
Exmouth and District Water Bill	Commons	..	..	..	..	..	..
Gaslight and Coke, Commercial Gas, and South Metropolitan Gaslight and Coke Companies Bill	Lords	Feb. 9	Feb. 10	Feb. 25	March 12	..	..
Great Yarmouth Water Bill	Commons	Feb. 10	Feb. 10	Feb. 16	Feb. 26	March 2	..
Hinckley Local Board Gas Bill	Lords	Lords Bill	March 5	March 15	..	..	..
Huddersfield Tramways and Improvement Bill	Commons	Feb. 9	Feb. 10	Feb. 23	..	..	..
Hull Lighting Bill " " " "	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Hyde Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
King's Lynn Corporation Bill	Lords	Feb. 9	Feb. 10	Feb. 23	..	..	..
Lancashire County Justices (Water, &c.) Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
Lancaster Corporation Bill	Lords	Feb. 10	Feb. 10	Feb. 16	March 11	March 13	..
Lincoln Gas Bill " " " "	Commons	Lords Bill	March 16	..	..	..	..
Liverpool Corporation Water Bill	Lords	Feb. 9	Feb. 10	Feb. 16	March 12	..	..
Liverpool United Gas Bill	Commons	Feb. 9	Feb. 10	March 12	..	..	..
London Gaslight Company Bill	Lords	Feb. 9	Feb. 10	Feb. 24	..	..	..
Maidstone Gas Bill " " " "	Commons	Feb. 9	Feb. 10	Feb. 24	March 12	..	..
Malton Gas Bill	Lords	Feb. 9	Feb. 10	March 1	..	..	..
Oldham Improvement Bill	Commons	Feb. 9	Feb. 10	Feb. 23	..	..	..
Phoenix Gaslight and Coke Company Bill	Lords	Feb. 9	Feb. 10	March 8	..	..	..
Portmadoc Water Bill " " " "	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
Prescot Gas Bill	Lords	Feb. 10	Feb. 10	Feb. 16	..	..	..
Preston Improvement Bill	Commons	Feb. 9	Feb. 10	Feb. 23	March 12	..	..
Rathmines and Rathgar Township (Vartry Water Supply) Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Rathmines and Rathgar Township Water Bill	Commons	Feb. 16	Feb. 16	March 11	..	..	..
Reading Gas Bill " " " "	Lords	Feb. 10	Feb. 10	Feb. 16	..	..	..
Rochester Corporation Bill	Commons	..	..	..	..	..	..
Sea Water Supply to London Bill	Lords	Feb. 9	Feb. 10	March 1	..	..	..
Sligo Borough Water Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
South Metropolitan Gas Company Bill	Lords	Feb. 10	Feb. 10	Feb. 16	..	..	..
Southwark and Vauxhall Water Bill	Commons	..	..	..	..	..	..
Stafford Borough Bill " " " "	Lords	Feb. 9	Feb. 10	Feb. 23	..	..	..
Wakefield Corporation Water Bill	Commons	Feb. 9	Feb. 10	Feb. 23	March 17	..	..
Wandsworth and Putney Gas Bill	Lords	Feb. 10	Feb. 10	Feb. 16	March 11	March 16	..
Wigan Improvement Bill	Commons	Lords Bill	March 18	..	..	..	..
Wrexham Water Bill	Lords	Feb. 9	Feb. 10	March 2	..	..	..
Yeadon and Guiseley Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 17	..	..	..
" " " "	Lords	Feb. 9	Feb. 10	March 4	..	..	..
" " " "	Commons	Feb. 9	Feb. 10	March 10	..	..	..

HOUSE OF LORDS.

TUESDAY, MARCH 16.

METROPOLITAN WATER-RATES.

The Earl of CAMERDOWN had given notice that he would this day call attention to the present position of the metropolitan ratepayers who consume water, with reference to the charges which are, and may be made by the Water Companies; and ask whether the Government will take steps to ascertain—(1) if the Companies are correct in law in interpreting "annual value" to mean "gross annual value," and (2) if each successive re-valuation of the Metropolis under the Metropolis Valuation Act, 1869, will alter the rateable valuation of metropolitan property in respect of the water supplied by the Companies. He said: My lords, I should be sorry, at this period of the session, to call your attention to the question of the Metropolitan Water Supply; but I think, under the present circumstances of the case, it is necessary on the part of the ratepayers that some representation should be made to your lordships, from the fact that the introduction recently of a Bill on the subject, in the House of Commons, by the Home Secretary, coupled with its subsequent withdrawal, has placed the ratepayers in such a position that I very much fear, unless the Government will consent to take some steps with reference to their interests, their position will be much worse than it was before. I am not about to weary your lordships by entering upon a general discussion as to the question of water supply, nor am I going into that of the quality of the supply, which questions have been already entered into by the House, and have not any direct reference to the point that I have now before me; but I am going to limit myself solely to the rating powers of the Companies, and call your lordships attention to that subject, and for this purpose I shall address myself to the rating powers as they at present exist, as they are exercised, and as they are increasing, and will apparently continue to increase unless some steps are taken to limit them. My lords, it may be necessary as well that I should remind you that the London Water Companies hold their rating powers under Acts of their own, and, generally speaking, their charges are equal, and consist of a certain percentage on the annual value of the premises which they supply under the several powers given to them by the Water-Works Clauses Act of 1847. At a much later period the Metropolis Valuation Act of 1869 was passed, which had reference to an entirely different state of things, and which was introduced without any special relation to the Water Companies; and according to the words of the preamble of that Act it was passed because it was expedient that provisions should be made for successive re-valuations of property for the purposes of local taxation, and to provide for uniformity in the assessment of the rates and of charges. My lords, I have the authority of those who introduced the Act to state that it was not their intention to include the Water Companies in it, and remembering at the same time that the payments made to the Water Companies are payments in the nature of a charge for an article supplied, and not in the nature of a tax or rate, I believe it would lead to the question of whether the Water Companies are justified in trying to increase their rates under the valuation which is fixed by the Metropolis Valuation Act. It was provided by this Act that the property of the Metropolis should be re-valued at periods of five years, and I must trouble your lordships by reminding you that the last valuation was made in 1875, and that, some ten months before, I came down to this House and called your lordships attention to the fact that if the Government did not take some steps to prevent the provisions of the Act (which was not intended by Parliament to apply to the Water Companies) from applying, the result would be that the Water Companies would try to come in under the Act of 1869, and greatly increase their charges without making any change whatever in the quantity and quality of the article supplied. But, unfortunately, the suggestions that I then made met with but very scanty attention from the Government, and the noble Earl opposite did not agree in the view I then took, and the answers he gave me were two in number. In the first place, he said that it did not necessarily follow, and it would be impossible to say before the lists were finally approved and came into force, that the value of the house property would be generally raised or not, so as to increase or affect the water-rates; and, secondly, that it was not intended by the Government to confer any additional powers of rating upon the London Water Companies. Now, my lords, I do not know whether, in the first answer that he gave, the noble Earl was really serious or not. He must have known perfectly well, as most of your lordships knew, that the re-valuation of the Metropolis, which had been completed, and which was, in fact, complete in all respects, except as to the arrangements to be made in regard to appeals, had largely increased the rateable value of the house property of the Metropolis. With regard to the second answer I received—that there was no doubt whatever the Government never intended to confer any additional rating powers upon the Companies—I would submit that it is not the question whether Government intended or not to confer fresh powers upon them, but whether, in point of fact, the Companies could not claim to take the increased annual valuation of the property as the basis of their assessments; and, unless some provisions were inserted in the Act to debar them from so doing, they would undoubtedly make such a claim, and in this way they would be enabled to levy heavy additional charges for the water they supplied without altering the quantity or improving the quality. I may say further, in correction of the remarks the noble Earl then made, that I should like to call the attention of your lordships to what the noble Marquis, the Secretary for Foreign Affairs, whose absence from the House, and particularly the cause of it, we all deplore, said upon the subject. He made some remarks which showed that the Government at that time had not very formally considered the question; and, if they had, their views, at all events, have since then changed very materially, because he said that as to taking the supply of water out of the hands of the Companies and vesting it in those of any metropolitan representative body, such a scheme must be regarded as entirely utopian. Considering the fact that the Metropolis Water-Works Purchase Bill has since been introduced into the other House of Parliament, I think I am justified in saying that the matter was not very completely considered at that time by the Government. Well, my lords, what has been the result? Why, that if the noble Earl was correct in the answers which he gave me, I was quite justified in the statement I then made, because the statement has turned out to be true to the letter. The Companies have made their claim upon the basis of the Metropolis Valuation Act; they have raised their charges, and even in those cases in which they have not raised them to the highest amount, they have a certain right to raise them, and, therefore, in the purchase of their undertakings proposed the other day, no doubt allowance had to be made for the value of the unexhausted portion of that power, and this right they assumed to have, and they will unquestionably found a claim upon it whenever this question comes to be settled. My lords, with respect to the Bill which has been lately introduced into the other House, I do not think it is necessary for me to enter into the details of the measure, because, if I did so, your lordships might think that I was entering into controversial matters, and not addressing myself to the merits of the case. I will, therefore, only say that the Bill having been introduced—no doubt with the best intentions in the world—a general expression of opinion took place to the effect that the proposed compensation was much too large, and it was consequently found necessary in the end

to withdraw the Bill, because it became apparent that it could not have been passed through the other House within so comparatively short a time of the session as remains, so as to allow time for its discussion by this House. But, my lords, the material point to which I wish to call attention is this: Now that the Bill has been withdrawn, in what position do the ratepayers find themselves? When the measure was before the House of Commons, I understand that a statement was circulated to the effect that, if Parliament did not pass the Bill, the Companies would increase their rates, and lay the foundation for a still larger claim for compensation in future. The representatives of the ratepayers in Parliament were urged to accept the Bill; but it being now gone, in what position will the ratepayers be, should those fears turn out to be well founded, and the Companies exercise the powers they undoubtedly possess to raise their rates to the maximum amount authorized by their Acts of Parliament. Let me point out to your lordships that we are now nearly at the end of the period of the first quinquennial valuation. The charges of the London Water Companies were raised in consequence of the valuation of 1875. We are now in the year 1880, and another valuation is being made. If, therefore, the Government do not at once take some steps, when the property, as probably it will be, is valued at an increased amount, the water-rates will be again raised without any provision for a better or purer supply of water, and the result will be that your lordships will find that, in common with all other consumers, you will have to pay a great deal more for your water supply, and that if the ratepayers insist upon the future purchase of the water undertakings, a very large additional compensation will be demanded for the unexhausted value of the rating powers. I should like to ask the Government whether, under these circumstances, they will not take some action in favour of the ratepayers, and I call their attention to the two questions that I have put into the notice to show that, even under the existing state of things, some improvement may possibly be made, and that there are one or two points on which the opinion of the Law Officers of the Crown might be taken with great advantage to the ratepayers. In the first place, the Companies claim to base their rates on the annual value of the premises chargeable, and no doubt they have a right so to claim by the terms of their Acts; but they choose to interpret "annual value" to mean the gross annual value of the premises rated. Now, up to the present time that question has not been raised; not because the ratepayers agree with the Companies that it is a proper and legal basis upon which to make the charge, but because no individual ratepayer likes to enter into a long and costly contest with the united strength of all the London Water Companies. There is another point also worthy of consideration, which is whether the Government will take legal opinion of the highest authority as to whether the valuation of the property referred to in the Act of 1869 is to apply to the Water Companies, and whether that valuation can be made use of by them as the basis upon which their charges can be levied. What I wish to know is whether the Government will introduce a Bill in order to declare what was the intention of Parliament in passing the Act of 1869, and to define and carry out that intention, because it has been almost universally considered that it was never intended to apply to the Water Companies, and, therefore, it does not and ought not to apply to them. It may be said by the noble Earl that this is a question with which the Government have nothing whatever to do, but that it is a matter to be settled between the ratepayers and the Water Companies themselves, and, therefore, that there is no reason why the ratepayers should not defend themselves in the usual manner by an appeal to the tribunals of the country, or, at all events, why the inhabitants of the Metropolis do not take measures through their local government to create a supply of water for themselves, under which the water-rates should be regulated by that local government, as it is in large provincial towns. But the circumstances are so different, that it is almost unnecessary to reply to such a suggestion. The answer is obvious. In the first place, the local government of the Metropolis does not consist of one perfect and distinct body, which can take up such a question as this on the part of the ratepayers; and in the second place, the Government are themselves large consumers of water, and they will find themselves sooner or later, for their own protection, obliged to take up the idea of the purchase of the Water Companies, and to introduce another Bill for the purpose. If they do so they will unquestionably find that these two questions—as to whether the gross value or the annual value of the property supplied is to form the basis of rating, and as to whether the Metropolis Valuation Act, 1869, assessment is to be adopted by the Water Companies—will have to be dealt with, because it will most materially affect the value of the property, and the future amount of compensation to be awarded to the Companies for giving up the right of charge they now possess. This is all I wish to say upon the question; but I desire it to be understood that I have made these remarks in no spirit of hostility to the Water Companies. I wish to see them fairly dealt with, and in a spirit of strict justice; but in my opinion it would be a monstrous thing that the consequence of passing the Metropolis Valuation Act of 1869, which never in any way contemplated making provision with reference to the water supply of the Metropolis, should be the means of increasing the water-rates of the Metropolis, and of thus putting money into the pockets of the Shareholders in the Water Companies, without in the least degree increasing the quantity of water supplied, or improving the quality of it—an injustice which Parliament never could have intended to sanction when it passed an Act which applied simply to the regulation of local government taxation.

Earl BEAUCHAMP: My lords, the noble Earl has introduced a question which is undoubtedly a very difficult one to deal with—namely, the question of how the Legislature can best deal with the Metropolitan Water Companies in any arrangement which they may hereafter have to make, but more especially with respect to the limitation of their charges, and as to whether the value of the assessment upon which they are entitled to charge depends upon the annual value of property in the Metropolis, as defined by the Metropolis Valuation Act of 1869. Now, my lords, the noble Earl said with great justice that when the Act of 1869 was passed, it was not intended to interfere with the water supply, either in regard to its quality or quantity, or to the rates which were chargeable for it. All this has nothing whatever to do with the Metropolis Valuation Act of 1869, and therefore the rates now charged for water are not levied in respect of that Act, but are imposed by the Companies in virtue of their own private Acts of Parliament, which give them power to charge up to a certain amount. I may, therefore, state at the outset that the charges made by the Companies do not depend upon the Act of 1869, but on the powers conferred upon them by their own Acts of Parliament. The powers given by these Acts are somewhat at variance with each other, and even sometimes at variance with the annual value as fixed by the assessment made under the Metropolis Valuation Act. The noble Earl has asked me whether the Government intend to take any steps to ascertain if the Water Companies are legally correct in claiming to take the annual value at the gross annual value, and whether the valuation under the Metropolis Valuation Act should affect the water-rates. The Companies, I apprehend, receive their rents by virtue of their special Acts of Parliament, and these Acts are all framed upon the principle that the rates shall depend upon the annual value of the premises rated. But the question arises as to what is the annual value so

chargeable. The Metropolis Valuation Act does not in any way affect the annual value of the property chargeable by the Water Companies, but still the Companies are required to prove, in any way they can do so, the annual value of the property on which they make their charges, and they can, of course, make use of any evidence they choose to bring forward to satisfy the justices whose duty it is to hear the cases. No doubt, whenever any fresh valuation of property in the Metropolis takes place, the valuation which has been arrived at under the Metropolis Valuation Act would form a very important element in the minds of the magistrates, in determining what was the actual annual value of the property so rated, but they could only bring forward as evidence the valuation under that Act. It does not in any way affect the valuation of the property itself. The Companies rates are received quite irrespective of the Metropolis Valuation Act; still, these bodies have the right to prove their case in any way they think proper, by the use of any evidence they can command. No doubt the Metropolis Valuation Act of 1869 would afford them very useful evidence as to the value of the property in the Metropolis, and there is equally little doubt that the Companies will avail themselves of that evidence when they apply to magistrates for the regulation of their charges. The noble Earl drew attention to the present position of the ratepayers, and all I can say in regard to them is, that they are in exactly the same position they were in before the Act of 1869 was passed. No alteration whatever has been made, and no new powers have been conferred upon them by the passing of the Act. Before that period they were at liberty to bring forward any evidence they could obtain with respect to the value of the property assessed, and it is quite open to them to adopt precisely the same course now; so that the present position of the ratepayers is neither better nor worse than it was before. With respect to the annual value, I may take it that the annual value of property will always be liable to fluctuation; but, as a matter of fact, we know that the annual value of property does increase in the Metropolis, and so long as the Companies enjoy the powers which Parliament conferred upon them by their special Acts, I do not see any way of escaping. I was in hopes the noble Earl would discover some ingenious mode by which we might be saved from the necessity of giving to the Shareholders their "pound of flesh;" but he has not favoured us with any such scheme, and I must say I think it would be a very strong measure to rescind what Parliament has already granted to the Companies, because, upon the faith of these engagements, their powers have been exercised in the expenditure of large sums of money on capital account. I will not say that Parliament cannot do it, because, as a matter of fact, Parliament can do anything; but I do say that it would not be right that Parliament should act in any such manner. As to annual value, I may say that the question of what is really the annual value of property has not yet been settled by any decision of the Superior Courts; it has been left to the magistrates to decide. However, if any ratepayer is dissatisfied, or has any grievance in consequence of the charges made by the Water Companies, what he has to do now is simply to go to the magistrates, to whom, at present, the duty of defining annual value is relegated. The question has, as I have said, never yet been raised in the Metropolis before any of the Superior Courts; but I believe the Court of Exchequer has decided one provincial case. The matter is one of great difficulty, and I am informed that probably within a short time the question as to what is to be considered the real annual value of property for the purpose of founding the assessment upon it by the Water Companies will be raised. As regards what the noble Earl has said about an expensive litigation before a magistrate, I believe I am right in saying that the proceedings at the present time are extremely simple. The noble Earl complains that the valuation is made, not upon a thorough basis, but because such and such a sum is the result of a particular valuation. There is, however, really no direct power to interfere with the charges of the Water Companies except in the way I have mentioned; but what the noble Earl seems to be determined upon is that the valuation should not depend upon the re-valuation of property made from time to time. He has said that unless some steps are taken, the last position of the ratepayers will be worse than the first. He referred to the Bill which has been recently introduced into the House of Commons; but the question of water supply, either as respects the quantity of water supplied, or its quality, is by no means a question unknown to Parliament. Very important alterations were made by the Act of 1852, which is the first Act that gave anything like a system of efficient control. Then this control was increased and extended by the Act of 1871. The history of the Act of 1871 is rather remarkable. In the early part of the session a Bill was introduced, which contained, among other provisions, powers for the Government to purchase compulsorily the undertakings of the London Water Companies. But the opposition the Bill encountered was so great that the measure had to be withdrawn. Later in the session another Bill was introduced containing most of the propositions of the earlier Bill; but omitting this important clause in regard to the purchase of the Companies undertakings. If, in 1871, when they were able to deal with very large questions, the Government hesitated to proceed by a compulsory measure to take powers to buy up the water undertakings in London, and if no attempt has since been made to revive that scheme, I think your lordships will say how extremely difficult the question must be, and how insuperable the obstacles are which have been thrown in its way. No doubt the abandonment of that part of the Bill has made it very difficult indeed for Parliament ever to approach this large question of the purchase of the water undertakings by compulsion. A great deal has been done by that measure in the way of regulation, and the improvement in the quality of the water supplied; but the question of compulsion—that is, taking the water-works by compulsion—is not, and cannot be raised again. With regard to the second Bill of 1871, which subsequently became law, I need not trouble your lordships by going into the matter. It is sufficient to say that the Government of that day were obliged to abandon the measure which they proposed for the compulsory purchase of the interests of the Water Companies. The Bill which was introduced by the present Government at the beginning of this session has been withdrawn, but the attention of the Government to the matter has been by no means relaxed, and I venture to say that it is one of the earliest matters that will demand and obtain the attention of the new Parliament. A great deal has been said with regard to the terms upon which the compensation is to be arranged, but the noble Earl did not go into the question of what was said to be the enormous compensation to be given to the Companies in the Bill introduced into the House of Commons. I do not wish to enter on that question further than to say that I think a great deal of exaggeration has been imported into the discussion, and it seems to me that sufficient consideration has not been given to the great difference which exists between the payment of $3\frac{1}{2}$ per cent. upon a large capital and a larger percentage on a very much smaller one. I think the ratepayers would really be benefited by the terms which were proposed, although, no doubt, they involve very large amounts—much larger, indeed, than those which have been expended. I will not take up your lordships time by going into the statistics which I have before me, but I wish to say this, that in a very short time—I may say that twelve years is a very short time in the history of a large question like this—during twelve years a

large relief has been afforded to the ratepayers, and if the scheme of the Government had become law, by the year 1900—that is, ten years less than the period which has elapsed since legislation upon this question took place—very considerable relief would be afforded to the ratepayers in respect to charges for water. It is to be remembered that a question of this magnitude, involving the supply of one of the first necessities of life to a population of over $4\frac{1}{2}$ millions, scattered over an enormous area, requires to be dealt with in a large sense, and must necessarily require the use of machinery and money on a most extensive scale. I will not pursue the Bill of 1880 further than to say that by it the question has been brought face to face alike with Parliament and the Water Companies, upon the basis of an arrangement between them; and when the scheme is more fully considered, I think it will be found that there is a great deal more to be said for it than has hitherto been said. With regard to the question which the noble Earl has put with respect to the operation of the Metropolis Valuation Act of 1869 in the matter of the charges made by Companies for the supply of water, it does not bear immediately upon the other and still more important question of the supply of water to the Metropolis, and all that can be said with reference to these charges is that they at present are made under the Companies own special Acts of Parliament. I think, therefore, the question that has been asked by the noble Earl has been put under a misconception of the case, and that he has failed to point out any practical means by which the ratepayers may escape from the position in which they are now placed, or remedy the evils of which he has complained.

Earl FORTESCUE said a great deal of the disadvantage under which the ratepayers of the Metropolis laboured in regard to the supply of water, of good quality and in sufficient quantity, arose from the defective principles which had been adopted by the Legislature when they first conferred upon the Water Companies the powers they now enjoyed. In other large towns in the kingdom the Local Authorities had taken into their own hands this important question of the water supply, and the ratepayers of those towns were now reaping the benefit of the success of the measures which had been adopted. No such action had been taken by the Metropolitan Local Authorities, and now the enormous compensation which was demanded rendered legislation on this question almost impossible. The public did, however, possess some power of regulating the Companies, and this he considered they might use with advantage to the consumers, and none of them would be more useful or more generally acceptable to the ratepayers than that the Companies should be compelled to give them a constant supply of pure water at high pressure. The conditions insisted upon in the Companies private Acts, in his opinion, constituted a claim for a very considerable diminution in the aggregate amount of the compensation to which the Companies were entitled. Those conditions could not be conveniently increased, and the result was the large present income they enjoyed, and the prospective increase of it which must naturally be the outcome of the increase in the valuation under the Metropolis Valuation Act, 1869. With respect to the Bill which had been introduced and withdrawn during the present session, all he would say was, "*De mortuis nil nisi bonum*;" but the late Bill was, no doubt, a *bona fide* attempt on the part of the Government to bring about a result which, in the main, would be most desirable, and which he had been for many years anxious to see accomplished in the Metropolis.

The subject then dropped.

Petitions against the Rathmines and Rathgar Township (Vartry Water Supply) Bill were presented from (1) Rathmines and Rathgar Township Improvement Commissioners; (2) Corporation of Dublin.

HOUSE OF COMMONS.

TUESDAY, MARCH 16.

METROPOLIS WATER-WORKS PURCHASE BILL.

Mr. E. JENKINS asked the Secretary of State for the Home Department whether he is aware that large operations took place on the Stock Exchange in Metropolitan Water Companies shares in anticipation of the scheme presented to Parliament; whether he has any reason to believe that the details of that measure were communicated to persons outside the Home Office before it was made public, and if so, if he has caused any inquiry to be made to ascertain the parties guilty of such disclosures; and whether it is to be taken that the present scheme has been finally abandoned.

Mr. CROSS: I have no means of information, as to the first part of the question, other than that in the possession of the honourable member. As to the second part of the question, if I had reason to suspect that any information had been given, as to the details of the measure, by any of the officials at the Home Office, I would readily join with the honourable member in the opinion that means ought to be taken to ascertain the guilty persons; but I have no reason for such suspicion. I took such precautions in the matter as would render any information being given by the officials in the Home Office absolutely impossible; and I have letters in my hand from the professional gentlemen who assisted me, giving assurances that nothing could have escaped from them. As to the last part of the question, I know that the Vestries have met to consider the subject; but I have not yet received the memorial which I understand I am shortly to receive from them, praying that the matter may be carefully investigated. If time had allowed this session, I should have been able to show clearly what advantages the ratepayers would have received under the Bill; but we must remember that the final decision must have rested with a Committee of the House (before whom all parties would have been heard), after hearing what the ratepayers had to say. If we should find ourselves in our present position in the next Parliament, we shall certainly consider it to be our duty to deal with what we must look upon as the great question of a sufficient supply of pure water for the Metropolis; and we should hope to put before Parliament such a scheme as would secure the confidence of all classes concerned.

WEDNESDAY, MARCH 17.

The petition of the Hinckley Gaslight and Coke Company against the Hinckley Local Board Bill was withdrawn.

FRIDAY, MARCH 19.

A petition against the Chester Gas Bill was presented from the Corporation of Chester.

COURT OF REFEREES.—MONDAY, MARCH 8.

(Before Mr. L. PEMBERTON, Chairman; Mr. A. BONHAM-CARTER, Mr. RICKARDS, and Mr. FORSYTH.)

LIVERPOOL UNITED GAS BILL.

The Midland Railway Company having petitioned against the Bill of the Liverpool United Gas Company, their *locus standi* was objected to, and the case came on for hearing this day.

Mr. MICHAEL, Q.C., appeared for the promoters of the Bill; and Mr. VENABLES, Q.C., for the petitioners against it.

Mr. VENABLES, in arguing for the *locus standi* of the Midland Railway Company, said the Liverpool United Gas Company had introduced a Bill

into Parliament this session, in which, among other things, they sought authority to manufacture gas on a plot of land, about 14 acres in extent, which adjoined their present premises. The petitioners, on the other hand, were promoting a Bill in the present session for the purpose of constructing a line of railway, called the Bootle branch, a portion of which would pass under the plot of land in respect of which the Gas Company were seeking powers. The land in question belonged to the Gas Company, who had power at the present time, however, to use it for storage purposes only, and before they could manufacture gas on the site they were obliged to come and obtain further legislative authority. The petitioners had at the present time no power to construct their branch line, but the fact that they were seeking this authority gave them, he contended, a right to be heard against the Gas Company's Bill. If the land had belonged to a third party, and both the Gas Company and the Railway Company had sought compulsory powers in respect of it, there could have been no objection to the *locus standi*. It was always understood that when promoters asked for compulsory powers to deal with land which they already possessed, it gave to another party also applying for such powers a right to *locus standi*. The Gas Company, he pointed out, were seeking to be owners in an entirely different sense from that in which they were now owners. At present they were owners with certain limited powers, which they asked to be extended, and in all probability the construction of gas-works on the land would interfere with the construction of the petitioners railway beneath it. The question for the consideration of the Referees, therefore, was whether the objects of the two parties could be met.

Mr. MICHAEL said it did not follow, as a matter of course, that when two parties, as promoters, sought to take the same land, *locus standi* should of necessity be granted to both. It must be shown that it was absolutely essential that one or other must have powers granted; but not both. The Midland Railway Company were the promoters of a Bill which the Gas Company would be forced to oppose, and then the whole question as to the land would be discussed. As it was, the petitioners forced the Gas Company to show that the land in question was suitable for their purposes, thus proving a negative that the Railway Company ought not to have the land for their purposes. If *locus standi* was granted to the latter, he argued that it was unnecessary, because the whole matter must be gone into in committee on the Midland Railway Company's Bill. If it was refused, the promoters in that case would not be in a worse position.

The CHAIRMAN, in the end, said the Referees were of opinion that the *locus standi* should be disallowed.

[The Gas Company's Bill consequently was unopposed. On the following Friday it passed through committee; and (as noted on p. 440) was reported to the House.]

Miscellaneous News.

HARROW DISTRICT GAS COMPANY.

The Half-Yearly General Meeting of this Company was held at the Guildhall Tavern, London, on Wednesday, the 10th instant—JAMES GLAISHER, Esq., F.R.S., in the chair.

The ENGINEER and SECRETARY (Mr. J. L. Chapman) read the notice convening the meeting, and the following report and accounts were presented:—

The Directors have pleasure in again laying before the Proprietors the half-yearly statement of accounts.

There is a slight decrease in the gas-rental, caused by the depressed condition of trade, but still by careful management the profits have been increased.

The balance of profit and loss account shows a total of £1174 1s. 8d. The Directors recommend that a dividend at the rate of 6 per cent. per annum be paid (free of income-tax), and that £200 be written off the parliamentary expenses, which will leave a balance of £21 11s. 8d. to be carried forward to the next account.

One of the Directors, Mr. A. H. Baynes, F.R.A.S., and one Auditor, Mr. F. G. Fenton, retire by rotation, who, being eligible, offer themselves for re-election.

Revenue Account, for the Half Year ended Dec. 31, 1879.		Cs.
Coals, including all expenses	£1119 15 8	
Purifying materials, &c.	33 14 1	
Salary of Engineer	125 0 0	
Wages	206 10 1	
Maintenance of works, &c.	258 12 2	
Repair of mains and service-pipes	53 18 1	
Renewing and refixing meters	13 9 5	
Lighting public lamps	27 3 6	
Rent, rates, and taxes	163 18 8	
Directors and Auditors	150 0 0	
Salary of Secretary	25 0 0	
Collector's commission	30 0 0	
Stationery and printing	17 2 3	
General establishment charges	72 4 2	
Bad debts	4 3 8	
Total expenditure	£2300 11 4	
Balance	1351 6 11	
	£3651 18 5	
Sale of gas—		
Michaelmas quarter:		
Private rental, 2,269,900 feet, at 6s.	£680 19 2	
Ditto, 308,800 feet, at 6s. 3d.	96 10 1	
Public rental & by contract	63 7 6	
	£840 16 9	
Christmas quarter:		
Private rental, 5,884,600 feet, at 6s.	£1765 7 8	
Ditto, 936,500 feet, at 6s. 3d.	292 13 5	
Public rental & by contract	172 9 0	
	2230 10 1	
Meter-rental, the half year	70 19 0	
Residual products—		
Coke, less labour and cartage	345 15 10	
Tar, " " " "	77 0 3	
Sulphate of ammonia	50 16 4	
	£3651 18 5	

The CHAIRMAN, in moving the adoption of the report, said it was very much like the others which had been presented at their half-yearly meetings, but the Shareholders attention possibly might have been attracted by the large increase in the capital account as compared with previous half years. This arose from the fact that they found the Pinner Gas Company were laying pipes, and were within two or three yards of the boundary of the Harrow Company's district; and that the former Company were really coming into the Harrow district to supply a very large house. The Board at once prevented them from entering their district; but, of course, it became a matter of anxiety with them as to whether they should go into the Harrow Weald. It was a question of two or three miles of pipe being laid, and with a sparse population; but it seemed to the Board that this sparse population might be only for a time, and that as the Company would in all probability get a fair return for their money, they had better maintain their rights; and the decision of the Board was to lay the pipes into the Harrow Weald. They had done so, and this accounted for the increase in the capital account. He was sure that the matter was carefully considered, and he had no doubt it would have the Shareholders approval, because the capital had returned a fair amount up to the present time, and he had no doubt it would return an increased amount in the future. It would be seen in the second paragraph of the report that mention was made of there having been a slight decrease in the gas-rental. This was breaking the rule they had hitherto had, for usually there had been a slight increase; but in looking to the cause of it—it was stated in the report to be owing to the depressed condition of trade—it was found that one of their largest customers, the Greenford Colour-Works, had been

so affected by the depression that they had consumed only half their usual quantity of gas; they had used from 100,000 to 150,000 feet of gas less in the half year than they had been in the habit of using. Then the railways had applied economy to the extent that the stations the Company supplied had used about 150,000 feet less of gas. This fully accounted for the slight decrease they had had in their rental. The sentence announcing this fact, however, closed with the statement that the profits had been increased, and this enabled the Directors to recommend the customary dividend, to pay off the usual amount from the parliamentary expenses, and to carry forward a small balance; so that, looking to the report in all its phases, he thought it would be seen to be satisfactory. The railway to which he had alluded on different occasions was now so far advanced that he was told it would certainly be opened on the 1st of June, and if this were so, he thought there was a certainty that the Company would have their coal very much cheaper in the ensuing winter than they had ever had it, and, as he had told the Shareholders before, whatever reduction they obtained in their coal they would apply in breaking through the heavy charge of 6s. per 1000 feet for their gas. They looked on the consumers as their best friends, and they wished to be working with them as far as possible. Therefore the full advantage of any reduction which the Company might obtain would at once be given to them, and it would be a pleasure to himself to do so, because he had always looked on the price of 6s. as being something they must alter as soon as they possibly could. This would be the first opportunity they had had. He did not know that there was anything further for him to say, inasmuch as the accounts gave so fully the financial position of the Company.

The DEPUTY-CHAIRMAN (Mr. John Chapman), in seconding the motion, said he quite concurred in what the Chairman had said as to the wisdom of extending their mains into the Harrow Weald, which would by-and-by become a most important part of the Company's district. As regarded the railway, all the bridges across the roads were completed, or nearly so, and there were only about 30 yards of line to be made to complete the system from St. John's Wood right through into Harrow Station, which was almost ready to be covered in. He thought the line was to be opened on the 1st of May. The Chairman had sometimes put before the Shareholders the prospect of 8 or 10 per cent. when this railway was completed, and therefore those dividends might not now be far off. With a reduced price of coal and a reduced price of gas, they hoped to see a large dividend for the Shareholders.

The motion was carried unanimously, as were others recommending the payment, free of income-tax, of dividends of 6 per cent. on the 10 and 7 per cent. capital of the Company, and that £200 be written off the parliamentary expenses.

The retiring Director and Auditor were unanimously re-elected, and briefly returned thanks.

The CHAIRMAN next moved a vote of thanks to the Resident Engineer and Secretary (Mr. J. L. Chapman, A.I.C.E.), and said that the Company were so dependent on the Engineer that, if he were to be careless and lose interest in the business, they would fall behind; but he thought the report showed that their Engineer had left no stone unturned to do the best he could for the Company.

Mr. C. HORSLEY, C.E., in seconding the motion, said he believed no more money was spent than in the case of any other company. He thought, as the Chairman had said, that the working must have been good to enable them to pay 6 per cent. on this occasion.

The motion was then carried unanimously.

Mr. CHAPMAN, in reply, said he certainly took a personal interest in the Company. He had begun with the Company, and hoped to continue with it, and he trusted they would soon get into the happy position of being able to pay 10 per cent.

On the motion of the CHAIRMAN, seconded by the DEPUTY-CHAIRMAN, a vote of thanks was passed to the Auditors.

Mr. A. H. BAYNES moved a cordial vote of thanks to the Chairman, saying that he did so feeling very much its force and justice. He could assure the Shareholders that no gas company could be better presided over than theirs was by Mr. Glaisher. He said this without the slightest affectation, and from his intimate personal knowledge of that gentleman's administrative ability. He congratulated himself as one of the Shareholders, that they had a gentleman of Mr. Glaisher's position to preside over their destinies.

Mr. T. C. HUDSON expressed his pleasure at seconding the motion. He had been on the direction from the beginning, and could, therefore, speak of Mr. Glaisher's value. He was always at his post, and ever ready to do the very best he could for the Company.

The motion was carried unanimously.

The CHAIRMAN, in reply, said he had hitherto done the best he possibly could for the Company, and would continue to do so. It was his duty, in redemption of the trust they had placed in him, and he would do all that lay in his power to advance the interests of the undertaking.

On the motion of Mr. G. RANDALL, seconded by Mr. KILSBY, a vote of thanks was passed to the Directors, to which

The DEPUTY-CHAIRMAN briefly replied, and the proceedings terminated.

PHOTOGRAPHING BY GASLIGHT.—We have received from Mr. C. E. Jones, the Manager of the Chesterfield Gas Company, a photograph, the negative for which was taken by gaslight without any reflecting arrangements being employed. It is due to Mr. P. Turner, the artist, to state that, after a few trials, he succeeded in producing, by gaslight pure and simple, a very creditable photograph indeed. Mr. Jones placed a large Wigham burner and lamp, in a spare building on the gas-works, at Mr. Turner's disposal, and he, together with other artists, some of whom came from Sheffield, have tried the experiment of obtaining a gaslight photograph without the aid of reflectors. The copy of the photograph sent us shows that the actinic power of gaslight is very great, and, when properly employed, is sufficient for all purposes, if not equal to the sun itself, for photography.

SITTINGBOURNE GAS COMPANY.—The annual general meeting of this Company was held on Monday, the 1st inst., when the report presented by the Directors was of a very satisfactory character. The accounts showed the continued success of the Company, and not only justified the course taken by the Directors in reducing the price of gas last year, but enabled them to make a further reduction to 4s. 2d. per 1000 feet in the town and 4s. 7d. in the outlying districts, to take place on and after the 31st inst. It appears from the balance-sheet that the total share capital paid up is £22,000, in addition to which there is a loan of £3200. The total receipts for the year amounted to £4764 6s. 7d.—viz., sale of gas, £3774 9s. 9d.; rental of meters, £44 0s. 4d.; residual products, £806 5s. 11d.; fittings account, £139 10s. 7d. The total expenditure was £2992 14s. 10d., so that there was a profit of £1771 11s. 9d. The report and accounts were unanimously adopted. A dividend at the rate of 7 per cent. per annum, free of income-tax, was declared; £200 was set aside to form a reserve-fund; and the balance of £202 4s. 8d. was carried forward. The retiring Directors, Messrs. Payne and Chapman, were unanimously re-elected, as was Mr. R. Whibley, the retiring Auditor.

**SCHEME FOR THE AMALGAMATION OF THE
SOUTH METROPOLITAN GAS COMPANY WITH THE PHOENIX
GASLIGHT AND COKE COMPANY,
UNDER THE POWERS AND PROVISIONS OF THE SOUTH METROPOLITAN
GASLIGHT AND COKE COMPANY'S ACT, 1876, AND THE ACTS INCORPORATED
THEREWITH.**

(Confirmed by Order of Her Majesty in Council, March 18, 1880.)

Commencement of Operation of Scheme.

1. This scheme shall come into operation on the 1st day of January, one thousand eight hundred and eighty, and all the provisions therein shall take effect on and from that date.

Amalgamated Company to be called South Metropolitan Gas Company.

2. The two Companies—that is to say, the South Metropolitan Gas Company and the Phoenix Gaslight and Coke Company, hereinafter respectively styled the South Metropolitan Company and the Phoenix Company—shall, except for the purpose of declaring a dividend for the half year immediately preceding the amalgamation, cease to exist as separate Companies, and the undertakings of the two Companies shall be united and form one undertaking, under the name and title of the South Metropolitan Gas Company, and by that name shall be one body corporate, with perpetual succession and a common seal.

Works and Properties of the Two Companies vested in the United Company.

3. All the lands, estates, property, plant, and effects, including all the gas-works, buildings, mains, pipes, meters, fittings, and conveniences connected therewith, and also all the moneys, books, rents, rates, claims, and demands whatsoever of or belonging to either of the said two Companies, shall be vested in the United Company to the same extent and for the same estate and interest as they were vested in either of the said two Companies separately.

All Rates payable to United Company.

4. All rates, rents, and charges owing to either of the two Companies shall be payable to the United Company, and shall be recoverable by such Company by the same ways and means, and subject to the same conditions as they would have been recoverable by either of the two Companies respectively but for this amalgamation.

Debts, &c., of the two Companies to be Debts of the United Company.

5. All debts, moneys, dividends, claims, and liabilities of every description due by, or recoverable from, either of the two Companies shall in like manner be due by and recoverable from the United Company, and all cheques for such or any other purposes shall be signed by two of the Directors of the United Company, and countersigned by the Secretary.

Contracts, Agreements, &c., preserved by the United Company.

6. All debts and liabilities of every description, and all purchases and agreements for purchases, contracts, sales, conveyances, and securities incurred or entered into by either of the two Companies before the amalgamation, shall be as valid and effectual to all intents and purposes for and against the United Company as if the same had been incurred by and entered into with the United Company instead of with either of the two Companies.

Actions or Parliamentary Proceedings not to Abate.

7. Nothing in this scheme shall prevent any action, suit, or other proceedings promoted by or against either of the two Companies, either separately or jointly, commenced before and pending on the said 1st day of January, whether in Parliament or at law or in equity, being continued, prosecuted, or enforced by or against the United Company, or by or against either of the two Companies, as the case may require.

Books to be Evidence.

8. All books, accounts, and documents which would have been evidence in respect of any matter for or against either of the two Companies, shall be admitted as evidence in respect of the same or the like matter for or against the United Company.

Accounts of the two Companies to be made out separately up to Dec. 31, 1879.

9. The two Companies shall make up their accounts to the 31st of December in the usual form and mode, and such accounts, when approved of and certified by the respective Auditors, shall be taken as correct, and all dividends, debts, claims, and liabilities shown therein as due from either Company shall forthwith be paid and satisfied by the United Company, and the balances remaining after all liabilities have been discharged shall, subject to the provisions of the South Metropolitan Company's Act, 1876, be dealt with as the Directors think fit.

Application of the Reserve-Fund.

10. The reserve-fund of the Phoenix Company shall be added to the reserve-fund of the South Metropolitan Company, and form the reserve-fund of the United Company.

Registers of Amalgamating Companies to subsist until replaced.

11. All registers of shares, mortgages, bonds, and debenture stock of either of the two Companies, and all registers of transfers thereof respectively, and all shareholders address-books, and all certificates of shares or stock of and in either of the two Companies which are valid and subsisting at the commencement of this scheme, shall continue to be valid and subsisting, and shall have the same operation and effect after as before such commencement, until new or altered registers, books, and certificates respectively are substituted in their stead in pursuance of this scheme.

Resolutions, &c., continued.

12. All resolutions, orders, and proceedings of general meetings and Boards of Directors, which, at the time of this amalgamation are binding on either of the two Companies, or their respective Shareholders, Directors, Officers, or Servants, or any of them, shall, so far as they are applicable, continue in full force and be binding on the United Company, and their Shareholders, Directors, and Servants accordingly, until the same be varied, altered, or repealed by order of a general meeting or a Board of Directors of the United Company, as the case may require.

General Saving of Rights and Claims.

13. Everything done, suffered, and confirmed by or relating to either of the two Companies before the commencement of this scheme, shall be as valid as if this scheme had not been confirmed, and the commencement of this scheme shall, except only as is in this scheme otherwise expressly provided, be subject and without prejudice to everything so done, suffered, and confirmed respectively, and to all rights, liabilities, claims, and demands, and all parliamentary proceedings, both present and future, which would be incident to, and consequent on, any and every thing so done, suffered, and confirmed respectively; and with respect to all such things so done, suffered, and confirmed respectively, and to all such rights, liabilities, claims, and demands, the United Company shall to all intents and purposes represent both of the amalgamating Companies.

CONSTITUTION AND REGULATION OF UNITED COMPANY.

Provisions of existing Acts continued.

14. The Acts relating to or affecting the South Metropolitan Company and the Phoenix Company in force at the date of the commencement of

this scheme shall, except so far as the same are varied by or inconsistent with this scheme, remain in full force; and all rights and powers of such Acts, or any of them, conferred on and vested in either of the two Companies in relation to the undertaking of such Company, may be enjoyed and exercised by the United Company: Provided that in the event of the provisions of any Act of the Phoenix Company being inconsistent with those of any Act or Scheme of Amalgamation of the South Metropolitan Company, the provisions of the Acts and Scheme of Amalgamation of the last-named Company shall (except otherwise specially provided by this scheme) prevail and be observed by the United Company.

Half-Yearly Meetings.

15. The half-yearly general meetings of the United Company shall be held so soon after the 31st of December and the 30th of June in each year as the Directors may deem expedient, but not later than the months of April and October respectively.

Directors of the United Company.

16. The number of Directors of the United Company shall be ten, subject to reduction to eight in manner following, that is to say:—The first Directors shall consist of six from the South Metropolitan Board, and four from the Phoenix Board; but no vacancy occurring by death, retirement, or disqualification shall be filled up until the number be reduced to eight, and after the number shall be reduced to eight, the number shall not be more than eight nor less than seven; but when the present Secretary and Engineer of the South Metropolitan Company shall retire, he may be appointed a Director, and thereupon the number of Directors may be increased by one until the next vacancy, when it shall be again reduced to eight or seven, as the case may be.

Remuneration to the Directors.

17. The fees payable to the Directors continuing in office shall, subject to the provisions of the South Metropolitan Company's Special Act of 1842, not exceed the rates following, that is to say:—

If the number be 10	£4000
" " 9	3700
" " 8	3400
" " 7	3100

But if the number be at any time increased by the appointment of the present Secretary and Engineer of the South Metropolitan Company, as provided in the preceding section, the fees shall be increased in like proportion.

Retiring Allowances.

18. The compensation payable to any Director vacating his office by reason of this amalgamation shall, if he retire immediately upon the confirmation of this scheme, be equal to seven years purchase of the fees receivable by him in the year preceding the amalgamation; but if the number of Directors be not reduced to eight at the confirmation of this scheme, any two Directors, either separately or together, may, within a period of two years therefrom, retire and receive compensation at the rate aforesaid; that is to say, if they retire within the first year from the confirmation of the scheme, six years purchase of the fees receivable in the year preceding the amalgamation, and if within the second year, five years purchase of the fees receivable in the said year: Provided that all the present Directors of the two Companies may respectively receive their customary fees until the scheme is confirmed.

Rotation of Directors.

19. At the first ordinary meeting to be held in every year after the confirmation of this scheme two Directors shall retire from office, and the Shareholders present in person or by proxy shall elect persons to supply the places of the Directors then retiring from office, agreeably to the provisions in the Companies Clauses Consolidation Act, 1845; and the persons elected at any such meeting, being neither removed nor disqualified, nor having resigned, shall continue to be Directors until others are elected in their stead, in manner provided by the same Act.

Auditors—Remuneration and Retiring Allowances.

20. The Auditors of the two amalgamating Companies in office at the date of the commencement of this scheme shall continue in office until the first general meeting at which the Auditors are appointed held by the United Company. At that meeting the Shareholders of the United Company shall elect three Auditors, and thenceforth the number shall be three, and the remuneration shall not be more than £75 per annum each, and any person being an Auditor of either of the two Companies at the time of the amalgamation, who is not elected an Auditor for the United Company at the said general meeting, shall be entitled to a gratuity equal to two years salary.

Officers, &c., of the two Companies to be Officers, &c., of United Company.

21. All officers and servants in the employment of either of the two Companies at the time of the amalgamation shall hold their respective offices and employment, and be deemed to be officers of, or persons employed by the United Company, until removed in pursuance of this scheme, and they and their respective sureties (if any) shall, for the purpose of any liability incurred by them respectively in respect of such employment and suretyship, be deemed respectively to have been employed by, and become bound to the United Company, in the place of either of the said two Companies.

Salaried Officers to receive Annuity for Life.

22. Subject to the provisions hereinafter contained, every salaried officer of either of the two Companies who at the time of the amalgamation has been employed by either of such Companies for five years or more, and whose office and employment is abolished, or whose services are dispensed with in consequence of this amalgamation, shall be paid by the United Company during his life an annuity, payable quarterly, equal, if he had been in the service of either of the amalgamating Companies 20 years or more, to two-thirds of the annual emolument derived by him from his office at the date of the commencement of this scheme; and with respect to any such person who has been in such service less than 20 years, the said annuity shall be diminished at the rate of one-twentieth part for every year less than 20 years during which he has been in such service.

Annuities may be Compounded for by Payment of a Principal Sum.

23. Any annuity payable under the preceding section, or any retiring allowance or pension granted to any officer of either of the two Companies previously to the amalgamation, may, with the consent of the United Company and of the annuitant, be compounded for by payment of the principal sum for which an annuity of the amount would be purchasable under the table regulating the granting of annuities by the Postmaster-General. And any such principal sum, together with the amount of any retiring allowances granted to Directors in pursuance of this or the scheme for the amalgamation of the South Metropolitan and Surrey Consumers Companies, confirmed by order of Her Majesty in Council, dated Oct. 28, 1879, shall be a charge upon the general funds of the United Company, which shall be liquidated by the 1st of January, 1881.

Salaried Officers not entitled to Annuity may be Compensated.

24. The United Company may pay to any salaried officer whose office is abolished or whose services are dispensed with in consequence of this

scheme, and who is not qualified to receive an annuity under section 22, a sum of money not exceeding one year's emolument by way of compensation for the loss of such office.

Annuity may be Increased by Sanction of Board of Trade.

25. The annuity or sum of money payable under either of the last two preceding sections may, in the case of an officer who has rendered special services to either of the two Companies, with the special sanction of the Board of Trade be increased to a larger amount than is authorized in those sections respectively.

Gratuity to Weekly Servants.

26. A gratuity not exceeding three months pay may be given to any weekly servant whose services may be dispensed with in consequence of this amalgamation.

Decision as to Offices Abolished.

27. The decision of the Board of Directors of the United Company as to whether an office or employment has been abolished, or whether any services have been dispensed with in consequence of this amalgamation, shall be final and without appeal in any case, except that the present

Secretary and Engineer of the South Metropolitan Company may, at any time within four years from the confirmation of this scheme, retire from those offices and receive, under the provision of clause 22, an annuity or retiring allowance of the same amount as he would have received if he had retired at the commencement of this scheme; and such annuity, if compounded for, shall be computed at the same amount as it would have been at that date.

Capital.

28. Upon this scheme coming into operation, the authorized capitals of the two Companies shall constitute the capital of the United Company. The £360,000 stock of the Phoenix Company, limited to a dividend of 7½ per cent., and the £144,000 stock, limited to a dividend of 5 per cent., shall be respectively converted into equivalent amounts of B stock, limited to a dividend of 10 per cent., under the sliding scale, at the standard price of 8s. 6d. per 1000 feet—viz., the £360,000 into £270,000, and the £144,000 into £72,000, and shall be entitled to all the benefits and incidents of such stock. The capital of the United Company shall be classed A, B, and C, respectively, in accordance with the following

Table of Capital.

Name of the Company.	Acts relating to the two Companies.	Amount authorized by each Act.	Total of each Class under this Scheme.	Called up.	To be Called up.
	A CAPITAL.	£	£	£	£
South Metropolitan Company	Order in Council dated Oct. 28, 1879	500,000	500,000	500,000	—
	B CAPITAL.				
South Metropolitan Company	Order in Council	250,000	1,350,000	1,305,000	18,000
" "	Portion of the unissued capital of £250,000 referred to in the Order in Council	18,000			
Phoenix Company	5 Geo. IV., cap. 78, 1824	540,000			
	7 & 8 Vict., cap. 159, 1864	200,000			
	" "	270,000			
	" "	72,000			
	C CAPITAL.				
South Metropolitan Company	Remaining portion of the unissued capital of £250,000 referred to above	232,000	232,000	—	232,000
Total		—	2,082,000	1,805,000	277,000

The unissued capital of £277,000 shall be called up in the following order, viz.:—

First.—The calls outstanding upon the £360,000 stock of the Phoenix Company, limited to a dividend of 7½ per cent., in amount £36,000, which shall be paid in full, but when paid shall be converted into £27,000 B stock.

Second.—The £18,000 of new capital to be created by the South Metropolitan Company as B stock.

Third.—The £232,000 of C stock.

Dividend on Different Classes of Shares.

29. The three classes, A, B, and C, shall participate equally in the profits up to 11 per cent. ; but in the event at any time of a larger dividend than 11 per cent. being payable on the said three classes, one-half of such larger dividend beyond 11 per cent. that but for this agreement and scheme would be payable to the holders of B capital, shall be paid to the holders of A capital, in addition to their own proportion of such larger dividend as aforesaid.

United Company to issue New Certificates.

30. The United Company shall, as soon as may be after the confirmation of this scheme, convert all the shares into stock, and call in all certificates in the Phoenix Company, and issue in lieu thereof, and at their own expense, new certificates specifying the class to which they belong, in the name of the United Company.

Borrowing Powers.

31. The amount authorized to be borrowed by the United Company shall be the aggregate of the amounts authorized to be borrowed by the special Acts of the two Companies respectively, and which at the date of this amalgamation are as follows, viz:—

	Authorized.			Issued.			To be Issued.		
	£	s.	d.	£	s.	d.	£	s.	d.
<i>South Metropolitan Company.</i>									
32 & 33 Vict., c. 130, 1869.	62,500	0	0	62,500	0	0	—		
59 & 40 Vict., c. 229, 1876.	187,500	0	0	—			187,500	0	0
17 & 18 Vict., c. 94, 1854.	35,000	0	0	35,000	0	0	—		
26 Vict., c. 37, 1863.	25,000	0	0	25,000	0	0	—		
Totals	310,000	0	0	122,500	0	0	187,500	0	0

United Company may exercise Powers of raising Capital.

32. The United Company may exercise in its own name the powers possessed by the two Companies at the date of the amalgamation, of raising capital by shares or by borrowing, in the same manner and to the same extent as either of the said two Companies might have done before the amalgamation; but, in exercising the further borrowing powers of £187,500, the United Company shall give the Proprietors of A capital the option of taking it up before offering it to the Proprietors of any of the other classes.

District of the United Company.

33. The district to be supplied by the United Company shall be the districts now supplied by the two Companies respectively, and the provisions of the South Metropolitan Company's Act, 1876, respecting the illuminating power and purity of the gas to be supplied and the price to be charged for the same, and as to the appointment of Referees and Examiners to test the illuminating power and purity, and also the provisions for the regulation of the dividend to be paid to the Shareholders by the price charged to the consumer, and the appointment of a Public Auditor by the Board of Trade to examine the accounts, and other matters, shall apply to the United Company and the whole of the district supplied by them, and the bye-laws, restrictions, orders, and proceedings of the

South Metropolitan Company shall continue in force with, and be applicable to the United Company.

Provided that the penalties imposed by sections 51 and 52 of the South Metropolitan Company's Act, 1876, respecting deficiencies in the illuminating power or purity of the gas supplied in the district of that Company, shall not apply to the gas supplied in the district of the Phoenix Company until twelve months after the confirmation of the scheme.

Provided also that if the price of three shillings and fourpence, now charged in the district supplied by the Phoenix Company, is maintained at that or any lower rate, and the price of three shillings, now charged in the district supplied by the South Metropolitan Gas Company, is continued at that or any lower rate, the United Company may, for a period of twelve months after the commencement of the amalgamation, pay dividends on the capital of each Company respectively, according to the price charged in the district of each Company, as prescribed by section 21 of the South Metropolitan Company's Act, 1876, and subject nevertheless to clause 30 of the scheme of amalgamation between the South Metropolitan and the Surrey Consumers Companies.

United Company may Sell and Dispose of Lands.

34. The United Company may from time to time sell and dispose of any of their lands and plant which may not be required for the purposes of their undertaking, and a resolution of a general meeting that any of the said lands or plant are not so required shall be sufficient evidence thereof. The proceeds of any and every such sale shall be applied to the general purposes of capital in the United Company.

Interpretation of Scheme.

35. If any question arises as to the interpretation of this scheme, whether in connection with the said Acts relating to or affecting the two Companies or otherwise, the same may be referred to the Board of Trade for their decision, and the decision of the Board of Trade thereon shall be final.

United Company to pay Costs of Amalgamation.

36. The United Company shall pay all the expenses of and incidental to the closing of the accounts of the two Companies respectively, and of and incidental to their amalgamation.

METROPOLIS GAS SUPPLY.

THE METROPOLITAN BOARD OF WORKS AND THE LONDON GAS COMPANY'S BILL.—At the meeting of the Board last Friday, the Parliamentary Committee reported, with reference to the Bill of the London Gas Company by which they seek power to sell or let on hire apparatus for the use of gas for other purposes than lighting, that the Board in their petition asked that the amount of capital which the Company might expend for the purposes of the Bill should be limited to £25,000. The Company's Parliamentary Agents had now written to state that while not admitting the right of the Board to appear against the Bill, the Company were willing to insert a provision to the effect that the amount of capital to be applied to the purpose of carrying out their proposal should be limited to £20,000. The object of the Board being thus attained, the Committee recommended that the petition should be withdrawn; and this recommendation was agreed to.

METROPOLIS WATER SUPPLY.

The following is Dr. Frankland's report on his analyses of the water supplied to London during February:—"Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies, and by the Tottenham Local Board of Health, was—Kent, 1·3; Colne Valley, 1·5; Tottenham, 1·7; West Middlesex, 2·8; Chelsea, 4·1; East London, 5·3; New River, 6·0; Lam-

beth, 6.1; Grand Junction, 7.0; Southwark, 7.0. The Thames water supplied by the West Middlesex Company, though inferior to that sent out by the same Company in November, December, and January last, was of much better quality than that delivered by any other Company drawing either from the Thames or Lea. The Chelsea Company's water was also much less impure than the supplies taken from the same source by the Southwark, Grand Junction, and Lambeth Companies, who distributed water in a condition quite unfit for dietetic purposes. The water of the Grand Junction and Lambeth Companies was slightly turbid, and contained moving organisms. The Lea water, delivered by the East London Company, was superior to the worst samples of Thames water; but that sent out by the New River Company was much polluted by organic matter, and was not fit for dietetic purposes. It was also slightly turbid from inefficient filtration, and contained moving organisms. The deep-well water supplied by the Kent and Colne Valley Companies, and by the Tottenham Local Board of Health, was of its usual excellent quality for dietetic purposes, and that sent out by the Colne Valley Company was suitable for all domestic purposes, having been softened before delivery. Seen through a stratum two feet deep, the waters presented the following appearances:—Kent, Colne Valley, and Tottenham, clear and colourless; Chelsea, West Middlesex, and East London, clear and pale yellow; Southwark, clear and yellow; Grand Junction, Lambeth, and New River, slightly turbid and yellow."

Results of Analyses expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Mat- ters.	Or- ganic Car- bon.	Or- ganic Nitro- gen.	Ammonia.	Nitrogen, as Ni- trates and Nitrites.	Total combined Nitro- gen.	Chlo- rine.	Total Hard- ness.
Inner Circle.								
Thames—								
Chelsea	30.48	.202	.038	0	.232	.276	1.6	19.4
West Middlesex	30.80	.138	.030	0	.313	.343	1.6	19.8
Southwark	31.32	.345	.067	0	.228	.295	1.7	19.4
Grand Junction	32.28	.365	.048	0	.235	.283	1.7	19.0
Lambeth	33.10	.318	.039	0	.237	.276	1.7	19.4
Lea—								
New River	31.48	.319	.035	0	.238	.273	1.7	19.0
East London	31.28	.259	.051	0	.183	.234	1.6	20.0
Deep wells—Kent	44.14	.061	.015	0	.412	.457	2.5	25.1
Outer Circle.								
Colne Valley	12.10	.070	.016	0	.324	.340	1.4	6.4
Tottenham Local Board .	40.47	.086	.019	.086	.000	.089	2.9	20.0
Corporation of Birming- ham*	22.40	.258	.059	.002	.264	.324	1.6	12.2
Corporation of Glasgow†.	2.96	.147	.014	0	.007	.021	0.60	1.1

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
† Analyzed by Dr. E. J. Mills, F.R.S., of Anderson's College, Glasgow.
Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

The Registrar-General publishes the following table in reference to the water supply of London during February. According to the returns furnished to him by the Metropolitan Water Companies, 133,002,130 gallons, or 627,007 cubic metres of water (equal to about as many tons by measure, tons by weight), were supplied daily; or 239 gallons (108.6 decalitres), rather more than a ton by weight, to each house, and 33.7 gallons (15.3 decalitres) to each person, against 32.7 gallons during February, 1879.

COMPANIES.	Number of Houses, &c., supplied in		Aver. Daily Supply of Water in Gallons* during	
	Feb., 1879.	Feb., 1880.	Feb., 1879.	Feb., 1880.
Total supply	557,059	577,382	129,941,836	138,002,130
From Thames	263,006	275,819	61,975,478	69,737,558
„ Lea and other Sources . .	294,053	301,563	64,966,358	68,264,272
THAMES.				
Chelsea	29,562	29,945	7,540,200	8,330,900
West Middlesex	51,614	53,692	9,985,325	10,929,160
Southwark and Vauxhall . .	82,470	88,790	23,581,470	23,715,438
Grand Junction	38,989	40,285	10,999,983	12,164,860
Lambeth	60,371	63,107	12,868,500	14,597,500
LEA AND OTHER SOURCES.				
New River	127,916	129,741	26,136,000	26,151,000
East London	118,910	122,746	30,827,800	33,780,500
Kent	47,227	49,076	8,002,558	8,332,772

* Including that for manufactures and for various purposes other than for domestic consumption.
Note.—The return for February, 1880, as compared with that for the corresponding month of 1879, shows an increase of 20,323 houses, and of 8,060,294 gallons of water supplied daily.

BRISTOL UNITED GASLIGHT COMPANY.

The Half-Yearly General Meeting of this Company was held on Monday, the 15th inst.—Mr. F. TERRELL in the chair.

The SECRETARY (Mr. H. H. Townsend) having read the notice convening the meeting, the following report of the Directors was submitted:—

The Directors, in presenting a report in accordance with their custom at the half-yearly meetings of Proprietors, are gratified to be able to say that the affairs of the Company are in a state of prosperity, and this will be made fully evident by the perusal of the audited accounts to the 31st of December last.

That portion of the new works at Stapleton which was last year built under a contract with Messrs. John Aird and Sons, was completed at the end of October last, and gas was there manufactured during the winter of 1879-80. This addition to the manufacturing capacity of the works has realized the expectations of the Directors, and enabled them to meet the large increase in the quantity of gas required by the consumers.

The electric light has made a small progress in the few applications for which it is specially adapted, but the scare caused by the highly-coloured statements which have appeared from time to time in the public prints still have an influence in keeping down the market price of gas stocks throughout the kingdom below their intrinsic value. Gas proprietors have, however, no real ground for alarm at the electric light, and public confidence in gas stocks as investments is steadily returning.

The Directors recommend that a dividend at the rate of 10 per cent. per annum on the capital of the Company entitled to a dividend be declared, subject to the deduction of income-tax.

The CHAIRMAN, in moving the adoption of the report, said it possessed the merit of being short, and also, he thought, the additional merit of being satisfactory. At the last half-yearly meeting the Directors were able to state that the first portion of the works at Stapleton were in working order, and that they hoped these works would soon be put to good use. This hope had been realized, the works having done the Com-

pany this service, that they were now able to provide all their customers with as much gas as they required. There had been no falling off in any respect. A very large supply of gas had been required, and he thought there might have been some difficulty in meeting the demand but for the new works at Stapleton. Another satisfactory portion of the report was that which dealt with the finances, which were in a good condition. He knew of nothing that affected the Company injuriously. Some time back the electric light operated as a scare, and a few Proprietors, he was sorry to say, were weak enough to part with some of their shares. He hoped the scare had now passed away. They continued to hear flourishing accounts of what the electric light had done and might do, but they saw no practical outcome of it. They also heard of certain candles invented by a gentleman named Jablochhoff, but he (the Chairman) thought it would be a long time before the public would light themselves to bed with the Jablochhoff candle. There was no real ground for shareholders in gas companies being alarmed.

Mr. T. T. TAYLOR seconded the motion, observing that the city now had a full supply of gas of good quality.

The motion was carried unanimously.

The CHAIRMAN then moved that a dividend at the rate of 10 per cent. per annum be declared for the half year ended Dec. 31 last, and said that in consequence of the financial condition of the Company being good, the Directors had come to a resolution to make a reduction of 2d. per 1000 feet in the price of gas as from the 1st of January last; so that those who had been paying 3s. per 1000 feet would now pay 2s. 10d.

Mr. C. METIVIER seconded the motion, and it was agreed to.

On the motion of Dr. HIGGETT, seconded by Mr. J. BARTLETT, a vote of thanks was passed to the Chairman and Directors for their services.

The CHAIRMAN having acknowledged the compliment on behalf of himself and his colleagues,

The ENGINEER (Mr. W. Fiddes), in answer to questions, stated that a 5-foot burner gave a light equal to about 17 candles, and a 2½-foot burner a light equal to 5½ candles. Two of the latter would give a light equal to 11 candles only, whilst one 5-foot burner would give 17 candles light; so that in such a division of light there was a loss of about 35 per cent. as compared with that given by the 5-foot burner.

The CHAIRMAN, referring to the division of the light, and the use of reflectors in the gas-lamps of the city, remarked that it was not the act of the Company, but of the Sanitary Authority; and, of course, the Directors did not care to interfere with the new arrangement. They must sit down quietly and let the Authority find out their mistake, which he was sure they would do.

The proceedings then terminated.

LEWES GAS COMPANY.

The Half-Yearly Meeting of this Company was held on Monday, the 8th inst.—Mr. E. MORRIS in the chair.

The SECRETARY (Mr. E. Hillman) read the following report of the Directors:—

The Directors report that the transactions for the half year ending Dec. 31, 1879, have been satisfactory. The balance on the revenue account amounts to £1156 14s. 2d., and the Directors recommend that £159 5s. 10d. be taken from the profit and loss account, making together £1316, thus enabling them to declare a dividend at the rate of 5 per cent. for the past half year upon the capital of the Company.

The new retorts are approaching completion, and the Directors have entered into a contract to cover the whole of the yard with an iron roof. The tank foundations are in a forward state, and the Directors have made a satisfactory contract for the erection of the gasholder.

The cancelling of the certificates of shares has been effected, and the capital of the Company converted into stock.

In consequence of the enlargement of, and additions to the works now in progress, it will be necessary to increase the capital of the Company, and a meeting of the stockholders will be held at the close of the present meeting, to authorize the borrowing of money for the purposes referred to.

The CHAIRMAN, in briefly moving the adoption of the report, said the Company's transactions for the past half year had been satisfactory, and the Directors hoped the dividend they proposed to pay would be approved of.

Mr. CROSSKEY seconded the motion. In reference to the affairs of the Company he thought it right to say that the very severe winter had not interfered so much as usual with the supply of gas to the town. For this they were much indebted to their Manager (Mr. J. Hammond), and it was also on account of the alterations now in progress at the works. The Directors were unable, till the price of iron lowered, to make satisfactory progress with the holder, and other matters; but when these works were finished he believed they would be satisfactory to the Shareholders.

Mr. GODLEE said he had reason to be perfectly satisfied with, and to place the most implicit confidence in the Directors, consequently he would take it for granted that the dividend about to be declared had been fairly earned. If, under the present difficult circumstances, the Directors could fairly pay 10 per cent., they were entitled to great credit. He congratulated the Shareholders on having passed through a long and tedious winter with scarcely the means to supply all needs. With regard to the quality of the gas supplied, he might say he had tested it in the daytime, and at all times during the night, and he had come to the conclusion that it was pure in quality and adequate in quantity.

The motion was carried unanimously, and the dividend recommended in the report declared.

The meeting was then made special for the purpose of considering the following resolution:—"That in order to increase the available capital of the Company for enlarging and improving the works and for other purposes, the Directors be and they are hereby authorized to borrow any sum or sums of money not exceeding £6700 for enlarging the works and for the other purposes of the Company, and to give such security for repayment of the same as the Directors are legally authorized to do."

In answer to Mr. Lenny, the CLERK said the sum mentioned was the maximum allowed by the Company's Act of Parliament.

Mr. CROSSKEY said there was no doubt they would require more than the £6700 if they included the contract for the gasholder-tank and the foundation for the new holder. The Directors would therefore have to devise some other means of obtaining additional money, but thought it right to exercise their borrowing powers first. If they were able to obtain it at a moderate rate of interest, it would place the Shareholders in a better position, as they would not have to issue a greater amount of share capital.

The CHAIRMAN, in moving the resolution, said the question of issuing fresh shares, if the sum mentioned did not suffice, was a matter for future consideration. According to the resolution, the Directors might borrow the whole or any part of the money; but the Shareholders could depend upon it the Directors would act as they considered most advisable for the promotion of the Company's interests.

Mr. LENNY seconded the motion, and it was carried unanimously.

ARMAGH WATER SUPPLY.—On Tuesday, the 16th inst., an inquiry was held at the offices of the Armagh Town Commissioners as to the desirability of expending a sum of £8000 in improving the water supply.

SOUTH METROPOLITAN GAS COMPANY.

An Extraordinary Special Meeting of this Company was held on Friday last, at which was submitted the Company's Bill before Parliament, entitled "A Bill to authorize the South Metropolitan Gas Company to purchase additional lands, construct new works, and raise further capital, and amend their Acts, and for other purposes." Captain HEATHORN presided.

The SECRETARY and ENGINEER (Mr. George Livesey) having read the notice convening the meeting,

The CHAIRMAN said: Ladies and gentlemen, you are all aware, no doubt, that when a company is promoting a Bill in Parliament it is necessary to hold a meeting of shareholders to consider and, if thought fit, to approve of the Bill. It is for this purpose, in compliance with the Standing Orders of Parliament, that your Directors have called you together to-day. When we were before Parliament in 1876 we obtained sufficient additional capital for the probable requirements of the Company, as then constituted, for some time to come; but circumstances have altered the position of the Company. In 1876 the Board of Trade and a Committee of the House of Commons did all in their power to open a way for the amalgamation of the Southern Companies, but owing to the course pursued by the Lambeth and Camberwell Vestries the effort was unsuccessful. It has been the lot of the South Metropolitan Company, under the auspices of the Board of Trade, to carry very nearly to completion the policy both of Parliament and the Board. Amalgamation with the Surrey Consumers and the Phoenix Gas Companies has been effected, for I have just heard that the scheme for the amalgamation of the Phoenix Company with this Company has been confirmed by Her Majesty in Privy Council. These are the altered circumstances under which application is made to Parliament for the means of enabling the Company to pursue and give full effect to the policy thus inaugurated. Should we obtain the Bill, as we confidently trust that we shall, having done all in our power to further the objects of Parliament and the Board of Trade, the manufacture of gas will be carried on in a locality wholly unobjectionable. When this is considered, as also the advantages, present and prospective, to the consumers as well as the Shareholders, whose interests under the sliding scale are now identical, I think you will be only too glad formally to approve the Bill, which I now call on the Secretary to read, and after you have heard its provisions I will move the resolution.

The SECRETARY read the Bill, and stated that the site referred to, and for the acquisition of which a conditional agreement had been entered into, was between Greenwich and Woolwich.

The CHAIRMAN then said: You have heard the Bill read, and I beg leave now to move—"That the Bill in Parliament you have heard read, having been considered by this meeting of Shareholders of the South Metropolitan Gas Company, in compliance with the Standing Orders of Parliament, be and is hereby approved, and that, with reference to its prosecution or withdrawal, the Directors be authorized to act as they shall see fit."

Mr. JENKINS said that the meeting, as they were aware, was purely a formal one to comply, as the Chairman had informed them, with the Standing Orders of Parliament, and no subject other than the Company's Bill now before Parliament was properly discussable at the meeting. The Directors were very sorry to have been obliged to bring the Shareholders together at so short a time before the ordinary meeting of the Company, which would take place on the 7th of April; but they thought it quite proper, having regard to the safety of the Bill, that they should have the Shareholders approval that day, and that the Bill should be placed in a position which would not jeopardize its being passed this session. Therefore it was that they had called the meeting this day. The Chairman had stated that the scheme had been confirmed for the amalgamation of this Company and the Phoenix Company, and, therefore, for the future the South Metropolitan Gas Company would include not only the old Surrey Consumers Company, but also the Phoenix Company; and, although there might be a sort of regret among some of the Shareholders of the old Surrey Consumers Company, and of the Phoenix Company, that they had no longer a connection with those Companies as such, yet being absorbed by a Southern Company would, perhaps, be a source of gratification to the Shareholders hereafter, and he was quite sure that it would be a great source of strength to the United Company. He was certain also that in considering the terms of the amalgamations the old South Metropolitan Company's Directors, while having a careful regard for the interests of their own Proprietors, had not neglected to consider with justice the claims of those with whom they had amalgamated, and he was hopeful that hereafter there would be no heartburnings, as they would be all one Company, merely separated by the nominal distinctions of "A" and "B" Shareholders. Under those circumstances, he begged to second the resolution, which he hoped the meeting would carry unanimously.

Mr. Pocock said he thought it would have been as well if a copy of the Bill had been sent round to the Shareholders, that they might have digested its contents, and have come to the meeting and discussed the matter with the Board.

The SECRETARY stated that the course adopted was that which was prescribed by the Standing Orders of Parliament, and he believed that, under similar circumstances, a copy of the Bill was never sent by the railway companies or any other public company to their shareholders. As the advertisement stated, the meeting was called pursuant to the Standing Orders of Parliament, and the Bill had been read. This was merely a formal meeting. He might say to those who had not followed what he had read, that the Bill was for additional capital, in order to enable the Company to erect new works below Greenwich, when they were wanted.

Mr. FRANKLIN said, like Mr. Pocock, he felt a little surprised at being that day called on to support the Directors of the Company in so large a scheme, and that no explanation had been given to the Shareholders as to the necessity of this proceeding. They were, he said, led from time to time, in the course of the discussions on the question of amalgamation, to suppose that there would be advantages accruing to the United Company by the acquisition of the different sites. For instance, as to the Surrey Consumers Company, they were told that the Company held a prominent position on the Thames, and this would be an advantage to the amalgamated Company, as it would facilitate the receipt of materials, and that they possessed a large space of land which was available for the extension of works. Now the amalgamation was a realized fact, they were surprised by being informed that a very large extent of land was required at some distance from the Metropolis, and this without any explanation as to the sites they held.

The SECRETARY said that they would be used as now, as far as they could be.

Mr. FRANKLIN repeated that the clauses of the Bill had simply been read, and no explanation had been given whence the necessity had arisen for what was asked for in the Bill. He thought if this had been done it would have saved a great deal of misapprehension, and given the opportunity of discussion in the event of there being any opposition.

The CHAIRMAN: I think the meeting will be with me when I state that we should never go to Parliament unless we were obliged; but the fact is that the necessity arises on our amalgamation with the Phoenix Company. It has nothing to do with the requirements of the two Companies previously amalgamated. It is entirely a matter rendered necessary by

the increasing want for space that the Phoenix Company have felt for some time past. The Phoenix Company themselves introduced a Bill for this particular purpose.

The SECRETARY: The same Bill.

The CHAIRMAN: Yes; only it was thought expedient, as the amalgamation had practically taken place, alibut the signing, that they should drop their Bill, and we took it up.

Mr. FINLAY thought it only fair and due to the Proprietors to make a few remarks with regard to the old Surrey Company. He thought both Mr. Pocock and Mr. Franklin must know, on the times they had attended meetings of the Surrey Company, that they were pushed for room, and this was the reason the Company were absorbed by the South Metropolitan Company. He did not wish to pry into the business of the Phoenix Company, or to say one single word against them, only he had seen their works, and was quite inclined to think that they were just as much pushed for room as—in fact, more than the Surrey Company were. If this really were so, it was quite impossible to carry on the United Company without taking new land. The land in the Old Kent Road belonging to the South Metropolitan Company comprised about 40 acres, and was very valuable; but it was only valuable for manufacturing purposes up to a certain point. They could only, for instance, build on it so many retort-houses; but the land was very valuable as a site for gasholders, and it was quite impossible, now that the South Metropolitan Company had absorbed the Surrey and the Phoenix Companies, that the undertaking could be carried out with any advantage, except with an extension of land. The only question was, where was it to be obtained? They had all been on the look-out, and the Phoenix Company had hit on the site referred to in the Bill, and, if it could be obtained, he was sure—speaking as one deeply interested—that it would be to the advantage of them all. He felt sure the South Metropolitan Company, now amalgamated with the other two Companies, could not be carried on economically in its present state.

Mr. Pocock said he was not going to object to the purchase of the land. He only thought, when such a matter came before them, that as much explanation as possible should be sent out by the Directors, so that the Shareholders and all interested might come forward and support them. They did not want to run counter with the Directors, but he wished to ask two or three questions: What was the price of the land, the situation, and how was the capital to be raised?

The SECRETARY replied that the money would be obtained by shares to be sold by auction. They could not mention the price of the land.

The CHAIRMAN: The Bill is to purchase land. We have the option to purchase or not, as we please.

A SHAREHOLDER observed that any one who knew anything of the suburbs of London must know their growth, and, if the land was necessary and they could get it now, he should say get it. ["Hear, hear," from the Chairman.]

Mr. ROSTON said that, under the altered circumstances of the Company, the value of the land in the Old Kent Road was doubled if they retained it for a storage station, and if they acquired the land on the new site, the Shareholders must not suppose that they were going to spend a lot of money on it.

A SHAREHOLDER observed that they ought to have perfect confidence in the Directors or none at all.

The CHAIRMAN: Every inquiry seems now to have been exhausted; but if there is anything more I can explain, I shall be only too glad to do so. I think you understand that the object of the Bill is to purchase land somewhere, wherever it may be, and we shall take care of your interests that the price given for it is not more than it ought to be. I think you will see that it is necessary that we should have the power to purchase the land for the increased works incident to our greater business through the recently concluded amalgamation with the Phoenix Company.

The resolution was then put and carried unanimously.

The SECRETARY, in reply to Mr. Pocock, said it would be a useless expenditure to send a copy of the Bill round to all the Shareholders.

The CHAIRMAN: We shall be very happy to give a copy to those who apply for one.

The SECRETARY, in reply to a further question, said the half-yearly report would be issued in a few days, and in it there would be an announcement that the Shareholders of the late Surrey Company might send in their share certificates and have them exchanged for stock certificates of the South Metropolitan Company. He might also refer to another matter. Their meeting was fixed by advertisement for two o'clock on the 7th of April, and the Phoenix Company's meeting was fixed for the same day and hour. The Phoenix Company's Shareholders, however, now had the right to attend the South Metropolitan Company's meeting, and for this purpose notice would be given to adjourn their meeting till half-past two or three—they would arrange the hour with the Phoenix Company's Directors. There would, therefore, be no need of the Shareholders of the South Metropolitan Company attending the Company's meeting until half-past two or three. He added, in reply to a question, that in future there would be no necessity for the Phoenix Company holding meetings, and their forthcoming meeting was for the purpose of declaring a dividend only.

A SHAREHOLDER then moved a vote of thanks to the Chairman for his conduct in the chair, and to the Directors for their management of the Company's affairs.

Mr. Pocock seconded the motion, which was carried unanimously.

The CHAIRMAN: We are very much obliged to you. The consideration you show us, and the confidence you repose in us, is one of the most agreeable things to us in connection with these meetings. We are all in the same boat as you are; and as long as you repose the confidence in us which you do now, we shall continue to try and deserve it.

ROCKHAMPTON (QUEENSLAND) GAS COMPANY.—At the last half year's meeting of this Company, the Secretary (Mr. H. Mills) read the report of the Directors on the operations of the Company during the six months to Nov. 30, 1879. It stated that upwards of a mile of new mains had been laid, and were beginning to bring in a return. Further extensions were being arranged for. An exhibition of gas-cooking stoves, gas-fittings, and gas-burners was held at the Agricultural Society's Show Grounds last July, and attracted a large share of public notice. In order to induce increased consumption, the Directors recommended that the price of gas for cooking purposes be reduced to 10s. per 1000 feet from and after Jan. 1. The reductions in the price of gas authorized at the last general meeting had been a benefit to the consumers of upwards of £270, and this deduction from gas-rental the Directors were happy to say had been partly recouped by increasing consumption—the rate of increase from the corresponding period of last year being 11 per cent. A dividend at the rate of 10 per cent. per annum was recommended; and the reserve-fund, after the payment of the present dividend amounted to £1160. The condition of the works and the steady conduct of the business were highly satisfactory, everything being kept in thorough good order and in a condition to supply more gas than was at present used; but to be fully prepared for largely increased demands during next winter, the Directors were building sufficient benches of retorts to double the present daily supply of gas, and confidently hoped it would all be required.

DEWSBURY CORPORATION GAS SUPPLY.

We have received from Mr. Charles Armitage, the Engineer and Manager of the Dewsbury Corporation Gas-Works, the following details of their working during the half year ending Dec. 31, 1879:—

Gas made as per station-meter	63,265,400 cubic feet.
Gas sold to private consumers	52,965,700 cubic feet.
Gas sold for public lighting	3,284,000 "
Gas used on works	302,700 "
	56,552,400 "
Unaccounted for.	6,713,000 cubic feet.
	Equal to 10·6 per cent.
Capital employed—	
£217,714 5s. 6d. = £34 8s. 5d. per ton of coal carbonized, or £3 17s. 4d. per 1000 cubic feet of gas sold.	
Coal carbonized—	
Common	5,920 tons = 93·59 per cent.
Cannel	405 " = 6·41 "
Total	6,325 tons.
Illuminating power required by Act	14 candles.
Illuminating power supplied	17 "
Gas made per ton of coal.	10,002 cubic feet.
Gas accounted for, per ton of coal.	8,941 "
Gas made per mouthpiece, per ton of coal	5,677 "
Coke made (calculating 13 cwt. per ton of coal).	4,111 tons.
Coke sold	2,740 "
Coke sold, per cent. on make	66·65 per cent.
Coke used in heating retorts	1,065 tons.
Ditto, per cent. on make.	25·90 per cent.
Coke (small) used in firing boilers.	806 tons.
Ditto, per cent. on make.	7·44 per cent.
Average price of coke sold	5s. 6d. per ton.
Tar made per ton of coal.	11·47 gallons.
Average price of tar per gallon.	2·88d.
Liquor made per ton of coal.	33·07 gallons.
Average price of liquor per 1000 gallons.	92s. 7d.
Average cost of coals per ton	8s. 7d. per ton.
Coke, tar, and liquor realized per cent. on cost of coal	90 per cent.

	£	s.	d.	Cost per 1000 Cubic Feet Sold.
Manufacture—				
Coal	2,720	13	1	0 11 60
Purifying material and labour	147	12	4	0 0 63
Stokers wages, Enginemen, and Foremen	566	14	5	0 2 42
Yard labour	268	10	7½	0 1 16
Repairs and renewals of retorts	212	6	3	0 0 92
Repairs and maintenance of works.	221	2	9	0 0 96
Cartage and carriage	76	19	6	0 0 31
Distribution—				
Salaries of Meter Inspectors	161	4	0	0 0 68
Repairs and renewals of meters	66	8	0	0 0 28
Repairs and renewals of mains and services	100	5	2	0 0 42
Rents, rates, and taxes—				
Rents	175	0	0	0 0 75
Rates and taxes	287	16	11½	0 1 22
Management—				
Managers and Clerks salaries	125	0	0	0 0 53
	147	13	6	0 0 63
Stationery and printing	30	11	7	0 0 13
Law charges, &c.—				
Law charges	3	5	4	0 0 01
Bad debts	120	7	5	0 0 52
Discounts	209	19	0	0 0 90
Total working expenses	5,641	9	11	2 0 07
Less residuals—				
Coke	763	1	0	—
Tar	912	11	8½	—
Liquor	863	14	6½	—
Rents of property, meter-rents, and sundries	715	7	0	1 1 88
Net cost of manufacture and distribution	2,389	12	4½	0 10 19
Interest on mortgages	4,512	4	3	1 5 25
Amount required for sinking-fund	2,000	0	0	0 8 53
Balance of profit	941	19	4½	0 4 03
Total rental, including public lamps.	9,843	16	0	3 6 00

LEICESTER CORPORATION GAS AND WATER SUPPLY.

A Special Meeting of the Leicester Town Council was held last Tuesday—the Mayor (Mr. J. Bennett) in the chair—when the Gas Committee reported that the accounts of the gas undertaking for the half year ending Dec. 31, 1879, show that the net profit made, after paying interest on the mortgage debt and dividends on the debenture stock issued as the consideration for the purchase of the concern, and upon the new stock and debentures issued, was £6639 11s. 3d. Out of this sum there had been paid £1002, being the half year's amount of sinking-fund on the original capital debt of £476,651 12s. 6d., leaving a balance of £5637 11s. 3d., which, added to the balance of net profit for the half year ending June 30, would make a total of £11,410 18s. 5d. to be paid to the district fund at the close of the current financial year—the 25th inst. The Committee hoped the figures would be satisfactory to the Council, and especially so considering that during a portion of the year there had been a reduction in the price of gas of 2d. per 1000 feet. The Committee further reported that they had received from Mr. George Alfred Robinson a notice to terminate his engagement as joint Manager of the gas undertaking at the end of June next; and they had appointed Mr. Charles Stephen Robinson sole Manager from that time. They concluded their report by saying: "It should be mentioned that the 18½ acres of land, part of the site for the new gas-works, which was given up by the Corporation to the Company, subject to arbitration, if necessary, has not until this year been the subject of any financial arrangement. The accounts for the last half year will, however, show a payment to the borough fund of £500 for interest or rent for the two years during which the land has been given up to the gas undertaking, and the question of value and rectification of capital accounts between the respective departments is left for settlement at a future time."

Mr. DOWNING, who moved the adoption of the report, said it gave the Committee considerable pleasure to present it. Having explained the items which made up the profit, he stated that the amount of £11,410 18s. 5d. would be handed over to the Treasurer, in favour of the district rate, on the 24th inst. This was a satisfactory result of their twelve months clear trading, and would affect the finances of the borough by a reduction of 4d. in the pound on the district rate. He would like to remind the Council, however, that the year's profits had been affected to the extent of £3750

in consequence of the reduction of 2d. per 1000 feet in the price of gas which took place in the last quarter of the previous year. They had spent on capital account £57,567 5s. 10d., and this expenditure involved a large additional charge for interest, and necessarily decreased their surplus profits. They estimated the profits for the present year from Jan. 1 at £10,000. During this year the outlay on newmains would be considerable, and there would possibly be an increase in the price of coal. An advance of 10d. per ton in the price of coal would mean a reduction of profits to the extent of £3000 per annum. On the other hand, they hoped for increased consumption of gas from two or three causes. They were laying down a new main to supply the east and south of Leicester; then there would be a consumption at the new barracks; and they all looked forward to an improved trade to increase the consumption. They were also about to hold an exhibition of gas apparatus, which might have the effect of increasing the number of gas-stoves in use, and so increase the need of gas in summer.

Mr. HOLYLAND seconded the motion, which, after a short discussion, carried.

The report of the Water-Works Committee, which was then read, stated that for the half year ending Dec. 31 the net profits, after paying interest on the mortgage debt and dividends on the debenture stock issued as the consideration for the purchase of the concern, were £1735 19s. 6d. Out of this sum £767 had been paid, being the half year's amount for sinking-fund on the original capital debt of £452,434, leaving a balance of £968 19s. 6d., which the Committee recommended should be added to the reserve-fund, at present amounting, with interest, to £1392 14s. 11d., but authorized by the Act under which the works were purchased to amount to £5000.

Alderman PAGET moved that the report be adopted. He said that they had an increasing surplus from the undertaking, and the affairs of the Water Committee were going on in a satisfactory manner. The profits for the half year ending June last were £1442 4s. 5d., and for the half year ending Dec. 31 they were £1735 19s. 6d., making £3178 3s. 10d. for the year. Out of this sum there had been paid to the sinking-fund £1534, which left a net sum to go to the reserve-fund for the two last years of £1644.

Mr. GREEN, who seconded the motion, remarked that the surplus, though modest as compared with that from the gas-works, was still growing.

The motion was then put and carried.

HEYWOOD LOCAL BOARD GAS-WORKS.

At the last Meeting of the Heywood Local Board the minutes of the Gas Committee which were presented stated that they had received a report from Mr. Thomas Newbigging, C.E., of Manchester, who had made a full and careful inspection of the gas-works, and had considered all the circumstances of the gas supply, with a view to advising on the state of the works and plant, and as to what extensions are desirable and necessary.

The report described the works as favourably situated for the supply of gas to the district, and said were it not for the circumstance that, owing to their distance from railway and canal, all material has to be carted to and from them, their position would be unexceptionable. The site of the works embraces 3½ acres of land; but if the portion on the hill side, which is not readily available, be excluded, there is about 2½ acres. On this site, with judicious care in the carrying out of future extensions, the Board will be able to manufacture and purify 1 million feet, and to store 620,000 feet of gas per day of 24 hours.

The retort-house is an indifferent building, and, in the older portions, the roof is in bad condition, and the walls bulged and irregular. Its width inside, throughout, is only 42 ft. 9 in., and as the retort-bench is 17 ft. 6 in. wide, there is left a space of only 12 ft. 7½ in. on each side for the men to work. In working a retort-bench of this limited width, there is, Mr. Newbigging contends, a want of economy both in fuel and labour. The bench should be 20 feet in width, and the space in front on each side at least 18 feet, making a total width of 56 feet inside the house. The retorts employed are set seven in a bed, and they consist variously of ovals, 18 in. by 13 in.; D-shaped, 16 in. by 13 in.; and kidney-shaped, 16½ in. by 11 in., and 8 ft. 4 in. long each. The greatest number of retorts at work during the past winter has been 122. From these there has been produced a maximum of 351,000 feet of gas every 24 hours, which is at the rate of 2877 feet per retort. In each bed of seven retorts is carbonized every six hours a mixture of 9 cwt. of coal and 2 cwt. of cannel, ora total for the 122 retorts of 38 tons 7 cwt. in the 24 hours. This shows a production per ton of coal and cannel of 9152 feet, which, even taking into account that the retorts are of a small size, is an excessively low production. There should, the report says, be no difficulty in carbonizing, on an average, 2 cwt. of material per mouthpiece at each charge, or 8 cwt. in the 24 hours; which would give a yield of 3920 feet per retort, taking the production of gas per ton at 9800 feet, which should be readily attained, and a total of 90 retorts (instead of 122 retorts) would thus have been ample for the maximum day's make. The average production of gas per ton of coal and cannel carbonized during the past year was 9208 feet; so there can be no doubt the settings are radically bad. Mr. Newbigging observed that the heats were generally poor, and in some instances the retorts black along two-thirds of the bottom. The hydraulic main, with the exception of the new portions last erected, and the ascension-pipes, are too contracted in size; and the mountings of the retort-bench generally are far from being satisfactory.

The condenser is fairly regular in its action, but it is rapidly becoming worn out, and is patched and repaired in many places. It will shortly need renewing, and the report recommends the Board, when that time arrives, to adopt the annular form of condenser, which, besides being more accessible than the present apparatus, has a better appearance without being more costly, can be regulated to the make of gas at different seasons, and does its work with great efficiency. The exhausting power is very ample, and the machines (Jones's) in duplicate appear to be in good working condition. The washer-scrubber of Kirkham and Co.'s make, erected in October last, removes all trace of the ammonia impurity from the gas by the time the latter has reached the fifth chamber of the apparatus, leaving a surplus of two chambers for an increased make. Taking into account the circumstances of the lime and oxide of iron purification, the difficulties the Manager has had to contend with during the past heavy lighting season would, Mr. Newbigging says, have been aggravated if he had been without the assistance of this, or some other equally efficient scrubbing apparatus.

The report continues:—"The lime and oxide purifiers are too small for the quantity of gas they have to purify. They are 12 feet square each, whereas they should be at least 15 feet square each to ensure economy and efficiency. But it was not altogether to the restricted purifying area that the difficulties with the heavy back pressure during the earlier portion of the present winter were due. I found on my first visit that the men employed on the purifiers were unskilled in the method of preparing the lime, as it was slaked and placed on the grids in the state of flour—quite as fine, and almost as dry. The result was that in a very brief time it caked

perfectly hard, and had to be taken out and replaced by fresh lime before it was half spent, thus entailing a waste of both time and material, besides allowing the gas to pass in only a partially purified condition. Neither was this the principal cause of the difficulties encountered. I find that the wood grids in use in the purifiers are, as a rule, worn out and damaged. Not only are they twisted and buckled, making it impossible to spread an even depth of lime upon them, but many of them have ribs broken out, and to prevent the finely powdered lime from falling through and leaving wide gaps for the gas to traverse *en masse*, pieces of coarse canvas or bagging are thrust into these wide spaces, or spread over them, thus still further curtailing the already sufficiently contracted purifying area. I would not have mentioned this if only an occasional piece of canvas were used to stop an accidental hole; but when fully one-third of the area is blocked in this way, it is necessary to draw attention to the circumstance. There is still another cause to account for the great increase in the back pressure and the other evils complained of. In thinking the matter over, I came to the conclusion that the high pressure indicated, and which frequently reached 16 inches between the purifiers and the retorts, was due, in some measure, to obstructions in the pipe connections. Accordingly, on investigation, I found that the rise in the pressure was highest during or after rain, which was clearly owing to the entrance of water into the pipes; and this conclusion was fully verified by the fact, that, at such times, a pump attached to the lowest point of the mains had to receive frequent attention to remove the volume of water that was found to accumulate. By proper manipulation of the lime, and the clearance of the water from the mains, the pressure was reduced as low as $7\frac{1}{2}$ inches (4 inches of which was due to the holders), and that, too, within an hour of the time for changing the purifying vessels. The difficulty in the purification is not caused in any way, as has been alleged, by the altered proportions of coal and cannel employed in producing the gas. I recommend the erection of a new purifying-house to contain two sets of vessels, 18 feet square, with dry centre-valves. If one set, or four purifiers, are erected at first, they will serve till the daily make reaches 500,000 feet."

The station-meter is fixed in such a position, being almost completely buried in the ground, that it was found impossible to examine it; but from what Mr. Newbigging did see of it he has reason to believe the works are greatly in need of a new and better meter, and certainly of a suitable house to contain it. The present meter is so placed that the top of the outer case is about level with the ground; the index, which is raised above the meter, being actuated by a vertical spindle rising from the end of the measuring-drum shaft. He does not think it is possible, under present circumstances, that the true water-line can be said to be maintained; at least there is no means of ascertaining if it is, as should be the case by a momentary inspection, and the registration of the make is consequently uncertain and unsatisfactory. The connections are only 9 inches in diameter.

The two old gasholders are worn out and useless for the purposes of storage, and their small diameter and depth, 40 ft. by 14 ft., is not such as to justify their renewal. Besides, the ground space which they occupy may be employed more usefully, whilst the tanks can readily be converted into underground storage wells, in which the works are at present deficient, for the reception of the tar and ammoniacal liquor. No. 1 holder will shortly need renewal, and it should then be telescoped, when it will store about 64,000 cubic feet of gas. No. 2 holder is in need of repair, and should be attended to in the summer. The recently constructed new tank and gasholder are an excellent piece of work in all respects. The storage for gas at the works, when No. 1 holder is telescoped, will stand thus:—

	Diameter. Bottom Lift.	Depth.	Available Storage Room in Cubic Feet.
No. 1 holder . . .	50 feet	by 36 feet . . .	64,000
No. 2 " . . .	75 " "	48 " " . . .	200,000
No. 3 " . . .	100 " "	48 " " . . .	356,000
Total			620,000

It will thus be seen that the storage room for gas, as compared with the present maximum daily production, is very ample.

Mr. Newbigging strongly recommends the Board to set about manufacturing their ammoniacal liquor into sulphate of ammonia, as the process is an easy one, and no great expense need be incurred in providing the necessary plant. In adopting this suggestion they would not only get rid of the great nuisance that arises from carting the liquor through the principal streets of the town to the railway, but would add considerably to their yearly balance of profit.

After referring to the lighting of the town, the report concludes:—"The leakage or unaccounted-for gas has been gradually increasing for the last four years, until for the year ending Dec. 31, 1879, it has reached 24.42 per cent. of the make. There should be no difficulty in reducing this to 12 or 14 per cent. It was, of course, impossible for me to examine the condition of the street-mains and service-pipes, but I went over the whole district, and noted the sizes of the mains, which were fully described to me. In several of the streets there are duplicate mains, which should be dispensed with without delay, and a single one of sufficient capacity laid down instead. I recommend especially that you should do this with the two mains, a 12-inch and a 6-inch, leading out of the works, and laid side by side for some distance. By taking up these, and substituting a single main of 18 inches diameter for part of the length, and 16 inches for the remainder, you would be enabled to give your maximum supply at the least possible pressure, thus reducing your leakage, and afford a supply to the farthest limits of your district without difficulty. I am of opinion, however, that it is to the renewal of the wrought-iron service-pipes that you must look for a material reduction in your present excessive loss by leakage, and I recommend that you should at once systematically set about the renewal of all service-pipes that have been in the ground for more than eight years. No question of expense should prevent you from undertaking this work without delay, as the result will amply repay you for the outlay that will be required. Close attention should be paid to the inspection of the meters. The smaller sizes should be examined and watered every six weeks all the year round; and the larger ones, such as are used in factories and other considerable establishments, every fourteen days during the lighting season."

Mr. Newbigging thinks the alterations and extensions more immediately required might be carried out in the following order:—

1880. Erect purifying-house and one set of four purifiers 18 ft. square each, with dry centre-valve. Cover in the two old gasholder-tanks.
1881. Erect new station meter and governor, and house for same. Remove the existing purifiers, adapt the building for the manufacture of sulphate of ammonia, and erect sulphate plant.
1882. Erect annular condenser. Erect new workshops and stores, exhaustor-house, and pump-house.

In this way the cost would be spread over three years, and the recuperative power of the works would prevent the added capital from being burdensome.

SOUTH-WEST OF ENGLAND DISTRICT ASSOCIATION OF GAS MANAGERS.

The Fifth Half-Yearly Meeting of this Association was held at Taunton, on Tuesday, the 9th inst.—Mr. S. W. DUKIN (Southampton), the President, in the chair.

The HONORARY SECRETARY (Mr. T. W. R. White, of Sherborne) read the minutes of the previous meeting, which were confirmed.

Four new members were then elected; after which The President delivered the following

INAUGURAL ADDRESS.

Gentlemen,—I have to thank you for the honour that you have conferred upon the town of Southampton in electing me to fill the office of President of this Association, more especially when I consider that other places of importance, and better representing our special industry, might have been selected from, to furnish some one to preside over your deliberations. I am proud to represent my native town, although we cannot boast of vast industries, or ancient fame, or of being a pleasant watering-place, where the weary may drink in sea breezes, or an inland health-resort, where the weak may resort for relief; yet we are a busy, growing town, and useful as a mail packet station and for general commerce, and it will afford me pleasure to welcome this Association there when they elect to come.

Passing from these opening remarks, allow me to say, without any disparagement to the parent Association, that we are met together to get at each other in a friendly way, for the exchange of ideas that may be helpful in discharging the duties which come to every one of us, and to lift each other up above surrounding circumstances, which sometimes tend to pull us down to them. We therefore should always be willing to obtain knowledge that will help us to master our duties.

The success of a gas company depends much upon the manager's assiduity. The dividend is not earned in the board-room, however well that very necessary department may be managed; but, in the first instance, at the works, and to effect that object the chief product there made should be safely conducted through the consumers' meters.

At the meter our control ceases, and other perplexities arise, and, as I showed a short time since, in my paper on "Bad Gas-fittings, with Practical Illustrations," not of our own making or seeking. Some reform in this respect may eventually come, but it is a long time coming.

I am sure you will not expect me to take up your time in dilating too much on any one topic, as the process of gas manufacture, in its various stages, opens up matter for discussion, and I have no doubt the ability possessed by our various members will enable them to bring up from time to time papers that will elucidate some of its mysteries.

In the carbonizing of coal many attempts, as you know, have been made to introduce machinery for the charging and drawing of retorts. Some of these appliances have fallen into the rear, others are making headway. Being in a neighbouring town a few weeks since, I had an opportunity of witnessing the performance of Mr. West's apparatus. There everything in the retort-houses was being adapted to the proper working of the system, and when this has been accomplished, I am told that with four-hour charges 11,000 cubic feet of gas per ton of coal will easily be obtained. It resolves itself into the cost of producing—labour, and repairs, &c.—and the plan that will do its work best and cheapest is the one that will succeed. Mr. Warner, of South Shields, has also been working in this direction, and with apparent success.

In heating retorts, some question has been started as to whether we are using the best and most economical method.

The venerable hydraulic main, too, is beginning to shake on its crutches, and anti-dips are as plentiful as blackberries in autumn.

A great diversity of opinion exists as to the influence of condensation on gas. Whether to remove the tar direct from the hydraulic main, or to continue the contact for a longer period than we now do, is a question, and, as far as I can judge, it is one of gradually reducing the temperature, which, in a variable climate like ours, and with apparatus exposed to all climatic variations, becomes somewhat difficult. Perhaps some one of our members may take up this question on a future occasion.

Some time since it became the fashion to erect huge scrubbers for the elimination of ammonia, and no doubt these will continue to be used; but now the old washing vessel is to the front again as an auxiliary, with, of course, great improvements in detail. Whereas formerly the gas went in with a rush, it is now broken up into small streams. The object of this is obvious to all. Then there is the hybrid scrubber, with its revolving discs, which does good work and occupies little space.

The final stage of gas purification in our cities and large towns is the question of the day for us, owing to legal enactments. The demand for purer gas, whether a righteous cry or not, has to be met, and during the past few years great strides in advance have been made; but from all I can gather, the process mostly adopted is not always successful in its results. There are still some missing links, which further experience will perhaps forge on, and so complete the chain of the process. Whether that process will be the use of lime and oxide in open vessels, or whether the "wet nursing" will obtain, time alone will show.

Gas managers have been taunted with being behind the times; but with multifarious duties on their hands, there is not much time left for erudite studies. If the public taunt us, we can return the compliment by stating that they are certainly behind in the way they use, or rather waste the gas. Notwithstanding, I have no doubt improvements will go on from retort-house to improved methods of consumption, and the purer and more cheaply gas can be made and supplied, so will the intenser lights be kept at a respectful distance. The electric light will, no doubt, be used for some purposes, but it is not capable of being stored for use at all hours of the day and night, like gas; and therefore you can only obtain a supply when the motor is working.

We have yet a wide supplementary field for the use of gas for cooking, heating, and driving purposes; and here I would pay a passing tribute to my late friend and predecessor, Mr. James Sharp, who did good work in his day in lecturing on gas cooking from nearly one end of the kingdom to the other. He sowed the seed from which manufacturers of gas cooking apparatus, and gas companies also, are reaping a goodly harvest. As an example of what may be done, I have had fixed during the past winter some 50 gas-fires for warming different apartments at our consumers' residences, and this arose partly from my medical man seeing one in operation at my residence, and having one fixed for his own use, and recommending them to others. Amongst heating stoves, Dr. Bond, formerly Curator of the Hartley Institute, Southampton, but now of Gloucester, has brought out the Euthermic heating and ventilating gas-stove, which has some good points about it.

Gas-engines are worth attention, as they can be utilized for various purposes, one of which, by the kindness of our ex-President, we saw in use for driving the air-pumps to fill the bellows of the splendid organ in Salisbury Cathedral.

The letting out of gas-cookers on hire is becoming more general, and if gas directors would offer some inducement to managers to participate in the prosperity of their companies, much more in this way might be done. Our friend Mr. Hardick is to give us some of his experience of the hiring-out system.

The insurance of gas-works is obtaining a place in our economy, and one large Company I know of have just arranged a policy of insurance. Some persons, perhaps, may say it is not necessary, as we have good reserve-funds; but others may not be in that happy position. If an insurance is effected, you then have the advantage, in the event of accident, of not disturbing the nest-egg, which will some day be required for its legitimate purpose.

Another question has just been brought to the front in the JOURNAL OF GAS LIGHTING—viz., the abolition of meter-rents. You may say it will increase the cost of gas. Yes, to a certain extent, it will; but on the gas demand note it will disappear, and save a quantity of unnecessary work. It will facilitate control over meters, and the whole obligation of keeping them in repair will rest on the companies; whereas, if a consumer is the owner, and the meter gets out of order, he will occasionally tell you he is an old consumer, and the company ought to put it right. Some may say a reduction in the price of gas would be better, as every one can understand this, and the rent of the meter is not noticed. There is some truth in that, but with not a few consumers the meter-rent is a grievance, and the less number of these the better. I rather lean to the side of abolishing meter-rents.

I have not touched on the subject of street lighting. Sufficient has been shown in various towns of what can be done in this respect by the improvements of our friend Mr. Sugg, and others not so well known to fame; but the lighting authorities, out of consideration for the pockets of the poor ratepayers, seem to "love darkness rather than light."

In concluding, allow me to say that I might have touched on other matters of interest, but felt it was part of my duty not to take up too much of your time, and I beg to thank you for listening so patiently to what is but the traversing of a somewhat beaten track.

On the motion of Mr. COCKEY (Frome), a vote of thanks was passed to the President for his address.

The reading of papers was then proceeded with, these being taken in the order in which they here appear:—

Mr. A. EDWARDS (Taunton) read the following paper:—

NOTES ON CARBONIZING.

You are all doubtless well aware of the points to be observed in selecting coal—such as size, quality, and purity of gas and quantity of coke, relative price, &c., &c. I will not, therefore, occupy your time by entering into details relative thereto, but may remark, in passing, that it does not always happen that the coal which is alleged to produce the largest quantity and the best quality of gas per ton proves the most economical in working, especially if a chemical analysis only is the voucher for these particulars. The writer prefers a working analysis, made in the ordinary course of manufacture on his own works, from a sample of from 10 to 20 tons, as a coal which may prove most useful in one works may, from various causes, be much less useful in another.

As to the coal when purchased, it is desirable to note that by mixing with a rich heavy coal, which takes very high heats, and a long time to give up its gas, some other coal, which, with lower heats, gives off its gas quickly, results often above the average production of both coals, as to quantity and quality of gas, daily production per mouthpiece, and percentage of coke used as fuel, are obtained. The proportion of each coal might, of course, be raised from time to time, according to the result desired.

The writer strongly recommends the weighing of all coal delivered to stokers, and the periodical calculation and comparison of the results obtained under the following heads:—

Quantity of gas obtained per ton.

Average illuminating power.

Cost of coal for each 1000 cubic feet of gas produced.

The writer's experience of the leading varieties of coals, as regards the quantity and quality of gas resulting, may be set down as follows:—

Real Old Silkstone Coal (Screened Nuts).—10,500 to 10,600 cubic feet of 17-candle gas. Impurities low.

Best Derbyshire Silkstone.—9800 cubic feet of 17½-candle gas, to 10,200 cubic feet of 16-candle gas. Impurities low (except CO₂).

Gloucestershire Coal (large).—9500 cubic feet of 17½-candle gas, to 10,000 cubic feet of 16-candle gas. Ditto, through. 8500 cubic feet of 16½-candle gas, to 9000 cubic feet of 16-candle gas. Impurities over the average.

Best Newcastle Coal (Pelaw Main or New Pelton).—10,000 cubic feet of 17-candle gas. Impurities low.

Real Llantwit Coals.—9500 cubic feet of 18-candle gas, to 10,500 cubic feet of 14½-candle gas. Impurities high.

Wigan Nuts.—10,000 cubic feet of 15-candle gas, to 10,750 cubic feet of 14-candle gas.

Abersychan Seams.—9500 cubic feet of 15½-candle gas, to 10,600 cubic feet of 13½-candle gas. Impurities high.

As to materials for settings, after several trials of other kinds of materials, the writer is of opinion that the best Stourbridge retorts and other fire-clay goods are superior for use in gas-works to any others at present procurable. Fire-clay materials alone should form the mass of a retort-stack, the extra first cost being compensated by the greater durability of the work.

The furnace need not be of any fixed design, but may profitably be varied, both as to size and shape, according to the quality of coke available as fuel, and the amount of work required of it. Large furnaces and good coke being necessary to carbonize rich coals, while smaller furnaces will suffice to carbonize poorer coals.

As regards the vexed question of much or little brickwork in retort-settings, the writer would venture to suggest the happy medium. For all arches, pillars, &c., employing a dimension of 9 inches; where exposed to the direct action of the furnace gases, but not covering a retort in any part for more than 6 inches, measured across the direction of the stay, and in the flues away from the furnace, not more than 3 or 4 inches. Unless the furnace gases are deflected in some way on to the surface of the retort, no shield or other protection is necessary if the retort be properly charged in working.

Retorts keep their shape and work better when the supports over the furnace are placed not more than 14 inches apart, as compared with fewer supports. The writer would be glad to find some which need less support, but has failed hitherto.

Ample space should be given in the flues of retort-settings, provision made for cleaning them regularly, and this cleaning strenuously enforced. Chimneys and main flues should be of large capacity, having over rather than under one foot area per furnace served; proper dampers being provided and used for regulating the draught. Careful attention should be given to the stopping of leaks in retorts immediately they appear.

The ascension and dip pipes should never be less than 4 inches in diameter, and if above this size should have a diameter of 1 inch for each hundredweight of coal charged per mouthpiece per 12 hours. The seal in small works need not exceed 1 inch, if the back pressure caused by the purifiers, gasholder, &c., is reasonable.

In common with several other members of this Association, the writer has tried the experiment of dispensing with the dip in the hydraulic main.

His experience hitherto does not induce him to recommend the system. It is, however, possible that he has not yet tried the best apparatus for the purpose.

It is obvious that with the best appliances and materials good results cannot be obtained without the co-operation of the men employed as stokers. Considerable advantage obtains from giving them a money interest in the results of carbonizing. The system adopted at the writer's works consists of setting a task, varying from 17,000 to 21,000 cubic feet per man employed per shift, according to the number of retorts in action, the quality of the coal, &c., &c., and a payment of 3d. per 1000 cubic feet is made for all gas produced over and above the stipulated quantity, care being taken to prevent such extra quantity being unfairly produced or registered. This precaution is the more important as under this system unusual temptation arises to put in lighter charges during the later hours of the shift, whereby the illuminating power of the gas is depreciated, in consequence of the coal being over-burnt. The taking of the indication of the station-meter at the termination of each shift, and also three hours later, is sufficient to determine whether the gas is fairly made.

The quality of the coke produced from the coal carbonized should be carefully noted. Unless a sufficient portion of the coal produces a hard, strong, clean coke, capable of standing the draught of the furnace, and producing intense heat, the labour both of manager and stoker may well be spared, for excellent carbonizing results are unlikely to be obtained. This hard coke is not, however, the most suitable for domestic use, the draught of most house grates not being strong enough to keep it alight. It is for this reason often advisable to use a percentage of coal producing a more tender coke, taking the precaution not to stack such coke to any great height, or for a long period of time.

Finally, the writer is far from supposing that the few remarks he has been able to put together at short notice embody all that might be said upon this important subject, or are in themselves of sufficient value to deserve the attention given them; and he trusts the members present will, in the discussion to follow, supply from their varied experience the many defects and deficiencies of this communication, and thus bring about a result which may be worthy of the South-West of England District Association of Gas Managers.

Mr. T. HARDICK (Salisbury) read a paper headed—

REMARKS ON THE ADVANTAGES OF LETTING GAS COOKERS ON HIRE.

He said: I should feel very diffident in speaking of what we are doing, did I not know that some of my esteemed brethren, whose works are even smaller than those at Salisbury, may be encouraged in their efforts to promote the best interests of the companies they represent.

In the year 1872, I was looking through my carbonizing book, when I was struck with the very small quantity of gas used during the day, and taking the exact quantity for three promiscuous days in June, two in July, and two in August, I found that from 6 a.m. to 6 p.m. we used on the several days 3000, 3000, 6000, 5000, 7000, 5100, and 7000 cubic feet, or a total of 36,000 cubic feet in the seven days. I resolved, therefore, to bring the subject before my Directors, in my next monthly report, and this I did in the following manner:—"I have considered the desirability of the Company letting out cooking-stoves, on conditions and terms somewhat resembling those of meters, and have every reason to believe that it would answer the Company's purpose. The wear and tear of the stoves was a matter I could not quite make up my mind upon. I therefore procured an estimate from Messrs. Davis and Son, of Bath, who would undertake to keep their stoves in repair for five years at the rate of 5 per cent. per annum on the cost price. The risk, therefore, would be but small, as no large stock would be required, stoves being ordered from time to time according to the demand."

My Directors at once approved of the plan, and the Chairman, being in the medical profession, rendered great service in introducing and recommending it, very soon procuring for me an opportunity of testing its value in cooking at the Infirmary. This we did most efficiently for 112 inmates with two of Messrs. Davis and Son's stoves, a No. 3 and a No. 4 burner, and no fire was lighted for cooking in any manner for some time. Soon afterwards, when the Institution was greatly enlarged, Messrs. Davis and Son were employed to erect a large and suitable cooking apparatus.

In letting, I confined myself entirely to Messrs. Davis and Son's stoves, as I found them most satisfactory in every respect, easily fixed, inexpensive in repairs, and economical in the quantity of gas required. Another reason which induced me to persevere in the use of the same stoves was that it prevented any fruitless comparison between the stoves of the different makers, which might involve a frequent change according to the fancy of many cooks. I am, however, not prejudiced against any other maker, and am always ready to procure stoves made by other firms, provided the parties purchase them, and in no case do I make a profit on such business, my object being simply to sell gas.

From the first I had settled determinately that no rent or income from the stoves should go to swell the revenue account until the whole outlay had been recouped, being satisfied with the profits accruing on the sale of gas.

The following figures will show the disbursement for stoves and repairs up to Christmas last, and the amount received from the sale of stoves and for rent:—

Year.	Month.	Stoves Sold.	Rent Received.	Outlay for Stoves and Repairs.
1873				
1874	June	£28 16 9	£26 0 0	£271 11 11
1875	"	27 9 3	32 6 3	93 19 0
1876	"	36 12 0	35 15 9	40 16 9
1877	"	20 19 6	38 4 7	20 4 8
1878	"	10 11 0	36 8 4	20 13 3
1879	"	1 10 3	31 5 3	9 4 8
1879	Christmas	2 12 6	12 6 6	—
		£128 11 3	£212 6 8	£456 10 3
Less amount received for stoves sold and rent				340 17 11
Total				£115 12 4

A short time will now suffice for writing off the whole of the cost and repairs of the stoves, when any surplus rent may be applied for other purposes.

I have already mentioned that my day aggregate consumption in 1873, for seven days taken promiscuously in the months of June, July, and August, was 36,000 feet; in 1874, for corresponding time and dates, it was 68,000; in 1875 it was 111,000; in 1878, 197,000; and in 1879, 208,000. The following amounts represent the last item:—36,300, 32,000, 31,000, 29,000, 23,000, 32,000, 25,000. Some days, however, the consumption has reached 41,000 feet, and even more. A short time since I made some extracts from my book, and furnished one or two friends with them; but as I have

not a copy to refer to I cannot say if the results are more or less favourable. One thing is certain—I have carefully refrained from exaggeration. I have gone through my summer rental for the past two years, and find that the increased consumption of about 50 houses, where cooking by gas is practised, is something like 1,100,000 or 1,200,000 cubic feet. Of course, this does not include numbers of small families where the increase may be but a few thousands each. My consumption in the summer half year, before I made my report, was 6,673,700 cubic feet; last year it was 13,231,200 feet. I believe one-third of my summer make is consumed in the daytime, and a great many people become so accustomed to cooking by gas that they continue to do so all the year round. For cooking we increase the pressure to 4-10ths from about 10.30 a.m. to 2.30 p.m., which will be seen by referring to one of our pressure papers.

I look forward to much being done, not only for cooking, but for heating, &c. We have also two motive-power engines, each using about 150,000 cubic feet a year, besides many smaller ones.

Our charge for the use of stoves is according to the following scale:—

No. 1 burner	5s. 0d. per year.
No. 2 „	7 6 „
No. 3 „	10 0 „
No. 4 „	13 0 „

In 1877 we had in use for hire—4 No. 1, 27 No. 2, 43 No. 3, and 15 No. 4 stoves. These numbers are, of course, ever varying.

Mr. G. GARNETT (Ryde) had prepared the following paper, which, in his absence, was read by the Honorary Secretary:—

ON THE PROPOSED USE OF COAL GAS FOR RAISING STEAM FOR LOCOMOTIVE PASSENGER TRAINS ON RYDE PIER RAILWAY.

The joint London and South-Western, and London, Brighton, and South Coast Railway Companies, having completed their new line of railway from Ryde Pier to the Ryde Station of the Isle of Wight Railway, by tunnelling under the town, and having thereby thrown out of use the ordinary horse tram-cars, the Pier Company have determined to work their pier railway passenger traffic by steam tram-cars, and, in order to avoid nuisance to the promenade pier, to raise the steam by means of coal gas. It is thought that the novelty of the work now in course of execution may prove interesting to the members of the South-West of England District Association of Gas Managers.

The car to be used as a locomotive is one of the ordinary passenger cars, a portion of the floor of which will be removed where the engines and boilers are fixed. A wrought-iron under-frame is to be constructed, with horn plates, axle boxes, and spring arrangement, suited for inside bearings, and new steel wheels 2 ft. 6 in. in diameter are to be provided. Besides the two carrying axles, there will be between them, in the centre, a driving axle or ordinary shaft, as in Crampton's patent locomotive, with no wheels on it. The three axles will have cranks on the outer ends for coupling, like a six-wheel coupled locomotive. This arrangement dismisses gearing from the design, and admits of the free action of the springs without affecting the machinery.

The central shaft will be driven by two vertical steam-engines, each having cylinders 5 inches in diameter and 15 inches stroke. These unusual proportions are adopted for the following reasons—first, to acquire the power by a light engine with light reciprocating parts moving slowly and avoiding vibration and rattle; secondly, to be economical in width of space occupied, that being limited; thirdly, to expand the steam effectively by cutting off early and exhausting late, and to have as little pressure and heat as possible in the exhaust, so that it may be easily suppressed in the condenser, and issue as nearly as possible noiselessly and invisibly.

The engines will have link-motion reversing gear, operated from either of the end platforms, and the brake will also be made available at either end. The boiler will be vertical multitubular, so constructed as to utilize the heat to the greatest advantage. It will carry a steam pressure of 120 lbs., with a loaded margin up to 160 lbs., to avoid blowing off steam. It will be made of the best material, the shell plates being of best Staffordshire iron, the furnace and tube plates of Lowmoor iron. It will be fed by two injectors from light tanks fitted between the new under-frames which will receive the condensed exhaust water, and be replenished occasionally by a hose at the terminus.

The furnace will be constructed to burn gas and air on the Bunsen principle, and the gas will be supplied from four rectangular gas-bags similar to those used for carriage lighting on the Lancashire and Yorkshire Railway. These bags will each contain about 100 cubic feet of gas, and will be placed in the four inside corners of the car, which will itself have no passenger space except for the driver. These gas-bags will be filled from a station gasholder of 1000 cubic feet capacity, at a sufficient pressure to expand the bags and deliver all through one main-pipe in the centre of the car, fitted at each end with unions for receiving gas at the terminus. The gasholder will be provided with a crab for raising and lowering the counterpoise weights as occasion may require, to fill from the street-main at day pressure (7-10ths), and fill the bags at 1.5 inches pressure. When standing for any length of time at the terminus, the gas for getting up or keeping up steam may be taken direct from the main, but when running the furnace would take its supply from the store in the four bags, any one of which alone, in case of failure to the others, would be enough to run the car a few trips.

On the top of the car will be a long rectangular tank with numerous small tubes running transversely through it, and fitted on each side with louvre boards to direct the current of air through the tubes as the car travels, and the exhaust steam being injected into this tank, and made to travel the length of it two or three times, passing all the tubes, it will be condensed, suppressed, and recovered to the fullest possible extent for feed water.

The funnel will be central, neat in appearance, and no smoke or vapour will visibly issue from it.

It is calculated that the car will travel from eight to ten miles an hour alone, and, if needed, will draw six other cars, of ordinary size and weight, on a level at from six to eight miles an hour in fair weather, but will at any time draw four other cars at a good speed.

The length of the railway being a few yards short of half a mile, there is probably no reason to doubt the practicability of the application of gas as fuel, provided it is consumed at a sufficient pressure to prevent the burners from lighting back during the vibration of transit. The detail of the burners, however, is not yet determined on, the experimental trials not being concluded.

The execution and responsibility of the work is entrusted to Mr. F. Bradley, of the Clemenmore Iron-Works, Kidderminster, and it is now being carried forward.

Votes of thanks having been passed to those who had prepared papers, and to the President and Honorary Secretary for their services to the Association, it was agreed to hold the next meeting at Southampton.

In the evening the members of the Association dined together.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is still no sign of improvement in the coal trade of this district in fact, if anything, the pits are getting worse off for orders, and short time is increasing. The better classes of round coal for house-fire purposes are the chief drug in the market, very heavy stocks being now held throughout the district. These classes of fuel are at present being drawn upon only to a very limited extent for gas-making purposes; the requirements of consumers being only small, whilst it is too early for inquiries for next season's contracts. The lower classes of round coal, notwithstanding the improved demand for ironmaking purposes, are very plentiful in the market, and both these and the better sorts exhibit a downward tendency as the result of the anxiety of sellers to push their stocks upon the market. Prices at which round coal can be bought vary considerably, list rates being little adhered to where sales have to be effected. For best Wigan Arley it is difficult to get more than 8s. to 8s. 6d. per ton at the pit, whilst the common sorts, which in some cases can be bought under 6s., range from that price up to 7s. per ton; good Pemberton four-foot averages about 6s. 6d., and common round coal about 5s. to 5s. 6d. per ton. Engine classes of fuel maintain a very firm tone in the market, owing to the lessened production of slack, and as good qualities of slack at many of the collieries are becoming scarce, higher prices are being asked, good qualities fetching freely 3s. 6d. per ton, and common sorts 3s. per ton.

For shipment there has been only a limited inquiry, and as there has been a good deal of coal held on demurrage, sellers have been willing to take very low figures to secure cargoes.

For inferior classes of coke there has been less demand, but the better sorts still sell readily at full rates.

In the iron trade prices continue weak, so far as second-hand holders are concerned, and during the past week north country irons have been offered in this district at very low figures. Local makers of pig iron are, however, still firm at 70s. per ton for delivery into this district. For finished iron rather lower prices are being taken, although most of the makers are well supplied with orders. Second-hand lots of bars can be bought at about £8, with the makers asking £8 10s. to £9 per ton for delivery into the Manchester district.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The gas coal trade of the Tyne and Durham districts continued to be slack last week. The amount of shipments has had a tendency to fall away; and the demand from the London and other large gas-works is becoming less as the days lengthen. It is expected that there will be large shipments of gas coals to the Baltic and Mediterranean next month. It is needless to repeat that prices are unchanged. The house coal trade continues in a very poor state. Steam coals improve in demand as the trade upon the Continent reopens. Coke is in good inquiry. Fresh coke ovens are being built in all parts of the district. Its production will be largely increased by Midsummer. The sum of the whole matter, as regards the coal trade of the northern district, amounts to this: The business which was expected from the Continent is not coming to hand, and it is a great question whether iron, chemicals, &c., will go very much beyond the present point as regards value. Manufacturers and coal piters experience great difficulty in upholding what they have gained. Under these circumstances, the anticipations of the coal owners of a considerable rise in the price of fuel cannot be maintained. They have, therefore, made up their minds to be content with moderate gain—a good deal less than what they had anticipated. The most substantial advance realized and likely to be attained is, in the value of small and manufacturing coals. Over the three years preceding October last they were a sad drag upon the round coals. There was much trouble experienced in finding a market for them; and when they were sold it was at miserably low and unremunerative prices. So far from being a burden upon the value of round coals, they are now a help. The price of some of the better qualities of small coals is not far short of what is realized for second-class round; hence the trade here, if not all that was anticipated of it three or four months since, is in a sound position, compared with twelve months ago. And as Northumberland and Durham have a sliding scale for wages in operation, by which the pitmen's pay is regulated by the price of coals every three months, there is not much room for complaint either from the coal owner or from the workman.

The shipping trade is flat and dull. There is no local demand for tonnage. Freights generally are low. The business which is being transacted coastwise or over sea keeps limited. Rates are low.

The chemical market was somewhat depressed last week. Prices fell. The continental demand fell short. Chemicals which had been bought by merchants for forward shipments could not be placed. Under these circumstances prices have yielded. They are now lower.

There were numerous shipments of fire-clay and fire-clay goods last week.

Seven hundred and sixty tons of rich Spanish lead were sold in the Tyno last week, at the rate of £16 18s. per ton.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

If progress in the civilizing agencies of modern life may be estimated by the extent to which coal gas is used in street lighting, then Glasgow ought to stand well in the opinion of the public. In a large and most interesting volume just published, under the title of "Old Glasgow," it is stated that until the year 1780—exactly a century ago—there was not a public street-lamp in the city, and that in that year the magistrates resolved to put up nine on the south side of the Trongate; now, however, exclusive of some 500 lamps lighted by the Clyde Navigation Trustees at the harbours and docks, the Corporation light nearly 12,000 lamps, at an expenditure of over £20,000 per annum. In addition to all these, there are upwards of 25,000 lamps on common stairs lighted by the Corporation, and charged partly against the proprietors.

Gas Companies and Gas Corporations in other parts of the kingdom may feel interested in knowing that the Corporation Gas Committee of a royal burgh not many miles from Glasgow have recently disposed of the ammoniacal liquor manufactured at their works at the rate of 18s. 10d. per ton for one year. The two highest offerers were equal, but only one of the firms sent in an amended offer. Of course, it should be borne in mind that there is a material difference in the quality of the ammoniacal liquor resulting from the carbonization of cannel and common coal.

At the last meeting of the Police Commissioners of Wishaw it was announced that the cause of the delay in the arbitration connected with the acquisition of the gas supply undertaking of the town was owing in a great measure to the illness of one of the arbiters; but that the time now arranged for—three months—would give ample opportunity to have the work satisfactorily finished. The arbiter referred to is Mr. McCrae, of Dundee. When I mention that he has been in Glasgow recently, his friends at a distance will naturally conclude that there is no need to be

alarmed at learning of his illness. His fellow-arbiter is Mr. Hislop, of Paisley.

On Saturday morning several persons narrowly escaped suffocation from coal gas in a house in Temple Lane, Dundee, where two families resided. Edward Buchan, labourer, and his wife, and two boys, sons of Kenneth Gibson, were discovered about nine o'clock lying in bed insensible. Medical aid was called, and restoratives were successfully applied. The gas is supposed to have come from a leakage in the street.

At a public auction of shares, &c., at Arbroath, on Saturday week, the annuity No. 8 of £4 4s. of the Arbroath Corporation Gas Annuities was offered for sale at £96, and sold for £98 5s.

The ordinary monthly meeting of the Greenock Police Board was held last Tuesday—Provost Campbell presiding. The Gas Committee reported as follows:—"At a meeting of the Gas Committee, on the 9th of March, the Sub-Committee on Unaccounted-for Gas submitted a minute and a report by the Manager, and the several recommendations contained in these were adopted. Two of these recommendations are—first, that 36 lamp-pillars, with meters to indicate the consumption of gas per lamp, be procured and erected throughout the town, and that in future the average consumption of these meter lamps, having regard to the different sizes of burners used, should form the basis of the annual charge for gas supplied to the public lamps, in lieu of the present method of calculation. Secondly, that several district governors be fitted on the main-pipes at various points of the system, so as to equalize the pressure over the entire area of the town. The report by Mr. Stewart, the Manager, consisted of a plan showing the proposed arrangement of districts for regulating pressure and reducing the excess day and night pressures. The report also stated that the searching for escapes has continued throughout various parts of the town, and, although no serious escapes have been found, except 4-inch main broken in Lynedoch Street, at Steel's Land several small ones have been stopped. Examination and testing of mains and services have been made in Vennel, from Hamilton Street to Inverkip Street, and the 2-inch main in this street being old and defective, gas has been escaping from it in several places, but have all been repaired." The Gas Committee have been much dummed and pestered by Mr. G. C. Stewart, a local chemical analyst, who seems to be a sort of heaven-born genius if he can fulfil the promise which he makes as to the prevention of leakage from the gas-mains. He is said to have some particular method of discovering the waste of gas from leakage, which, according to his own statement, he can reduce to nearly 5 per cent. If the Police Board consent to pay him £500 by way of remuneration, he is willing to guarantee to reduce the leakage to 10 per cent. His letter has been remitted to the Gas Committee.

At the ordinary meeting of the Graduates Section of the Institution of Engineers and Shipbuilders in Scotland, held last Tuesday, a very interesting and comprehensive paper was read by Mr. Wilcox, M.A., C.E., on "Recent Progress in Electric Lighting." The discussion on the paper was adjourned.

It was reported to a meeting of the Greenock Water Trust, held last Tuesday, that the amount of water in store in the various reservoirs was 456,144,357 cubic feet, or a supply for 130 days for all purposes—certainly a very satisfactory state of things. It may be mentioned that the Greenock water supply comes down into the town from the hills in a series of falls, which represent a great amount of mechanical energy. In the course of the proceedings last Tuesday, Provost Campbell said he was in hopes that these falls would soon be let. Science was advancing every day, and they heard of water power being utilized in many ways. He had not the slightest doubt that they would yet receive a handsome revenue from the falls.

On Tuesday last, by order of the Home Secretary, Sheriff Birnie held an inquiry in connection with the application by the Parochial Board, as the Local Authority of Blantyre, for a Provisional Order to introduce a supply of water from Lees Burn into the proposed water supply district. Mr. E. P. Dykes appeared for the promoters, and there was no opposition. Dr. Downie, Medical Officer of Health; Mr. William Sillar, Inspector of Poor; and Mr. James Barr, C.E., were examined to show the needs of the district for a water supply. The population was 7000. The drainage area of the Lees Burn and a tributary was 1310 acres. The proposed reservoir, assuming no water to be flowing into it, would contain water for a population of 6000 for 40 days, at 25 gallons per head per day; and assuming three months of perfectly dry weather, with a minimum rainfall of a quarter of an inch per month, and that the population increased to 12,000, they would still be able to supply 25 gallons per head. The estimated cost at present was £8473, and it was not anticipated that the assessment would amount to 1s. per £1. The Sheriff stated that he would forward his opinion to the Home Secretary, and the inquiry terminated.

A large amount of business was done last week in the Glasgow pig iron market, but the improvement was to a considerable extent due to the covering of "bear" sales. As low as 56s. 6d. cash was accepted on Tuesday and Wednesday, but the close on Friday afternoon was 58s. 1½d. cash for buyers, and 58s. 3d. for sellers.

There is a slightly better inquiry for some descriptions of coal, but the market still remains dull.

ABERAVON CORPORATION WATER SUPPLY.—We hear that the Aberavon Corporation Water-Works have now been completed, and that the greater part of the houses in the borough are connected with the water-mains. Mr. John Henderson, who has, for the last twelve months, been inspector of the laying of the mains and services, has now charge of the whole of the works.

REDUCTION IN THE PRICE OF GAS BY THE SOUTHAMPTON GAS COMPANY.—At the last meeting of the Southampton Town Council, a letter was read from Mr. C. Crowther Smith, Secretary of the Southampton Gas Company, notifying that the Directors of the Company intended making a reduction in the price of gas supplied throughout their districts of 3d. per 1000 cubic feet in April.

WESTON-SUPER-MARE GAS COMPANY.—At the annual meeting of this Company on the 5th inst., a dividend of 10 per cent. per annum was declared on the class A shares, and 7½ per cent. on classes B and C shares. The retiring Directors were re-elected, and Mr. Helps, of Bath, was elected Manager, in the place of Mr. J. Perry, deceased, who held the appointment for a quarter of a century.

KIRKBRURTON GASLIGHT COMPANY, LIMITED.—The annual general meeting of this Company was held on the 1st inst.—Mr. T. Brook presiding. The Chairman referred to the principal items in the accounts, which showed a balance available for dividend of £447 5s. 11½d., out of which the Directors proposed to pay a dividend for the year at the rate of 7½ per cent. The report was adopted. Messrs. T. Brook and A. Matthews were re-elected Directors, and Mr. J. Sharp was re-appointed Auditor.

ARMAGH GAS COMPANY.—The annual general meeting of this Company was held on Monday, the 15th inst.—Mr. J. L. Riggs in the chair. The accounts showed that the gross revenue of the Company for the past year amounted to £4328 14s. 2d., and the working expenses to £3171 0s. 7d. There was a sum of £3261 8s. 6d. accumulated undivided profits. The

net profit on the year's working was £997 14s. 10d., out of which a dividend of 7½ per cent. was declared, absorbing £765, and leaving £282 14s. 10d. to be carried to the reserve-fund. The paid-up capital of the Company is £10,200.

BROADSTAIRS GAS COMPANY.—The report presented at the annual general meeting of this Company, on the 2nd inst., stated that the additions to the works were progressing satisfactorily, and that the Directors recommended the payment of the maximum dividends of 10 per cent. on the A stock, and 7 per cent. on the paid-up B stock. The accounts showed that the total capital paid up is £8640 (including £250 loan), or £984 13s. 8d. more than has been expended. The revenue account showed the receipts during the past year to have been £2472 1s. 10d., and there was a balance of £712 to be carried forward.

SLAITHWAITE GAS COMPANY.—The annual meeting of this Company was held on the 3rd inst.—Mr. C. Thornton in the chair. The Chairman read the report, which stated that the Directors regretted that the continued depression in trade had caused a diminution in the profits; but better times had set in, and the consumption was largely increasing, so that in a short time the Directors hoped larger profits would be made. They recommended a dividend of 7½ per cent. for the past year. The report and balance-sheet were approved, and the dividend as recommended was declared. Messrs. J. Crowther and H. Walker were re-appointed Directors, and Messrs. Wood and Wheawill, Auditors.

BOLTON WATER-WORKS ARBITRATION.—An arbitration, which has now been in abeyance for seven years, between the Corporation of Bolton and Mr. P. R. Hoare, was resumed on Monday, the 8th inst., at the Surveyors Institute, Westminster, before Mr. A. S. Hill, Q.C. Mr. Higgins, Q.C., and Mr. Black were retained for Mr. Hoare; and Mr. Pope, Q.C., and Mr. Yates were counsel for the Bolton Corporation. The matter in dispute is the value of certain land near Chapeltown and adjoining Wayou Brook and Bradshaw Brook, taken for the purposes of the Bolton Water-Works. Mr. John Cross, on behalf of Mr. Hoare, valued the land and minerals at £26,000, but the Corporation dispute the existence of minerals under the land, alleging that there is a "fault" which extends over the whole of it, and that therefore the land is not worth more than £500. The former sittings of the arbitration took place in February and April, 1873, and it was then adjourned *sine die*. Owing to the parliamentary engagements of the counsel the arbitration was further adjourned to the 29th prox.

DERBY GAS COMPANY.—The half-yearly general meeting of this Company has held on the 28th ult.—Mr. G. Gascoyne in the chair. In moving that the following dividends to the 31st of December last be paid, free of income-tax—viz., on each original share a dividend of £1 5s.; on each share issued under the powers of the Derby Gas Act, 1876, a dividend of 17s. 6d.; and on each new share issued under the powers of the Derby Gas Act, 1882, a dividend at the rate of 10 per cent. per annum—the Chairman said the Company's statutory dividends had been so uniformly paid, that he thought the time would scarcely come when either Edison or any other man would frighten the Shareholders out of their propriety. The Company's income last half year admitted of a larger dividend by £560 being paid to the Shareholders, on the calls of the new capital, than in the previous half year; and this was done in the face of a reduction in the price of gas in the outlying districts. There was a balance of £1306 to carry over to next half year's account. Mr. Richardson seconded the resolution, remarking that, considering the depression in trade, the position of the Company was highly satisfactory. The resolution was carried, and the retiring Directors and Auditor were re-elected.

CUCKFIELD GAS COMPANY.—The annual meeting of this Company was held on Tuesday, the 9th inst., when the report of the Directors, which was presented, stated that in consequence of the increased demand for gas last year it was found that the works were not sufficient to meet it, and they consequently called in the assistance of Mr. J. B. Paddon, C.E., of Hove; and to carry out their improvement and enlargement, it became necessary to increase the share capital of the Company, and to issue new shares to the amount of £1500, which were disposed of at par. A contract for a new holder and tank, and other works, now in course of construction and soon to be completed, was accordingly entered into. The accounts not showing such satisfactory results as usual, the Directors said they would be unable, without resorting to the reserve-fund, to recommend the payment of any dividend, but, with every prospect of ultimate success, they could recommend that 5 per cent. be declared and paid for the past year, and that the sum necessary, over and above the balance in hand, should be charged to the reserve-fund. Negotiations had been opened with the Hayward's Heath Gas Company to ascertain the possibility of amalgamating the two Companies, but, serious difficulties arising, the project had been abandoned.

WALTON-ON-THAMES AND WEYBRIDGE GAS COMPANY.—The half-yearly meeting of this Company was held on Saturday, Feb. 28, when the Directors reported that the works and plant were in a thorough state of efficiency, and that, comparing the accounts for the last six months with those of the corresponding half of 1878, it would be found the sale of gas had increased from 9,342,100 to 10,071,500 cubic feet, being an increase of 729,400 feet. The gross rental was £2732 4s. 2d., subject to a discount of 6d. per 1000 feet on all accounts paid within one month after quarter-day. The amount of the discount for the Michaelmas quarter was £64 1s. 5d., and for the Christmas quarter £128 6s. 10d., making together £192 8s. 3d. The net rental was therefore £2539 15s. 11d., as against £2560 10s. 8d., so that the loss by the reduction of price had been nearly compensated in the first half year by the increased sale of gas. The residual products, including the manufacture of asphalt, had realized £761 10s. 7d., as against £563 3s. 3d.—an increase of £198 7s. 4d. On the other hand, the balance to the credit of coal trade account was only £108 17s., as against £229 18s. 3d., a decrease of £121 1s. 3d., which was more than accounted for by the fact that, while the average cost of coal had been 1s. per ton higher, the average retail price in the district had been fully 2s. per ton lower than it was in the corresponding half of 1878. After providing for interest payable on loans and for the discount to be allowed off the Christmas collection, the accounts showed a net profit for the half year of £1284 4s. 4d., which, added to £176 18s. 6d., the balance from last account, made a total of £1461 2s. 10d. Of this sum £200 had been carried to depreciation-fund account, leaving £1261 2s. 10d. available for dividend, which the Directors recommended to be declared at the rate of 8 per cent. per annum, free of income-tax, the balance of £61 2s. 10d. to be carried forward to next account.

THE PRICE OF GAS IN PARIS.—It may be remembered that at the meeting of the Municipal Council of Paris on the 24th of December last (see *ante*, p. 96) it was resolved, having in view the numerous memorials that had been presented on the subject of the price and quality of the gas supplied by the Paris Gas Company, to forward a requisition to the Minister of the Interior to nominate—under the power conferred upon him by the 48th article of the treaty of Feb. 7, 1870, between the Gas Company and the Municipality—a Commission to inquire into the actual position of the gas supply of Paris, with a view to its improvement for the public benefit. We learn from the *Journal des Usines à Gaz* that such a Commission has been appointed, and it is understood that the following

eminent scientific gentlemen have been nominated to serve on it:—M. Aimé Girard, Professor of Chemistry at the Conservatoire des Arts et Métiers; M. Troost, Professor of Chemistry at the Faculté des Sciences; MM. Friedel and Lan, of the Ecole des Mines; M. Cahours of the Paris Mint; and M. Debray, Assayer. Notwithstanding the undoubted notoriety of all these gentlemen, it is worthy of notice, our contemporary remarks, how carefully every name either nearly or remotely connected with the gas industry has been eliminated. If this fact is to be taken as a guarantee of impartiality, it may, on the other hand, give rise to some severe criticism as to the possession by the nominees of that thorough knowledge of the practical conditions of gas manufacture which is absolutely necessary for the proper discharge of the duties now devolving upon them. Furthermore, the tardiness of the Minister of the Interior in nominating the Commission has really nullified the appointment, inasmuch as the article already referred to specifies that the Commission shall send in their report before the expiration of any period of five years from the date of the treaty. As the second of these periods expired on Feb. 6 last, it might not be unjustly urged that the power placed in the hands of the Minister of the Interior had lapsed by efflux of time. However, it may be assumed that the Paris Gas Company have nothing to fear from the inquiry of the Commission, and consequently they have done well not to raise any technical obstacle to the proceedings. At the same time, such consideration on their part—having regard to the specific terms of their treaty with the Municipality—should not pass unrecorded.

Register of Patents.

APPLICATIONS FOR LETTERS PATENT.

- 897.—SMITH, R., Edinburgh, "New or improved water supplying and regulating apparatus for water-closets and other analogous purposes." March 1, 1880.
- 919.—MACFARLANE, J. W., Lanark, N.B., "Improvements in apparatus for the manufacture and treatment of cast-iron pipes, columns, and similar articles." March 2, 1880.
- 947.—MACKIE, A., Pimlico, London, "Improvements in the construction of gas-retort mouthpieces and lids, and in the fastenings thereof." March 4, 1880.
- 962.—HYND, D., Dundee, N.B., "Improvements in lighting and illuminating, and in apparatus or means employed therefor." March 5, 1880.
- 967.—CLIFT, S., Conway, North Wales, "Improvements in the manufacture of gas-retort coal-tar products." March 5, 1880.
- 994.—WEBSTER, G. E., Nottingham, and FISHER, W. E., Birmingham, "Improvements in gas-burners, governors, and street-lanterns." March 8, 1880.
- 1034.—EDMONDS, E., Fleet Street, London, "A new process and improved means for carburetting air, and rendering it either explosive or illuminating at will." A communication. March 9, 1880.
- 1038.—STEPHAN, J. A., Worcester, "Improvements in the manufacture of heating and illuminating gases, in the apparatus to be used in such manufacture, and the means employed for the incandescence of the said gases." March 10, 1880.
- 1040.—BARTON, C. C., Rochester, U.S.A., "An improved fluid-pressure regulator, chiefly designed for maintaining a determined and uniform pressure in household and other water supply pipes." March 10, 1880.
- 1055.—M'LENNAN, J., Finsbury Park Road, and OWEN, R., Haverstock Hill, London, "Improvements in apparatus for regulating the supply of gas." March 11, 1880.
- 1063.—GLASER, F. C., Berlin, "Improvements in stoves and furnaces heated by gas." A communication. March 11, 1880.
- 1092.—WRIGHT, F., Baker Street, London, "Improvements in gas-regulators." March 13, 1880.
- 1103.—STANLEY, H. F., Highbury, London, "Improvements in jointing and laying pipes in shifting soils or under water." March 15, 1880.
- 1119.—FOULIS, W., Glasgow, "Improvements in apparatus for purifying and cleansing gases, the same being applicable for separating gases or vapours from liquids." March 16, 1880.
- 1121.—HAMER, P., Skegness, Lincoln, "Improvements in giving motion to the valves of water-meters and in apparatus or appliances therefor." March 16, 1880.
- 1126.—HADDAN, H. J., Westminster, "Improvements in liquid-meters." A communication. March 16, 1880.
- 1131.—JOHNSON, R., Seedley, Lancs, "Improvements in gas-engines." March 16, 1880.

- 1162.—WILSON, W., Oakland, U.S.A., "An improved collapsible tube-valve, to be placed in pipes and passages for admitting a flow of water, steam, air, or gas in one direction, and preventing a back-flow in the opposite direction." (Complete specification.) March 18, 1880.
- 1181.—CLARK, A. M., Chancery Lane, London, "Improvements in apparatus for effecting the absorption and washing of gases and vapours." A communication. March 18, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 3782.—DODD, J., Liverpool, "Improvements in and relating to flushing cisterns for water-closets, also applicable to other purposes where it is required to discharge a given or measured quantity of liquid." Sept. 20, 1879.
- 3826.—SUGG, W. T., Westminster, "An improved coupling for gas, air, or water pipes." Sept. 23, 1879.
- 3927.—REEVES, H., Camberwell Road, London, "Improvements in the manufacture of gas, more particularly adapted for lighting purposes, and in apparatus therefor." Sept. 23, 1879.
- 3951.—REDFERN, G. F., Finsbury, London, "An improved meter or apparatus for measuring water and other liquids." A communication. Sept. 24, 1879.
- 3980.—WILD, R., Littleborough, Lancs, and LEDGER, H., Leek, Stafford, "Improvements in and self-acting apparatus for treating and filtering sewage and other foul liquids, gases, and noxious vapours, also applicable to other filtering purposes." Oct. 3, 1879.
- 4519.—RAGOT, G., Ixelles, Belgium, "Improvements in apparatus for carburetting air with naphtha or other hydrocarbons for use in lighting or heating." Nov. 5, 1879.
- 5075.—GRÜNEBERG, Dr. H., Cologne, Germany, "Improvements in the construction of apparatus for distilling and concentrating of ammonia-waters and ammonia-containing liquors." Dec. 11, 1879.
- 5209.—ROSS, A. Q., Cincinnati, U.S.A., "Improvements in apparatus for charging and discharging the retorts of gas manufactories." Dec. 20, 1879.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

- 635.—CLAYTON, L. and L., "An improved mode of and apparatus for punching metal plates to be used as gasholder top sheets." Feb. 15, 1877.
- 657.—GREEN, C. H., "Improvements in the arrangements and construction of gas-stoves and utensils to be used therewith, and for other purposes." Feb. 17, 1877.
- 669.—NEWMAN, J., and DUESBURY, W., "Improvements in apparatus for transmitting gas from the retorts to the hydraulic main." Feb. 17, 1877.
- 840.—WIRTH, F., "A new filling for gas-meters." March 2, 1877.
- 842.—TRULL, C. K., "An improved apparatus for lighting gas." March 2, 1877.
- 857.—BARKER, E. D., and HARRIS, A. G. R., "Improvements in ball-valves and other draw-off valves." March 3, 1877.
- 995.—CALDWELL, A., "Improvements in apparatus for measuring and controlling or regulating the flow or supply of water." March 13, 1877.
- 997.—BRÉMOND, L., "Improvements in means to be employed for preventing the deposit of naphthaline in gas apparatus, mains, and fittings." March 13, 1877.

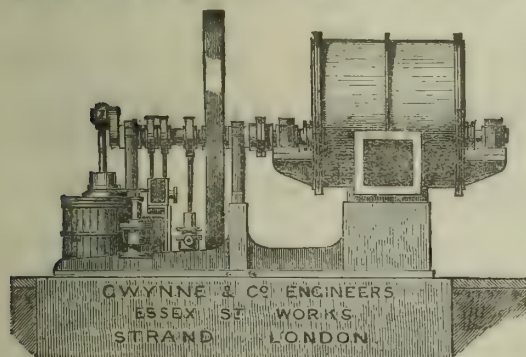
PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

- 442.—DEAN, W., and LANCASTER, R., "Improvements in gas-regulators." Feb. 6, 1873.
- 480.—PILLING, W., and HARLOW, B., "Improvements in the construction of stretch traps and grids for street and other sewers or drains." Feb. 10, 1873.
- 493.—GASCOYNE, W., "Improvements in the manufacture of D-traps for water-closets and other like purposes." Feb. 11, 1873.
- 569.—PATISON, J., "Improvements in the destructive distillation of coal and shale for the production of illuminating gas, fuel, and oil, and other products therefrom, and in the apparatus therefor." Feb. 15, 1873.
- 768.—PARLEY, W., "Improvements in the construction and manipulation of apparatus used in the manufacture of gas." March 3, 1873.
- 823.—WRIGHT, W., "Improvements in the manufacture of gas for heating and illuminating purposes, and in apparatus for the same, parts of which are applicable to other purposes." March 7, 1873.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce machinery of the very highest quality, and most approved design and workmanship. The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

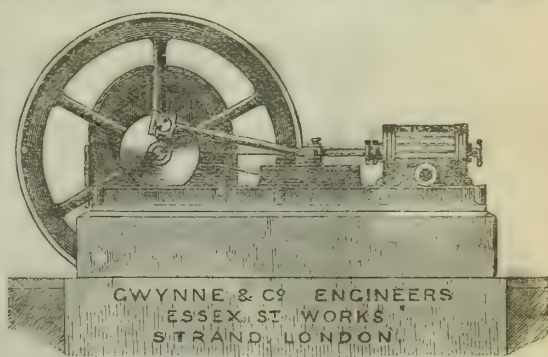
Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, **GWYNNE & CO.,** Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"Reliable compact Machine, well adapted for the purpose intended; of excellent workmanship."

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

WANTED, Readers of the NEW Edition,
"Cooking & Heating by Gas;" on Burners, &c.
Copies, by post, Threepence, direct from the Author,
MAGNUS OHREN, Assoc. M.I.C.E., Gas-Works, SYDENHAM.

WANTED, by the Advertiser, aged 20,
a Situation in a Gas Company's Office (in Manager's Office of a moderate size town preferred). Has been 5½ years in a Gas Company's Office.
Address No. 637, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Working MANAGER or FOREMAN of a Gas-Works. Thoroughly understands the Manufacture and Distribution of Gas, and Main and Service Laying, Meter Fixing, and Index Taking, &c., and Fitting in all departments.
Address No. 639, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser, who is
at present and has been the last five years Manager and Secretary to a Gas Company in a small town within 100 miles of London, a more lucrative Appointment.
Four recent testimonials and statistics of the present working will be sent upon application to No. 638, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser, aged 24,
Management of small Works, or Situation in large Gas Company's Office. Thoroughly conversant with Manufacture, Distribution, and Purification of Gas, Photometry, Sulphur and Ammonia Tests. Fair Draughtsman. Good references. Seven years in works making 90 million.
Apply, by letter, to No. 612, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN (good).—Wanted, a
young Man at once who is used to Gas Plant. Must be able to take out Quantities, &c.
Apply, by letter, stating age, references and salary required, to No. 640, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A Gas Engineering Firm require the
Services of a Travelling AGENT calling on Gas Companies.
Applications, with full particulars, which will be treated confidentially, to be addressed No. 641, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BOROUGH OF BRADFORD.

THE Gas Committee of the Bradford
Corporation require the services of a competent Person to act as SUPERINTENDENT of the Gas-Works at the Valley Road Station, at a salary of £150 per annum; and the services of another such Person to act as SUPERINTENDENT at the Thornton Road Station, at a salary of £100 per annum.

Any further information required may be obtained from Mr. Swallow, Gas Engineer, at his Offices at Mill Street, Bradford. It is indispensably necessary that applicants must be skilled in the Manufacture of Gas, and must be acquainted with mechanical work.

Application, endorsed "Superintendent of Gas-Works," accompanied by testimonials, to be sent to me on or before the 3rd of April next.

By order,
W. T. M'GOWEN, Town Clerk.
Town Hall, Bradford, March 15, 1880.

GAS SHARES to be Sold in the Ux-
bridge and Hillingdon Gas Company. Between 40 and 50 fully paid-up shares, for some years paying maximum dividends.

For particulars apply by letter to Mr. C. HORSLEY, 22, Wharf Road, CITY ROAD, N.

FOR SALE—A Set of Four Purifiers,
each 18 ft. long by 8½ ft. wide, and 6 ft. deep, with Centre-Valve and 12-in. Connections complete.
Parted with as being too small.
Offers to be addressed to the MANAGER, Edinburgh and Leith Gas Company, Baltic Street, LEITH.

TO BE SOLD.—The Stanstead Gas-
Works, near St. Margaret's Station, Great Eastern Railway, Hertfordshire.
Apply to GEORGE DAVIS, SUTTON-ON-HULL.

THE Sunbury-on-Thames Gas Company
have FOR SALE the following PLANT, in good condition, thrown out to give place to larger:—
Two Purifiers, 5 ft. by 3 ft. by 3 ft. deep.
Six-inch Connections with Lifting Screw and Traveller complete.

Three 6-in. Cathels's patent Four-way Valves.
Station-Meter to pass 1500 feet per hour, 4-in. Connections.

Five-inch Condenser, nine Pipes, and Tar Box with Overflow Pipe.
Six 6-in. Donkin's Valves.

For particulars and price apply to Mr. JOHN SMITH, Manager, Gas-Works, Sunbury-on-Thames. MIDDLESEX.

GAS PLANT FOR SALE.

THE Coventry Gas Company have for
SALE—

SCRUBBERS.—One 5 ft. 6 in. diameter, 20 ft. high. One 5 ft. 6 in. diameter, 15 ft. high. One 5 ft. diameter, 20 ft. high; with or without 8-in. Connections and Valves.

GASHOLDER.—One Telescopic, 40 ft. diameter and 34 ft. high, in two lifts; Cast-iron Tank for same, 41 ft. 6 in. diameter, 18 ft. high.

STEAM-JET VENTILATOR.—One No. 2 Körting's Patent Jet Ventilator, with Chest. One No. 3½ Körting's Patent Jet Blower.

VALVE.—One 12-in. Cathels's Four-way Valve.
The above are being replaced by large apparatus, and can be removed at once. Also a 100-light Gas Apparatus (Porter's make).

For particulars and prices apply to
W. L. ROBINSON, Manager.
Gas-Works, Coventry, Feb. 21, 1880.

THE Gloucester Gas Company, ceasing
to manufacture gas at their old works, will have the undermentioned APPARATUS for Sale about the beginning of August, viz.:—

About 150 feet of D-shaped Wrought-Iron Hydraulic Main, size 19 in. by 19 in. Also about 38 ft. of D-shaped Wrought-Iron Hydraulic Main, size 20 in. by 20 in. Annular Condenser, consisting of six Vertical Pipes, 24 in. diameter, 19 ft. high, with three 12-in. Slide-Valves and 12-in. Connections.

Scrubber (round), 5 ft. by 20 ft., with three 12-in. Slide-Valves, and 12-in. Connections.
Exhauster (Jones) to pass about 15,000 feet per hour.

Exhauster (Beales) to pass about 25,000 feet per hour.
Two Vertical Steam-Engines, each about 6-horse power, with Pulleys, and Shafting used for driving the above.

Boiler 14 ft. 6 in. by 3 ft. 6 in., with Centre Tube, and four Galloway Patent Tubes.
Three 4-in. Pumps, with cranked Shafting and a pair of Mitre Wheels.

Two Purifiers, 16 ft. by 8 ft., with six 12-in. Slide-Valves and 12-in. Connections.
Station-Meter by A. Wright and Co., London, with three 12-in. Slide-Valves, and 12-in. Bye-Pass and Connections, to pass about 25,000 feet per hour.

Gasholder, Double Lift, with Cast-Iron Tank, capacity 37,000 feet.
Gasholder, Double Lift, capacity 100,000 feet.

Gasholder, Double Lift, capacity 240,000 feet.
One 12-in. Governor, by Wright, London, with 12-in. Valves, Bye-Pass, and Connections.

Two 12-in. four-way faced Valves, by Cockey.
For further information, &c., apply to the undersigned.
R. MORLAND, Engineer.

AMMONIACAL LIQUOR.

THE Best Continuous Method for Work-
ing Large or Small Quantities of Liquor. This is an improvement on what is known as the "Coffee Still Process." The result in sulphate of ammonia is very large, nearly every atom of ammonia gas being driven out of the liquor before it is liberated, also a saving in acid. Small Working Models to work about 5 gallons per day, with steam boiler and every requisite, sent c.o.d., carriage paid, price £4 4s. Also improved (and, if required, continuous) method of Working Liquor Ammonia from Gas Liquor.
Address JOHN G. HARVEY, Milnsbridge, HUDDERSFIELD.

WANTED, Two Second-hand Purifiers,
about 8 feet square.
Address CLAYTON, SON, AND CO., Boiler and Gasholder Works, Hunslet, LEEDS.

THE Pembroke Dock and Town Gas
Company, Limited, invite OFFERS for the AMMONIACAL LIQUOR produced at their Works.
Particulars may be had of the undersigned.
J. H. SILCOX, Manager.

March 11, 1880.

TO LIME BURNERS, MERCHANTS, &c.

THE Directors of the Barnsley Gas Com-
pany are desirous of receiving TENDERS for the Supply of the whole of the LIME required at their New and Old Works, at Barnsley, for purifying purposes, for One or Three years, commencing July 1, 1880, the same to be delivered into the lime sheds at both works respectively.

Any further particulars may be had on application to the undersigned.

Tenders, addressed to the Chairman, to be sent to me not later than Thursday, the 1st of April next.

JOHN HUTCHINSON, Manager.
Gas Office, March 17, 1880.

TO MANUFACTURING CHEMISTS, TAR DISTILLERS, &c.

THE Directors of the Barnsley Gas Com-
pany are desirous of receiving TENDERS for the Purchase of the Surplus COAL TAR produced at the Works at Barnsley and Old Mill, for a term of One or Three years, commencing from the 1st of July next.

Probable quantity and any other particular on application to the undersigned.

Tenders, addressed to the Chairman, to be sent to me not later than Thursday, the 1st of April next.

JOHN HUTCHINSON, Manager.
Gas Office, March 17, 1880.

TENDERS FOR RETORTS, &c.

THE Gas Committee of the Dewsbury
Corporation hereby invite TENDERS for the Supply and delivery, at their Savile Town Gas-Works, 532 Lineal Feet of Fire-Clay Retorts, and the necessary Fire-Bricks, Fire-Clay, &c.

Sealed tenders, endorsed "Tender for Retorts, &c.," to be sent to Jesse Smith, Esq., Town Clerk, not later than noon of Wednesday, March 31, 1880.

The Corporation do not bind themselves to accept the lowest or any tender.

Further information may be had on application to the undersigned.

CHAS. ARMITAGE, Engineer and Manager.

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Gas Committee of the Dewsbury
Corporation are prepared to receive TENDERS for One, Two, or Three years (as may be agreed upon), commencing on the 1st of July next, for the Purchase of the Surplus TAR and AMMONIACAL LIQUOR produced at their New Gas-Works, Savile Town, which are situated close to the Canal. Quantity of coals carbonized, about 13,000 tons per annum. The tenders for Tar to state price per ton and the tenders for Ammoniacal Liquor to state price per unit per cent. of Ammonium Sulphate per ton of liquor.

Any further information may be had on application to the undersigned.

Sealed tenders, endorsed, to be sent to Jesse Smith, Esq., Town Clerk, on or before the 14th of April next.

The Committee do not bind themselves to accept the highest or any tender.

CHAS. ARMITAGE, Engineer and Manager.

BOROUGH OF SOUTHPORT.

THE Gas Committee of this Corporation
invite TENDERS for the Supply and Erection complete, at their Crowlands Gas-Works, of Two PURIFIERS, each 20 ft. square by 5 ft. deep. Also Centre-Valve and Lifting Apparatus.

Plans and specification may be seen at my Office, East-bank Street, Southport.

Tenders, endorsed "Purifiers," addressed to Keighley Walton, Esq., Town Clerk, Southport, must be sent in not later than Wednesday, the 31st of March inst.

By order,
JNO. BOOTH, Manager.

Southport, March 12, 1880.

BEALE'S IMPROVED PATENT GAS EXHAUSTERS,

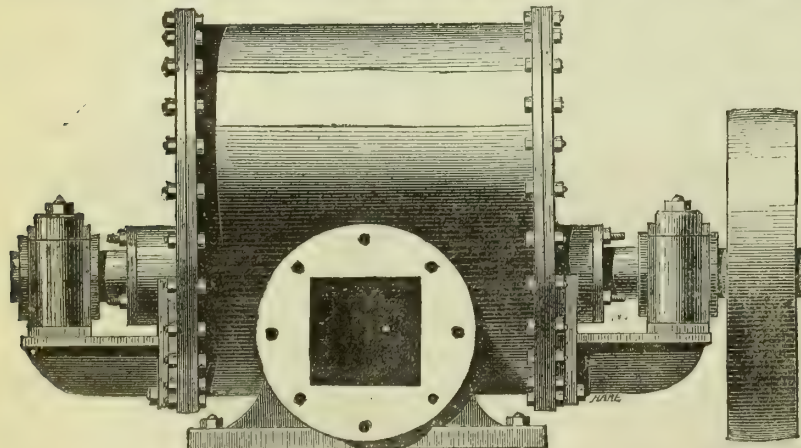
WITH OR WITHOUT

WROUGHT-IRON SPINDLES AND ENGINES COMBINED.

GEORGE WALLER & CO.,

MAKERS OF

ENGINES, EXHAUSTERS,
INDEX AND DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, AND OTHER PUMPS,
SCRUBBERS AND PURIFIERS,
CONDENSERS, BOILERS, &c.



G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

PHENIX ENGINEERING WORKS:

HOLLAND STREET, SOUTHWARK, S.E.

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TO CORRESPONDENTS.

W. E. S.—If it is a meter stamped in accordance with the Sale of Gas Act, 1869, you can proceed against a person doing as you describe with it. The 15th clause of the Act says: "Any person who shall knowingly tamper with or do any other act in relation to any stamped meter . . . shall on conviction forfeit a sum not exceeding five pounds, pay the fees for removing and testing, and the expense of purchasing and fixing a new meter: Provided that the payment of any such penalty as aforesaid shall not exempt the person paying from liability to indictment or other proceeding at law to which he would otherwise be liable, or deprive any person of the right to recover damages against such person for any loss or injury sustained by such act or default." We shall be glad of further particulars of the case.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 30, 1880.

Circular to Gas Companies.

THE Metropolitan Board of Works last Wednesday decided to continue the experiment of illuminating the Thames Embankment and Waterloo Bridge by means of the electric light, for another twelve months from the 10th of April, at the rate of twopence halfpenny per lamp per hour. At this stage of the experiment it can hardly be said who are the sufferers. Most certainly, to our knowledge, the Metropolitan Board of Works are not, as the lamps are lighted for an extremely small sum. We should like to know what the Société Générale d'Electricité expect to make in profits. What they have spent on the experiments upon the Thames Embankment, &c., &c., the report of the Board's Engineer and their Chemist fails to inform us. Twopence halfpenny per lamp per hour appears an exceedingly small remuneration, considering the work, and without knowing the details of the business of the Société Générale, we may make a guess that it does not pay, except as an advertisement. It is admitted that, as at present arranged, electricity has a small advantage over gas, light for light being considered. For instance, it is calculated by the Officers of the Metropolitan Board that, at the present rate of charge, for thirty-four pence the light of 2720 candles can be obtained by means of gas, and rather more than 3000 candles of light by means of electricity. This gain is not great, and considering the difficulties and risks which have to be overcome in furnishing the electric light, the general introduction of it into our streets does not seem at all desirable. Gas still holds its pre-eminence, and even where the electric light is used, gas is also employed. The varying seasons will, of course, make a difference. As the bright summer nights come on, very little artificial illumination will be required. Electricity may furnish the most

of this on the Thames Embankment and Waterloo Bridge; still the employment of gas is inevitable.

The use of the electric light is certainly extending over the world. In most European, and even in some Asiatic cities it is now employed. It illuminates a palace in Bombay, without, we may guess, any detriment to the Bombay Gas Company. It is also reported that it is to be used in the palace of the Shah of Persia, at Teheran, in which city, so far as we know, no gas-works exist. At how many *tomans* per hour the light is to be supplied in Teheran we cannot say, but we readily suppose that it could be furnished at a cheaper rate than the oil lamps which it would supersede. It has, however, to be taken into consideration that at Teheran it will be necessary to use a steam-engine to drive a Gramme machine, and there probably it will not be found particularly cheap; but what does that matter to a Shah with numbers of diamonds, but scarcely any money in his treasury? Still the fact is patent that the use of the electric light is spreading. It has reached as far as Burmah, where, by its aid, the King now lights his palace at Mandalay. Close by, however, is a supply of rich bituminous coal, which is, no doubt, admirably suited for gas-making; but no enterprising individual seems to have sought a concession to light Mandalay with gas. The fact is lives are held cheap in Burmah, and the enterprising concessionaire might find himself in singular difficulties as soon as his works were established and in action. All this, however, is nothing to us. We look over England, Scotland, and Ireland, and see no indication of any great spread of electric illumination. The experiments on the Thames Embankment and Waterloo Bridge are the only ones of any magnitude now being made; but here, too, we find some differences of opinion, as the Vestry of St. Martin-in-the-Fields refused permission for the illumination of Northumberland Avenue by means of the electric light. The Metropolitan District Railway have discontinued its use at Victoria Station, and the Corporation of the City of London seem now to ignore its existence; so we cannot regard the prospects of the light as of a brilliant character.

The ordinary half-yearly meeting of the Proprietors of the Commercial Gas Company is to be held next Friday, when the Directors will recommend the payment of dividends for the six months to Dec. 31 last at the rate of eleven and a quarter per cent. per annum on the old stock, and eight and a quarter per cent. on the new stock, both less income-tax. These dividends, it may be observed, are a quarter per cent. more than was paid the previous half year, and three-quarters per cent. more than this time twelve months ago. As the Company have, since Midsummer last, been charging only 3s. 3d. per thousand feet for gas, instead of 3s. 5d. as formerly—their standard price, under the sliding scale, being 3s. 9d.—the Directors could have recommended another quarter per cent. additional dividend; but have wisely resolved to add to the reserve-fund instead, to place £6200 to the insurance-fund, and carry over £3445 to the present half year's accounts. Like most other Gas Companies, the Commercial Company have gone forward with great strides in their make of gas, as compared with even a year ago. For the last six months of 1878 the quantity of gas they manufactured was a trifle more than 719 millions; for the first half of 1879 it was 740 millions; while for the past six months it reached nearly 768 millions. The revenue from the sale of gas for the two half years 1878-79 was £115,064 and £115,970 respectively; and last half year—notwithstanding, as before stated, the reduction of twopence per thousand feet, which came into operation on July 1—the receipts from gas sold advanced to £117,103. Very slight improvement is, however, manifested in the total value of residuals over the corresponding half of last year—coke and breeze produced only £18,144, as against £20,990; but, on the other hand, tar is credited with £6036, and ammoniacal liquor with £8412, against £4374 and £6344 respectively. Consequently, an advance in this branch of the Company's business is shown of close upon £1000. Nothing noteworthy appears on the debit side of the revenue account, the slight additions in many of the items being fully justified by the larger quantity of gas made. The amount carried to net revenue account, being the profit for the past six months, is £45,820, or nearly £2000 more than for the second half of 1878. No additions were made to the capital account of the Company according to the statement now before us; but the Directors, in their report, say, that in order to provide for the increasing demand for gas, they have entered into contracts for the construction of a new tank, and the erection of a new holder at their Poplar works. More capital being needed to carry out these extensions, the Directors intend applying to the Shareholders on Friday for their authority to raise

£60,000 by the issue of stock under the powers of the Company's Act of 1875.

The report of the Directors and the accounts of the London Gaslight Company have also been issued in anticipation of the half-yearly meeting to be held on the 7th prox. The report shows a very satisfactory and highly-gratifying state of affairs. After providing for all preferential charges, there remains a sum of £24,979, out of which the Directors recommend a dividend of ten per cent. on the ordinary capital. The report further states that the Bill promoted by the Company has reached its second reading in the House of Commons, and at this stage it will be taken up in the new Parliament. This Bill, as our readers know, is to enable the Company to apply £20,000 of capital for the supply of fittings, stoves, &c. This appropriation will be appreciated by all who can participate in the London Company's proposed arrangements. The importance of the superintendence of responsible officials over all the fittings supplied by Gas Companies can hardly be over-estimated; but there are some people who think that a Gas Company can push their authority too far in this way. Therefore it is the London Company do not seek any inquisitorial powers, further than to know that the apparatus on hire is being fairly used. But it must be well understood that the heating or cooking appliance in use is employed to increase the consumption of gas. The sole object the Company have in the promotion of this measure is to increase their sale of gas. They do not desire to make any profits whatever from the apparatus; but, as a matter of course, they will use their utmost endeavours to increase the consumption of gas, and in this way add to revenue. In the past half year the sum of £121,125 was received by the Company for gas sold and for meter-rents; but in future half years we anticipate much larger receipts under this head. The profit applicable to dividend is, as will be seen above, high, and it is explained in the Directors report that this result was owing to the low price of coal. This is a dangerous admission, which the enemies of the Company are sure to seize upon. If, they will say, cheap coal gives large profits to the Company, it should equally lead to a reduced price for gas. The charge made by the London Company for their gas is but small, considering the areas supplied. It might be smaller, if the Company would take our advice, and join in the combinations which are now almost perfect. Why, for example, should a small district round the Elephant and Castle be supplied for 3s. 3d. per thousand feet, when a neighbouring Company can supply it for 3s.? The two districts might well be combined, with equal advantage to the Shareholders of the Companies and the consumers in the districts. Again, it would be of great importance if the south-western district of the Company were annexed to the South Metropolitan combination. The north-western section would fall by natural selection into the hands of the Chartered Company, by whom the price and quality of the gas would soon be brought to modern standards. Further, the great aim of the Metropolitan Companies should be to be joined together, and bring the price of gas uniform all over the Metropolis. If the Water Companies had united, as we have always advised them to do, they would not be in the precarious position in which they now find themselves.

The ordinary half-yearly meeting of the Crystal Palace District Gas Company was held on the 25th inst., and, of course, passed off very pleasantly. With full dividends and a good balance, everybody ought to be well satisfied, and we believe that the Shareholders in the Company were well contented with the announcements made by the Chairman and Deputy-Chairman, and with the profits, which are probably by this time in their pockets. The success of this Company is remarkable. Starting in a sparsely-populated district, with, at the time, poor prospects, they have had the good sense to grow as the naked areas within their limits of supply are built over. There is a greater future in store for this Company, inasmuch as it is certain that further and more important building operations are imminent within their limits. Every shop and every good house built in the district adds to their profits; and inasmuch as acres upon acres of first-class building land must be filled up, a large increase in the consumption of gas is certain. Our anticipations, therefore, of the progress of the Company are fully justified.

The annual meeting of the Sheppy Gas Company was held on the 24th inst., when maximum dividends were declared on all classes of shares, and a bonus of one per cent. was paid in respect of dividends due for the year 1872. The Company are, as they should be, highly successful, and it has been found necessary to make additions to the works to provide for the increasing demands of the district supplied. Under the direction of Mr. A. W. Marks, the able Secretary

of the Company, the supply of stoves, gas-fittings, &c., has been found extremely profitable. The trade account for the year shows that £7154 was received for gas; for stoves on hire and gas-fittings, £351; and residuals produced £1460—a very good result, considering the price of coal and the charge for gas. On the whole, the Sheppy Company are to be greatly complimented on the results of their past year's working, and they could hardly have a better balance-sheet to present to the Shareholders.

The South-West of England District Association of Gas Managers held a very successful and pleasant meeting at Taunton on the 9th inst. The address of the President, Mr. S. W. Durkin, of Southampton, treated *de omnibus rebus et quibusdam aliis* in respect to gas matters. He began by remarking very properly that the profits of a Gas Company were not made in the board-room, where little else than talk goes on. It is commonly said that the profits are made in the retort-house; but wherever they are made, it depends on the Manager's assiduity. Of course, the influence which a Manager can exercise ceases at the consumer's meter, unless, indeed, special powers are conferred on the Company for the supervision of fittings. We may stop here for a moment to express a hope that in all future Gas Acts powers will be obtained by Companies to sell all kinds of gas-fittings, and to exercise a vigilant control over their use.

Mr. Durkin dealt carefully with the subject of carbonization and recent inventions. This matter was ably treated of at a subsequent stage of the meeting in a paper by Mr. Edwards, of Taunton, who gave an excellent account of the best methods of carbonization. We can express a tolerably full concurrence in all that was said on the subject by this gentleman. In so far as the selection of coals is concerned, we quite agree with him that the test of their goodness is a large experiment in the works of the Company, where alone a full knowledge of their value is to be obtained. He is quite right in rejecting any experiments made at other works, for scarcely two Managers agree in their workings, and, what is worse, the retort-settings vary in almost every case. Those proposed by Mr. Edwards we regard as excellent, and we hope that the system which he suggests will find a ready adoption. With payment by results we, of course, perfectly agree; but we doubt whether it would command respect in all quarters. Managers and stokers alike prefer a certainty; but, whether the gas produced be little or great, it is open to them to say that neither the success nor the failure is the consequence of their efforts, or their neglect. Nevertheless, we regard the system, as a system, as excellent, and should be glad to see it generally adopted. As for the abolition of the hydraulic main, that may happen by-and-by. The time has scarcely come for the demolition of this venerable relic of the oldest days of gas manufacture.

The vexed question of the best modes of purifying gas is not likely to be settled for years to come. For our own part, we have a preference for a combined washing and scrubbing, by means of which every trace of ammonia can be removed from the gas, and the greater part of the sulphuretted hydrogen taken out. It is idle, however, to say that the complete cleansing of gas can be effected in these vessels; it must go on to the open purifiers, in which, if the process be properly conducted, much more of what are commonly considered deleterious ingredients will be removed. Lime, if properly used, will take out a large portion of bisulphide of carbon, and so reduce the sulphur ingredient in gas, of which so much complaint is made.

It is, of course, the duty of every Gas Manager to promote, as far as lies in his power, the day consumption of gas, and this can be best effected by encouraging the use of gas stoves, cookers, &c. Mr. Hardick, of Salisbury, who contributed a paper on this topic, has been very successful in his endeavours to increase day consumption, by recommending the use of apparatus for cooking and warming. A like success, we are certain, will attend the efforts of any Manager who sets himself vigorously to work in this direction, and who is well supported by a liberal directorate.

The South-West of England Association of Gas Managers, therefore, may well be congratulated on the success of their recent meeting. We are happy to see these provincial societies making progress, for they do an amount of good which the present generation of Gas Managers are hardly in a position to appreciate.

SALE OF GAS AND WATER SHARES AT HARTLEPOOL.—On Thursday, the 25th inst., Mr. R. Merryweather sold by auction, at Hartlepool, 300 £10 shares in the Hartlepool Gas and Water Company. There was a most satisfactory bidding, the prices realized being from £12 14s. to £12 18s. per share, excepting the last lot of ten, which reached the high figure of £13 per share.

Water and Sanitary Notes.

MR. CROSS'S Metropolitan Water-Works Purchase Bill is not dead. It lies, for the moment, in a kind of trance, from which it will be roused shortly after the new Parliament meets. The opponents of the measure are numerous, but we fancy they will be reduced in number by a careful perusal of a letter which Mr. Edmund J. Smith, one of the valuers employed by Mr. Cross, last week addressed to *The Times*. In it he shows that the value of the Companies increases so rapidly that, if not purchased now, they will be lost for all time. It is something to learn that every year 20,000 new houses are built upon hitherto unoccupied ground in the Metropolis, within the area supplied by the Metropolitan Water Companies. No wonder that the incomes, and therefore the profits of the Companies, grow rapidly. There is here no necessity for resorting to the accusation that the Water Companies have greatly increased their rates. The fact is that, as we have said all along, in but few cases have charges been raised to the parliamentary standard. In the great majority of instances the Companies have charged very much less than the amount allowed by statute; and even in a case in which the progress of the Company has been most rapid, and the divisible profits have doubled in two years, maximum rates have not been charged. We have no doubt that this letter will go far to assure the general public, and reconcile many people to a purchase upon which they now look with something like alarm. The sum at which the Companies are valued does look enormous; but when it is remembered that no money will pass, and that the Water Trust will simply take over the Companies, giving in exchange for shares three and a half per cent. "water stock," and, further, that the business will continue just as usual, and that all the interest on the stock will be defrayed by the Trust, from the profits of the combined undertaking, there is really no cause for alarm. The income of the Trust will go on increasing just as that of the Companies has, and hence the solid value of the concern will be more and more established. It is consideration such as this which has so greatly raised the value of the Water Companies shares in view of their exchange for "water stock." There can be no doubt that, under proper administration, the value of the undertakings must go on increasing. Much, however, will depend on the gentlemen chosen to fill the principal offices, and still more upon the Engineers who will be retained to carry on the undertakings. These will, of course, be selected from the present officers of the Companies, whose knowledge and experience will be absolutely necessary to the Trust; whereas the services of officers other than Engineers can be easily dispensed with. We shall look with much interest, supposing the Bill to pass, on the appointment of the Vice-Chairman of Works, for upon him the success of the scheme will mainly depend. There are among the Engineers of the Metropolitan Water Companies some gentlemen admirably suited to fill the post, and we hope the Government patronage will be so exercised that one of these will be placed in the position he will be so competent to occupy.

But we are writing as though the Bill had passed, while, in fact, it has a severe ordeal to go through. The Government—we are speculating that the present occupants of office will retain their positions—will, we know, subject the Bill to the fullest investigation it can possibly receive at the hands of a Hybrid Committee, whose recommendations will, of course, decide whether the Bill shall go on, or be altogether dropped. To this investigation we attach the utmost importance. Great as is the confidence we may place in the judgment of Mr. Cross and the calculations of his valuers, we are still uncertain as to how a Committee will regard the evidence which will be placed before them for and against the scheme. It may be that sufficiently good reasons will be put forward in support of Mr. Smith's view, that the value of the Companies increases at such a rate that now is the time for purchase, or never; but we must wait. Six weeks at least must elapse before we shall hear again of the Water Bill in Parliament. What will happen in the meantime few people know, and we, in these columns, dare not speculate on the probable course of events.

It is amusing, at the present conjuncture, to hear talk of a revival of the scheme for bringing a supply of water for London from the Cumberland and Westmoreland lakes. No engineering feat could be easier than to construct an aqueduct for this purpose, and hollow out reservoirs on all the elevated points around the Metropolis from which water at high pressure could be furnished. All this would be an extremely easy matter; it follows that it takes the popular fancy; and a large number of the inhabitants of the Metropolis are at this time longing for a supply of soft water from the Lakes. The

cost of the works is modestly estimated at about £20,000,000; but then it is urged that a good deal of money may be earned by supplying towns along the line of the aqueduct. We may grant this, and accept the fact that the water has been brought to the Metropolis. But what preliminaries would have to be settled before this could be arranged? An Act of Parliament would, of course, be required; and it is certain that before water could, under such a scheme as this, be distributed in the Metropolis, the London Water Companies works would have to be bought up. Their value is set down at a sum of which our readers have already been informed. The execution of this scheme would cost another £25,000,000, so that we may say any change in the source of the water supply would double the cost of the undertakings. It is clear that, under these circumstances, the inhabitants of London must be content with a supply of what some people call "dirty" water. The Metropolis, rich as it is, cannot afford to wastefully expend money upon utopian schemes. We have around us plentiful supplies of pure water, and to these we must go when circumstances render it necessary.

The annual general meeting of the Bristol Water Company was held on the 20th inst. The Company is one of the few who pay maximum dividends. On this occasion they have been able to add a bonus of 2s. 6d. per share in liquidation of back dividends, and carry a balance of £319 to their reserve.

THE METROPOLITAN BOARD AND THE ELECTRIC LIGHT.

THE decision of the Metropolitan Board, to extend the contract with the French Electrical Society for a period of twelve months, will be accepted as a matter of encouragement for the promoters of the electric light. The most noticeable feature is the reduction in price which accompanies this new contract. Latterly the price charged to the Board has been threepence per light per hour, and previously it was much higher. On the new contract the price is to be as low as twopence halfpenny. Fifty lamps are to be maintained, as now—namely, forty on the Victoria Embankment, between Blackfriars and Westminster, and ten upon Westminster Bridge. Fitted with the frosted globes, each of these gives the light of 265 candles, making, therefore, a total of 13,250 candles. At the reduced price, the fifty lamps will cost altogether 10s. 5d. per hour, which will be at the rate of ninepence halfpenny per thousand candles. If we reckon that five cubic feet of gas per hour produce the light of sixteen candles, and that the price of the gas is 3s. 4d. per thousand feet, we then find that to produce the light of one thousand candles we must burn 312 feet of gas per hour, costing one shilling and a halfpenny. At this rate the electric light on the Jablochkoff system would appear cheaper than gas in the proportion of something like ninepence to a shilling—a difference of twenty-five per cent. But we must look a little further to get at the practical bearing of this question.

The 50 Jablochkoff lamps supersede 255 gas-lamps, giving a collective light of 2720 candles. To obtain this amount of light, we must burn 850 cubic feet of gas per hour, costing 2s. 10d. But, as already stated, the 50 Jablochkoff lamps at 2½d. per hour each, will cost 10s. 5d., so that by employing the electric light instead of gas for the partial lighting of the Victoria Embankment, the expense is enhanced at the rate of 370 per cent. Those who know the locality, and who remember how the Embankment was lighted when the gaslights were all in use, may judge whether the lighting is any better now under the mixed system, or whether there is any gain at all commensurate with the expenditure of half a sovereign per hour instead of only half a crown. Photometrically, the light is increased fivefold; but, practically, there is perhaps scarcely any increase at all. No doubt much of the effect of the electric light is lost by the circumstance that the lamps throw half their rays on the river. But many of the gas-lamps were in the same predicament, so that this consideration affects both. That so much more light should be given to the Embankment, and yet that there should be so little practical advantage, is due to the high concentration of the electric light. Experience still favours the idea that electricity has a sphere distinct from that of gas. There is no need to create great gas-flames to compete with the electric light. Had the gas-lamps on the Embankment been doubled in number, the illumination would have been splendid, and the cost would have been a little less than 6s. per hour, instead of the half-guinea required for the electric light.

The Gas Companies may learn from this example wherein their real strength lies. It is not in the production of beacon lights, but in the multiplication of lights possessing moderate power. Estimated by the photometric volume, they are now

beaten on the Thames Embankment. But what Vestry would ever consent to increase the lighting-rate fourfold in order to put up Jablochhoff candles instead of gas-lamps? In all instances the parish authorities ought to burn more gas than they do. But if they are to have more light, their most economical plan will be to multiply the gas-lamps rather than to have the electric light. The fact that the Metropolitan Board choose to go to this extra expense for the sake of the Jablochhoff system, simply shows the desire of that body to give every encouragement to a system of lighting which is supposed to compete with gas. But at present the competition on the Embankment is apparent rather than real. Certain spots are intensely illuminated, and a great deal may be said about the total increase of lighting power. But there is nothing as yet to prove that the electric light is going to supersede gas for the illumination of the public streets. Even at the new price, the experiment is a costly one. The difference is 7s. 7d. per hour, and if the electric lights burn for no more than five hours per night, the extra cost will exceed £13 per week, so that the actual expense beyond that of the gas which would otherwise be burned will amount to nearly £700 in a year's time. We are aware the Board have something to put on the other side of the account, owing to the circumstance that when the electric lamps become extinguished at the end of the five or six hours during which they burn, the gas-lamps which they have superseded still remain unlit, the Jablochhoff lamps having taken their place. But this saving of gas is only effected by leaving the Embankment in a state of semi-darkness, and is an incident which is simply submitted to because it cannot be helped. The saving brought about in this way is therefore due to a defective arrangement, and does not properly enter into the question of the comparative cost of the two systems.

The experiment altogether is doubtless an interesting one, and great credit is due to the French Company for the zeal and ability with which they have so far conducted their enterprise. It is also a satisfactory incident that the lighting of the Embankment by this system is subject to the keen scrutiny of the Officers of the Metropolitan Board, so that the record of the results is authoritative. The Gas Companies thus have the advantage of knowing what can actually be accomplished with the electric light.

ABEESYCHAN GAS COMPANY.—The annual meeting of this Company was held on Thursday last—Mr. Henry Lewis in the chair. The Directors report, and the statement of accounts for the past year, were taken as read, and adopted by the Shareholders present. The result of the year's working showed that the maximum dividends to which the Shareholders were entitled had been earned, leaving a balance to be carried forward to the credit of the revenue account for 1880. Reference was made to the proposal of the Local Authorities in the district to purchase the Company's undertaking, the prevailing opinion being adverse to the scheme, on the ground that if it were carried out the district would not benefit by the change. The retiring Directors were re-elected, as were also the Auditors, Messrs. Gane and Jackson. Votes of thanks were passed to the Chairman and Directors, and to the Secretary and Manager (Mr. William White), for their attention to the business of the Company during the past year.

PRESENTATION TO MR. JOHN GLOVER.—An interesting meeting of the *employés* of the firm of Messrs. Thomas Glover and Co. was held at their factory, 214 to 222, St. John Street, Clerkenwell, on Thursday last, the object being to present to Mr. John Glover, the managing partner of the firm, a testimonial expressive of the high esteem in which he is held by all who are in his service, and the gratification experienced by them at his being enabled to return to business after his recent illness. The testimonial was presented by Mr. McDonald, the cashier, and consisted of an admirably well-executed portrait of Mr. Glover, and an illuminated address, of which the following is a copy:—"Presented to Mr. John Glover, by the undersigned subscribers, *employés* in the firm of Thomas Glover and Co. (many of them upwards of 30 years), as a token of their respect and esteem for one who for so many years has proved a kind and just employer, and a true and generous friend. They congratulate him on his restoration to health, and hope that he may be spared for many years of happiness, to witness the beneficial results of his indefatigable exertions in the management of the works and business."

HORSHAM GAS COMPANY.—The annual general meeting of this Company was held on the 22nd inst.—Mr. J. Thorpe in the chair. The Directors, in their report, stated that, notwithstanding the reduction that had been made in the price of gas, from 5s. to 4s. 7d. per 1000 cubic feet from Lady-day last year, they were able to recommend the declaration of a dividend of 5 per cent. for the half year ending Dec. 31, making with the interim dividend paid at Midsummer a total of 9½ per cent. for the year. The erection of many new houses in the town and suburbs had rendered it necessary to make additions to the mains to the extent of 1434 yards, at a cost of upwards of £200. This had been paid for out of capital, but it would be for the consideration of the Shareholders whether the time had not now arrived for issuing the remaining 183 shares. The gradual increase in the Company's business rendered the present storage room for gas inadequate to the requirements; the total storage being 47,000 cubic feet, and the daily consumption sometimes reaching 90,000 cubic feet. The Directors therefore recommended the erection of a telescopic gas-holder to replace the largest holder at present upon the works. This would afford additional storage room of 20,000 cubic feet, and would cost about £1000. The dividend recommended in the report was declared, and the retiring Directors and Auditors were re-elected, a sum of £100 being voted to the former for their excellent management of the Company's business. The question of increased gasholder room was left in the hands of the Directors.

URBAN WATER SUPPLY.

In the last article on this subject (*ante*, p. 318) we referred to the important gravitation works of Bradford and Leeds as the source of supply to many of the towns, and indeed to a very large proportion of the inhabitants within the drainage area of the Aire. These two important towns have found it necessary to obtain water supply beyond their natural watershed, and have constructed reservoirs in the upper valleys of streams to the north of the Aire catchment. In the case of Bradford, there are no less than fifteen reservoirs, either completed or in construction, and several others authorized. Many of these, as storage reservoirs, receive the rainfall of large tracts of moorland, and collect it in the upper valleys of the Worth and the Wharfe as well as the Aire. In all cases the water, after filtration, is conveyed by gravitation to service reservoirs near the towns where it is used. The daily supply for Bradford itself is 8½ million gallons, considered equivalent to 24 gallons per head for domestic purposes, and 20 gallons per head for trade supply. It is safe to assert that a large part of this is wasted. The capital cost of works has amounted to nearly a million and a half sterling, or about £10 per head of population. The charge for water is at the rate of about 6d. per thousand gallons.

Bradford supplies as many as nineteen towns in various ways, the total population outside the municipal borough being 150,000, or about as much as that of the town itself. Some of the towns are themselves districts, and distinct Water Companies have been established to supply them from the Bradford reservoirs or mains. Of these Companies, the Calverley District Company supplies Calverley, Farsley, and Pudsey, but no information is given in the Return as to quantity, cost, or charge. Allerton has another Company which supplies 8 gallons per head per day, at a charge of 14½d. per thousand gallons. The local works appear to have cost rather more than 20s. per head of the population. Liversedge and Gomersall are also supplied from Bradford through the agency of Companies, but no particulars of the charges are stated. Birkenshaw has hitherto been supplied from Gomersall, but changes are now expected. Eccleshill is supplied in bulk at 9d. per thousand gallons. The quantity allowed is at the rate of 10 gallons per head per day, but in 1874 it was reduced in amount, the result being great illness and inconvenience. The charge to the consumer is 1s. 5d. per thousand gallons. This is much complained of, but as the distribution works have cost £5000, and the interest on, and gradual repayment of this sum, as also the cost of maintenance, must be added to the price paid to Bradford, there is perhaps not much ground for such complaint. Birstal has a local service reservoir, and receives about 13 gallons of water per head per day by an intermittent supply. The local works have cost at the rate of 30s. per head of the population, and the charge is about 13d. per thousand gallons. Cleckheaton has a constant daily supply of 18 gallons per head at a charge of about 13½d. per thousand gallons. This is received by connecting the local mains with those of Bradford. The distribution works have cost a sum equal to 30s. per head of population. Heaton receives 7½ gallons per head by meter. The works here have cost £5 14s. per head of population, and are not yet completed. The charge is nearly 1s. 6d. per thousand gallons. North Bierley, a very large district, receives barely 7 gallons per head per day, the works having cost about 30s. per head of population, and the charge being 1s. 8½d. per thousand gallons. Of this charge, however, only 7d. is received by the Bradford Corporation. Silsden receives little more than 4 gallons per head per day. The cost for works has not reached 30s. per head of population, and the charge for water rather exceeds 1s. 6d. per thousand gallons. Drighlington has a local supply of 12 gallons per head, the works having cost 20s. per head of population, and the charge being only 9d. per thousand gallons. Gildersome receives 6½ gallons per head by a branch from the Drighlington main, the town paying part of the interest on the cost. The local works have cost only 12s. per head of population, but the charge for water is 1s. 8d. per thousand gallons. No reason is given for this great difference between the two towns. Hunsworth receives 10 gallons per head per day. The cost of permanent works and other expenses has been very small, and the water is sold at a charge which, according to the Return, amounts to 1s. 2d. per head per annum. Here, however, the quantity said to be supplied is little more than a gallon per head per day. There is probably some error in the figures. Tong is supplied from Bradford, but no information is given. Clayton is partially supplied by local mains connecting with the Bradford mains, but at present only the lower part of the town can obtain water. The cost of works here has been at the rate of 24s. per head of population. The

charge is 1s. 3d. per thousand gallons. Thornton is also partly supplied. The works have cost a sum equivalent to only 20s. per head of population, but the local expenses are very high, and the charge is 1s. 11d. per thousand. The actual payment for water to the Bradford Corporation by this town appears, according to the Return, to be 1s. 3d. per thousand gallons. No complaint, however, is made, and the Local Authorities have recently completed arrangements to increase the supply, which, at present, averages only $2\frac{1}{2}$ gallons per head per day. Lastly, Denholme Gate is within the limits of the Bradford Corporation Acts, but, except through the agency of a private firm, does not receive any regular supply.

The town of Leeds is provided with water from the River Washburn, a tributary of the Wharfe, the water being stored in a succession of noble reservoirs affording ample provision not only for the town, but for a large additional population, the storage being sufficient to ensure a good supply even in times of exceptional drought. The total estimated yield when the system is complete, and all the reservoirs are constructed and in use, is as much as 14 million gallons per day; but at present only half that quantity is required for the town, the average daily consumption being about 25 gallons per head—one-third for domestic purposes, and two-thirds for trade. The cost of these magnificent works and of the distributing-pipes has amounted to a sum equivalent to a little less than £5 per head of population. The charge for water is at the average rate of something more than 6d. per thousand gallons.

Leeds supplies some towns in the immediate vicinity, of which Headingley has the largest population, but neither this town nor Bramley is referred to in the Return. Morley and Churwell are mentioned. The former, with its population of nearly 10,000, receives at present about $15\frac{1}{2}$ gallons per head per day for all purposes, but might demand 250,000 gallons per day. It is delivered to the borough at the rate of $7\frac{1}{2}$ d. per thousand gallons, and distributed by works which have cost at the rate of £2 6s. 10d. per head of population, and the local charge for water is stated to be 16·68d. per thousand gallons. Churwell is a small town, and has works in progress. The cost and charge of distribution cannot be estimated. It will have a small service reservoir. Rothwell, with Rothwell Haigh and Royd's Green, has a service reservoir to contain 24 hours supply, which is charged for by the Leeds Corporation at the rate of $7\frac{1}{2}$ d. per thousand gallons. The quantity stated to be used is only 3 gallons per head per day. The cost of the permanent works for receiving and distributing the water has been equivalent to £1 5s. 4d. per head of population, and the charge to consumers is 9·2d. per thousand gallons.

The River Calder, flowing almost entirely over the coal measures during its lower course, is even more remarkable than the Aire for the large urban population, amounting to nearly 450,000, within its drainage area. It contains three principal towns—Halifax, Huddersfield, and Wakefield—not one of them so important as Leeds or Bradford, but still ranking among the chief manufacturing centres in Yorkshire. In the upper part of the Calder are Todmorden, Langfield, and Luddenden Foot, in none of which are there any public arrangements for water supply. Halifax comes next in order. Its water-works comprise a number of storage reservoirs impounding the waters of the Ogden, the Luddenden, and the Hebden Brooks, some completed and in operation, others in progress. The quantity supplied to the town is at the rate of 40 gallons per head per day for all purposes. The cost of works is equivalent to £9 11s. 6d. per head of population, and the charge is 8d. per thousand gallons.

Of the towns supplied by Halifax, Elland is the most peopled. It receives about 9 gallons per head per day, but might claim much more. Its local works have cost a sum less than 10s. per head of the population, and the charge to consumers is 10d. per thousand gallons. Sowerby Bridge is said to receive 24 gallons per head per day. The cost of the local works has been nearly £10 per head of population, and the charge is about $10\frac{1}{2}$ d. per thousand gallons. Brighouse receives 12 gallons per head, at a charge of about 1s. per thousand gallons, the works having cost only about 10s. per head. Thornhill is allowed 9 gallons per head per day, with power to increase the quantity. The cost of works has been nearly 40s. per head of population, and the charge is 1s. 5d. per thousand gallons. Rastrick appears to take $10\frac{1}{2}$ gallons per day, but might claim 13 gallons per head for the present population. The price paid to Halifax is 6d. per thousand gallons. The works have cost a sum equivalent to 20s. per head of the population, and the charge to the consumer is $10\frac{1}{2}$ d. per thousand gallons. Hebden Bridge receives only $3\frac{1}{2}$ gallons per head per day, out of a total of $4\frac{1}{2}$ permitted

under an agreement which can be modified at the end of twelve months. The local works have cost a sum equivalent to 12s. per head of the population. The annual amount of water-rates, as given in the Return, does not cover the cost of maintenance and interest on money borrowed, and is probably stated in error. The towns of Nether and Upper Soot-hill, and that of Horbury, have a separate service reservoir. Nether Soot-hill takes $7\frac{1}{2}$ gallons, Upper Soot-hill 18 gallons, and Horbury $6\frac{1}{2}$ gallons per head per day. The cost of permanent works has been at the rate per head of 10s., £5 11s., and £2 8s. respectively, the chief works being in Upper Soot-hill. The charge for the water does not appear from the figures given in the Return, but we gather that at Nether Soot-hill it is about 1s. 5d. per thousand gallons. Hippersholme has a daily supply of 14 gallons per head, which might be largely increased. The cost of works has been at the rate of 20s. per head of the population. The charge for water is 13·6d. per thousand gallons, the actual cost of the water as paid to Halifax being 6d. per thousand gallons. A part of the town of Ovenden is supplied from Halifax, and about three-fourths of that of Greetland, the rest making use of local wells. Of the former town there are no particulars. Of Greetland we learn that the supply is at the rate of $7\frac{1}{2}$ gallons per head per day, the charge being 15·8d. per thousand gallons.

Of the other towns on this part of the Calder drainage area we learn that Sowerby Bridge is supplied from springs and wells, but has not any works. The same is the case with Northowram, Southowram, Denby, Slaithwaite, and Linthwaite. These complete the list so far as the main branch of the Calder is concerned, leaving the towns in the sub-drainage area of the Colne and its feeder the Holme, and also those of the Lower Calder and the Aire after its junction with the Calder, for consideration in another article.

THE WORKING OF THE ARTIZANS DWELLINGS ACT IN LONDON.

AN extraordinary account as to the sanitary condition of some parts of Whitechapel appears in the last Quarterly Report of Mr. J. Liddle, the Medical Officer of Health of that district. The principal facts are contained in the reports of the two Sanitary Inspectors appertaining to Whitechapel, and Mr. Liddle calls attention to the statements thus given as being of "great importance." One of the Inspectors describes the state of things existing in the neighbourhood of Goulston Street, situated in the north portion of the Whitechapel district. It appears that the courts and alleys thus referred to form part of an "unhealthy area" about to be dealt with by the Metropolitan Board of Works, under the Artizans and Labourers Dwellings Act of 1875. Many of the houses are said to have been condemned by the Metropolitan Board as "unfit for human habitation;" but, unfortunately, they continue to be inhabited, and their sanitary condition is "becoming worse every day." There is said to be great difficulty in getting the landlords to do anything in the shape of amelioration, and this is shown to arise from the peculiar position in which the property is placed pending its final disposal. Mr. Wrack, the Inspector, states towards the close of January last: "The claims of the several owners of property in the area are being considered by the Metropolitan Board of Works, and some of them, I believe, have already been settled; but up to the present time not one of the houses in this wretched locality has been closed or pulled down under the Act." The official representation as to the unhealthiness of the area was made as far back as May 31, 1876. At what date the Metropolitan Board undertook to apply the Act to the place in question is not stated, but the business appears to have been in hand some time, and the effect so far has been—if we may judge by the reports of the local officers—to make matters very much worse than they were at the beginning.

The case is instructive, as showing the working of the Artizans Dwellings Act according to its present constitution. When once a neighbourhood comes under what we may term the ban of this enactment, that which before was serious then becomes critical. Property once condemned is not likely to be improved, and a general spirit of lawlessness seems to infect the landlords directly they find their property is scheduled in an improvement scheme. Property thus circumstanced is the despair of Sanitary Inspectors. "It is only by daily visiting the localities," says Mr. Wrack, "and frequently urging the landlords of some of the property to effect the necessary improvements, that I am able to get any sanitary works carried out." The Inspector deprecates "the shocking condition of the dwellings" in certain places

which he specifies. "The unhealthy appearance of the persons occupying such places," he says, "especially the young children, is very lamentable, and causes me great anxiety." The area is "much overcrowded," and the Inspector fears the worst should any epidemic disease once enter the neighbourhood. The consequences in such a case, he apprehends, "would be very serious." On the strength of this report, the Whitechapel Board communicated with the Central Authority at Spring Gardens; but the latter replied, stating, "It does not appear that the complaint of the Inspector extends to any part of the property already acquired by this Board." Hence the central body declared itself "not in a position to take any action towards remedying the evils to which its attention is directed." Nevertheless, all the houses referred to by Mr. Wrack are situated in the area of the Goulston Street scheme, and Mr. Liddle accordingly expresses his hope "that the work of demolition and re-construction will, with as little delay as possible, be carried into effect."

"Demolition" Mr. Liddle may look for; but "re-construction" we fear may be very remote. The Act works slowly, and its first effect is evidently to aggravate the evil it is intended to cure. If the Inspectors are in perplexity, Mr. Liddle is equally troubled. He points out that while negotiations are in progress between the Metropolitan Board and the landlords, it is not likely that any improvements will be carried out, and the reasonable expectation is that "matters will become worse and worse." The only effectual remedy, in the opinion of Mr. Liddle, is "either to close the houses, or to demolish them with as little delay as possible." So thoroughly is Mr. Liddle shocked at the scenes which he witnesses, that he would much rather see the people ejected and the houses pulled down. "Some inconvenience," he says, "may be expected to be felt for a time when masses of the people are removed from a locality; but, in my opinion, greater inconvenience will be experienced in allowing these wretched houses to remain." We wish it were possible for Mr. Liddle to prove the correctness of the view which he thus entertains. As the Medical Officer of a crowded East-end locality, we are startled at the complacency with which he contemplates the summary ejection of a multitude of people from their homes, when, as yet, no provision has been made elsewhere for their reception. A great part of their present misery arises from overcrowding, an evil which itself accrues from a deficiency of house accommodation. To shut up or pull down certain houses now inhabited, would be to establish a still further disparity between the population and the extent of the accommodation provided for them.

The fact is, we are face to face with a very awkward problem in the working of the Artizans Dwellings Act. There are houses which are not fit to be inhabited, and which cannot even be made fit, owing to their structural defects. To condemn them, and yet to leave them occupied, is to throw them into a more miserable state than they were before. To shut up these houses, or pull them down, is to pack the poor population of London into still closer quarters. Mr. Liddle avers that "the working classes who have been compelled to remove in consequence of their houses being demolished for public improvements, readily find lodgings elsewhere," and he refers to certain of his previous reports in proof of that statement. That the poor people thus ejected find lodgings somewhere, we have no doubt; but we fear it has been with one of two results, as affecting themselves—namely, either increased cost or increased inconvenience. Speaking some time ago of Mr. Cross's Act, Mr. Liddle said: "I have not the slightest fear that inconvenience to any appreciable extent will be suffered by the people who will be displaced under the provisions of this statute." We should like to share Mr. Liddle's confidence; but we confess we view with something like dismay the clearance of populated districts, while the process of reconstruction is scarcely commenced. Mr. Liddle says in his present report: "In my opinion there was no necessity to make extensive provision in the Act for the building of houses for the labouring classes." And he adds: "Indeed, it would be interesting to be informed of a single instance in which such provision has been made, and appropriated to the actually dislodged families." For our own part, we should be interested in finding a single brick reared anywhere in London for the benefit of the aforesaid "dislodged families," under the provisions of the Artizans Dwellings Act. Demolition follows slowly on the heels of condemnation, and construction is not yet heard of.

But there is a worse page yet in this Whitechapel report, and some parts of it are so bad that we forbear to quote them. It is piteous to think that any of the labouring classes

of London, however poor and abject, should be thus housed. Mr. Isaac Battram, the Sanitary Inspector of the south side of the district, gives an account of certain "courts and turnings south of Royal Mint Street." It appears that here again we have another "unhealthy area" which has been brought under the wing of the Metropolitan Board. The date of Mr. Battram's report is somewhat later than that of Mr. Wrack's, being as recent as the beginning of last month. Concerning the places enumerated by the southern Inspector, we are told, "A more deplorable state of things could not possibly exist." Some of the houses—if they can be so designated—are destitute of the barest and most essential sanitary appliances. In some instances there is "no water supply," and in others there is too much, the premises being flooded through defective fittings, the water finding no sufficient out let by way of the drains. "The yards are also badly paved, and there are no dustbins." After wading through a hideous catalogue of miseries, we read, "The whole of the above-named houses are the property of the Metropolitan Board, and that body receives the rents thereof." "Every room is occupied by a separate family, and some of the rooms are overcrowded or indecently occupied." The Inspector asks that either the houses shall be closed, or steps taken to "put them in a proper sanitary condition;" and he very properly points out that should this state of things last until the hot weather sets in, an outbreak of fever or other contagious disease may be pretty confidently expected.

Most likely it is a feeling of humanity which induces the Metropolitan Board to let the people remain in these miserable habitations, although the idea of anything humane in connection with a revenue of rents drawn from such a scene of wretchedness seems fearfully incongruous. We feel assured that the Board are not influenced by mere pecuniary considerations in taking these rents and letting the people remain, otherwise we could scarcely find language too strong to denounce such a glaring inconsistency on the part of a great public authority. This wretched property is temporarily in the hands of the Board, and must so remain until a certain stage in the proceedings under the Act is arrived at. We should like to see the worst of the property pulled down at once, and decent dwellings built upon the space thus cleared. If only a dozen houses—or even half a dozen—were thus improved off the face of the earth, there would be a beginning, and that a good one, and more rapid progress could be made afterwards. As it is, the Act moves with slow and lumbering pace. After a long to-do, the people get turned out and the houses are pulled down. Then the land lies waste, perhaps for years. At last we may look for the buildings—we have not seen them yet—and by-and-by they will be occupied; but who the occupiers will be it is hard to determine. The people who were turned out from the old buildings will in many instances have migrated elsewhere. Some of them—perhaps a good many—will be dead. Possibly the very character of the neighbourhood will have changed in the interval, and the labouring classes will no longer care to dwell there. The Artizans Dwellings Act is neither quick enough in its working, nor practical enough in its application, to cope with the evils it is designed to remedy. That it will do good in the end, we believe; but its present effect is in many respects unsatisfactory. Better success may attend it in the provinces. In London it makes matters worse as a preliminary to mending them; and, unfortunately, the preliminary process threatens to be a very long one. The costliness of the entire proceeding is another point, and one on which we fear the ratepayers will have a good deal to say from time to time. The Act embodies a noble principle, but it requires further amendment to make it practical. It ought not to be so expensive, nor yet so slow, neither so awkward in its application, adding—at least for a time—to the very misery it was designed to remove.

STOCKTON AND MIDDLESBROUGH WATER SUPPLY.—On Saturday, the 20th inst., Mr. C. Neale Dalton, one of the Inspectors of the Local Government Board, held an inquiry at the Town Hall, Middlesbrough, into an application by the Stockton and Middlesbrough Corporations for a Provisional Order to amend the Stockton and Middlesbrough Corporations Act, 1876. Mr. H. G. Faber (the Town Clerk of Stockton) stated that the Order applied for was to enable the Stockton Corporation to borrow money for the purpose of acquiring the Stockton and Middlesbrough Water-Works, authority to purchase which was granted by the Act of 1876; to enable the Water Board to borrow money for the extension of those works; to enable the Board to pump more than 60 million gallons per week from the River Tees, any additional water so taken being supplied from a compensation reservoir on conditions to be determined; and, lastly, to extend the times for the commencement and completion of the works authorized by the Act, and for the compulsory purchase of land. Some conversation having taken place respecting the abstraction of water from the River Tees, the Inspector said that he would report early to the Local Government Board.

Communicated Articles.

THE CORROSION OF IRON.

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SEVENTH AND LAST ARTICLE.

Sir Humphry Davy first suggested the application of the principle of preserving metals at the expense of zinc by coupling the two together, to the protection of sheathing of wooden ships. Sheets of zinc were to be applied to the surface of the copper, so that the surfaces of the two metals should be not only physically but electrically connected. When such an arrangement is immersed in an exciting liquid like sea water, the zinc is the negative element in the system, and undergoes chemical change. Any chemical action which copper would undergo, when immersed alone, is in this way avoided, and transferred to the zinc. In my second article, the leading features of this class of phenomena have been noticed. The application of the principle has been extended to the preservation of wrought and cast iron. Davy himself suggested that zinc or *tin* might be used for preserving iron. In suggesting *tin* for this purpose, he fell into an error—an error which he, no doubt, was soon informed of by his contemporaries. When tin and iron are coupled together in a saline solution, the iron is negative to the tin, and undergoes chemical change. Tin is, therefore, not a preservative of iron as suggested by Davy; on the contrary, it is itself preserved at the expense of the iron. When zinc and wrought-iron plates free from rust are placed face to face, and the whole immersed in fresh water freely exposed to the air, the iron plates are preserved from oxidation until a large amount of the oxide of zinc has collected at the points of contact of the metals. When this condition of things is reached, the iron ceases to be preserved—it undergoes oxidation. In saline solutions similar results follow, the chief difference in the two cases being that in saline solutions the oxide of zinc collects more slowly, probably in consequence of the solvent action exercised by the saline matter on the oxide of zinc. At length, however, the oxide of zinc is deposited on the surface of the iron, and the preservative action of the zinc then comes to an end. In order to obtain good results by this method of proceeding, the mass and area of the zinc must be comparable with those of the iron which it is intended to preserve. To maintain this condition of things in ordinary cases is inconvenient, and therefore the good results at first anticipated have not been realized in consequence of the difficulty of fulfilling the requisite conditions. Further, where the preservation of the iron is more a matter of economy than of absolute necessity, it is questionable whether great advantages could be obtained by the use of zinc protectors even in the most favourable cases. The principle could not be well applied to the preservation of iron gasholders; and in many similar instances the remedy would be as bad as, or worse than the disease.

Pepys proposed the use of zinc plates for the preservation of polished iron and steel exposed to atmospheric air. There are, however, the same limitations in this case as in those already noticed. The corrosion of the iron is very considerably retarded, but not altogether prevented, and when the iron does begin to corrode, the zinc then completely fails to exercise a beneficial action.

This leads to the consideration of iron the surface of which is completely covered with a perfectly adherent layer of metallic zinc. One generally speaks of such as "galvanized" iron. Though it is possible to coat iron with zinc by means of a weak electric current (electro-plating), the so-called galvanized iron is obtained differently. It is prepared by taking plates or sheets of wrought iron, and entirely cleansing their surfaces from every trace of rust. They are then thoroughly dried, and completely immersed in a bath of molten zinc. The zinc and particles of iron on the surface of the plate chemically combine to form an alloy, and on removing the plate from the bath the greater portion of the zinc so removed remains adherent to the plate in consequence of its being alloyed on the iron surface. It is found that the zinc surface adheres more firmly if the iron plate be immersed in a bath of molten tin (that is, converted into tinned iron) before immersion in the zinc bath. From what has been said respecting the electrical relations of tin and iron in exciting liquids, it follows that, should such galvanized iron be abraded or corroded so as to expose the two metals, tin and iron, the iron would then be subjected to undue corroding influences.

"Galvanized" iron, therefore, is iron covered with a uniform layer of metallic zinc, the two metals being alloyed together at their surfaces of contact. So long as the underlying iron is not exposed at any point, we may regard the whole as a mass of solid zinc. Zinc is a metal particularly well adapted for resisting ordinary corroding influences, such as atmospheric air and moisture. A bright surface of the metal, it is true, soon tarnishes when exposed to these influences, but the layer of suboxide thus formed preserves the metal from further corrosion. Alkaline salts, such as common salt (NaCl), sensibly dissolve such oxide, and caustic alkalies, including ammonia, dissolve it with the greatest facility. Zinc is a metal ill adapted for cases where it is likely to be exposed to acid vapours, such as arise from the combustion of sulphur or sulphur compounds.

Assuming that galvanized iron is used in the construction of gas-holders, what will be their probable duration in a hot climate? Air and moisture would have but little action on the zinc, and therefore there would be little to fear in this direction. It is rather to the presence of ammonia in the gas and brackish water in the tank that we must look for agencies tending to corrosion. Since the coating of suboxide on the surface of the metallic zinc is the medium which preserves the metal from rapid change, it follows that ammonia,

which is a ready solvent of the oxide, must be prejudicial to the duration of the holder. It is well known to chemists that not only do the caustic alkalies, including ammonia, readily dissolve oxide of zinc, but that potash and soda also dissolve *metallic* zinc with the evolution of hydrogen gas. The action is augmented by increase of temperature. It is therefore very essential to know how metallic zinc would behave in a weak solution of ammonia. I have taken granulated commercial zinc, and thoroughly drenched the fragments with a strong solution of ammonia, so as to dissolve the oxide on the surfaces of the pieces. After rinsing with distilled water several times, a very weak solution of ammonia was then added, so as to thoroughly cover the zinc, and the whole was left loosely exposed for a couple of days. The ammonia solution was then removed and examined for dissolved zinc. The pieces were again rinsed with distilled water, weak ammonia solution added, and the whole allowed to stand as before. The process was repeated on the same pieces several times in this way, the ammonia solution being always found to contain very appreciable amounts of zinc. These results may be primarily due to the oxidation of the zinc in consequence of access of atmospheric air, and not owing to solution of the zinc direct, as in the case of potash and zinc. But the distinction is of no practical moment in the present instance, because we have seen that there are always small quantities of oxygen in coal gas; and therefore, if ammonia is allowed to be present in the gas supply in quantities above the merest traces, there will then be in the interior of the gasholder all the conditions which were present in the experiments I have made. It is obvious, therefore, that the galvanized iron would be very seriously affected in a hot climate, if the gas supply contained sensible quantities of ammonia. The influence of brackish water on the zinc would be to dissolve the protecting surface of oxide, and in that way expose the metal to fresh oxidation. There would also be the general electrical action set up between the galvanized iron holder and its iron pillars, unless the two were specially insulated, and it would be difficult to effect perfect insulation, in consequence of the continual change of the points of contact of the two metals. But the use of brackish water is not generally imposed on the gas engineer, and as the ammonia can be entirely removed from the gas in an economical manner, even in a hot climate, there is no reason why these two circumstances should prevent the employment of galvanized iron in special cases, seeing that it promises well. I imagine that the drawbacks to its use are rather of a mechanical than a chemical nature. The holder would necessarily require to be constructed from sheets of the metal, and the rivets employed would be of iron. Therefore, unless the heads of the rivets presented an unbroken surface of zinc (that is, they must be galvanized), there would be an undue tendency to corrosion on the part of the zinc. Such a gasholder admits of being protected by varnishes and paints, as in ordinary cases, and it would, no doubt, be found advisable to pursue this course.

I now come to a consideration of Professor Barff's process for preserving iron. It consists in heating the metal in an oven (muffle), through which a stream of superheated steam is made to pass during the operation. Certain temperatures have to be maintained, and atmospheric air must be excluded, in order that the film of oxide produced shall be perfectly adherent to the surface of the iron. The steam, under the circumstances, is decomposed by the iron, producing black oxide of iron (Fe_3O_4) and gaseous hydrogen, which escapes from the heated chamber. The reaction is expressed thus:—



The time needed to coat the iron surface with the black oxide of a sufficient thickness varies slightly according to the description of iron treated. At the end of seven or eight hours the film of black oxide is sufficiently thick for the purposes for which the iron is intended. I need not repeat the description of the properties of this oxide. It has been abundantly proved that iron can be successfully coated in this way, and that the resulting product is proof against all ordinary and extraordinary corroding agencies. The result, in fact, is iron in a condition pre-eminently adapted for the purposes I am considering, and not subject to those limiting conditions which characterize galvanized iron. I also understand that the cost of production is not greater than that of the latter. There is therefore no reasonable ground for believing that a gasholder constructed of wrought iron, coated by Barff's process, should not have an almost unlimited duration, even if exposed to the highest atmospheric temperatures in the presence of any or all of the impurities of coal gas which have been noticed.

The only possible objections to its use are purely of a mechanical description. The coefficient of elasticity of the black oxide is not the same as that of metallic iron; and therefore, when a sheet of iron which has been thus coated is seriously twisted or bent, the oxide cracks and admits of corrosion of the iron at the base of the fissures. Severe hammering also destroys the continuity of surface of the oxide. Neither of these imperfections, however, is likely to prevent the successful use of the iron for the construction of a gasholder, provided a reasonable amount of intelligence is exercised by those engaged in building it.

The application of Portland cement as a protective covering for iron is due to Major Crease. The conditions originally observed in using the process are not adapted for our requirements, and it would appear that the inventor has been striving to modify the principle, so that cement in a fluid condition can be prepared and applied as an ordinary paint. In Mr. Douglas's recent paper the subject is so fully dealt with, both from a chemical and a financial point of view, that I shall give a mere outline of the process. A bituminous varnish analogous to coal tar is applied in a hot state to the clean iron. When the varnish is hard, a specially prepared form of Portland cement is applied by means of a brush, like an ordinary paint. When the

cement hardens it performs a double function—firstly, it lends support to the pitch beneath it, counteracting its viscous character; and, secondly, it forms an additional coating impervious in a great measure to water and gases. Supposing Crease's process to be applied to a gasholder in a hot climate, the first question which suggests itself is—How would the cement coating behave when subjected to excessive alterations of temperature? If the coefficient of expansion of the cement coating be nearly the same as that of the iron it covers, there is no danger of the cement becoming detached from the iron. Iron tanks have been coated by the original process, and used for storing water at all temperatures up to near the boiling point. At the end of several years the cement lining has been found perfect. This fact is of itself sufficient to show that the coefficient of expansion of the cement is practically the same as that of the iron. The great merit of the inventor's improvements consists in his producing a perfectly smooth and semi-fluid form of cement, which admits of being applied by means of an ordinary paint-brush, and giving, in a few hours, a hard and impervious layer.

I cannot conclude without referring to a matter of historical interest. I am indebted to Dr. Percy for the information that Liebig contributed an article upon the corrosion of iron to the *Cornhill Magazine* for September, 1865. In it he says that the rusting of iron will not take place, even in moist air, unless carbonic acid gas is present. The magazine in question is not one in which such an article would be looked for, and this is the only apology I can offer for my ignorance of its existence.

THE THEORY OF DISSOCIATION.

By MR. H. B. DIXON, M.A.,

Millard Lecturer on Chemistry at Balliol and Trinity Colleges, Oxford.
IV.

A year later than the experiments detailed in my last article—1866—Wurtz published a second paper on the vapour density of amylene hydrobromide, which boils at 113° C., and exhibits a normal (2-volume) density up to 185° C. At this point it begins to decompose, its density gradually falling as the temperature rises till at 360° C. it occupies double the volume. If hydrobromic acid and amylene are brought together below 185°, they should combine completely; but if brought together above that temperature, only partial combination should take place. A delicate thermometer placed in the vessel where the gases meet will give, by its rise, an indication that chemical combination has taken place, and the amount of rise will also be roughly a measure of the amount of combination. The apparatus employed by Wurtz resembled that devised by Deville to detect a rise of temperature when hydrochloric acid and ammonia were allowed to come into contact at 350°. Wurtz found that hydrobromic acid and amylene heated to 120°, and meeting in a vessel at that temperature, caused a mercurial thermometer plunged in their midst to rise between 4° and 5°. When the two gases were brought together at 220° the mercury only rose through half a degree in the thermometer. The combination in the second case is only a fraction of that taking place at the lower temperature.

These researches of Wurtz led Deville to make some further experiments on phosphorus pentachloride. Phosphorus pentachloride, according to Cahours, possesses a regularly decreasing vapour density. At 182° C., just above its boiling point, its density is 5.08; at 300° C. its density is 3.61; at 182° its density corresponds with a condensation into three volumes; at 300° its density corresponds with a condensation into four volumes.

In this gradual diminution of density it resembles amylene hydrobromide; but it also resembles sulphur and acetic acid, which have a co-efficient of dilation that diminishes with the temperature. Two colourless glass tubes, about 15 inches long, closed at their extremities by plane faces of glass, and having a minute aperture to allow the enclosed gas to escape, were filled, one with an equal mixture of air and chlorine, the other with pentachloride of phosphorus. The two tubes were passed through an oil bath, from which their extremities slightly projected, so that the colour of the gases could be examined through the length of the tubes while they were exposed to the heat of the bath. As the temperature rose, the chlorine colour gradually became manifest in the tube containing phosphorus pentachloride, and increased in depth until the colour in the two tubes was sensibly the same. If the vapour of pentachloride of phosphorus is uncoloured, this experiment is a sure proof of its dissociation into free chlorine and phosphorus trichloride.

If iodide of mercury is heated in a small flask, it changes colour, melts, and volatilizes, giving rise to a colourless vapour of unchanged iodide of mercury, which on cooling condenses to a brown liquid. If the flask is heated strongly with a Bunsen burner, violet clouds are produced near the surface of the glass, which disappear as they travel towards the centre of the flask, where in the cooler space the dissociated mercury and iodine molecules re-combine. If a second similar flask containing equal volumes of air and iodine is heated to the same temperature, the colour is much more intense than in the flask containing iodide of mercury. This experiment shows the dissociation of the iodide to be only partial at the temperature employed.

These two experiments performed by Deville show that the decrease in density of the vapours of phosphorus pentachloride and mercury iodide is due to dissociation of the compounds into two constituents, which re-combine again on cooling. But the fact that complete dissociation can be proved to take place, in the case of one or two compounds, at a temperature not far removed from their boiling points, does not necessarily imply that all compounds exhibiting an abnormal vapour density are dissociated at the temperature at which their densities are determined. Admitting that amylene

hydrobromide and phosphorus pentachloride owe their decrease in density to dissociation, Deville still considered that the molecules of other bodies occupied, without decomposition, four times the volume occupied by an atom of hydrogen, their expansion being abnormal, like that of sulphur and acetic acid. As an instance, he gives the body produced by the union of ammonium iodide and mercury iodide, NH₄I, HgI. Its density, as determined at 350°, was 6.38; as determined at 440°, it was 6.49. The density calculated for 4 volumes is 6.44. Now, if the compound underwent dissociation when volatilized, it should occupy 6 volumes:—

Ammonium iodide 4 vols.
Mercury iodide 2 „

6 vols.

Marignac, in 1867, published his experiments on the latent heat of volatilization of ammonium chloride. If it be true that this compound breaks up into hydrochloric acid and ammonia at the temperature at which it volatilizes, then the quantity of heat absorbed in the process should be much greater than that absorbed by the volatilization of other salts, which undergo no chemical change as they pass from the solid to the gaseous state. Marignac employed a massive metal cylinder, in the upper surface of which three cavities of equal size were hollowed out symmetrically round the axis. The cylinder being heated from below, weighed quantities of different substances in open glass or silver tubes were placed in the two cavities, and an air thermometer in the third. After a certain time the residues were weighed, their loss in weight giving the quantities of the different substances volatilized in a given time, while the cylinder cooled through an observed range of temperature. By this means the latent heat of volatilization of ammonium chloride and of other substances was approximately determined, the heat supplied by the cylinder to each cavity being sensibly the same in unit time. The latent heat of volatilization of 1 gram of ammonium chloride was found to be 706 calories—a calorie being the amount of heat required to raise 1 gram of water 1° C.

Now, the heat of combination of hydrochloric acid and ammonia at ordinary temperatures, as determined by Favre and Silbermann, is 743 calories; at 350° C., the heat of combination would be 715 calories. The near agreement between this number and the latent heat of volatilization of ammonium chloride makes it exceedingly probable that in passing into the state of vapour the compound has broken up into its chemical constituents, which re-absorb the heat they gave out in combination. Tried by the same process, the latent heat of volatilization of mercury perchloride was found to be about 36 calories only.

The vapour density of phosphorus pentachloride, which at 182° C. corresponds with a condensation into 3 volumes, has been determined by Wurtz at a lower temperature. In a first series of experiments, he placed into a flask, containing dry air, some freshly-distilled pentachloride, and heated the whole in a transparent bath of melted paraffin. The moment the last trace of the pentachloride was seen to disappear, the orifice of the tube was sealed. After the flask was cooled and weighed, the sealed tube was opened under mercury, and the residual air remaining in the flask was measured. By this means the weight of the phosphorus pentachloride vapour present in the flask at the moment of sealing was determined, and also the pressure under which it existed, for the volume occupied by the air in the flask at the temperature of the experiment could be easily calculated from the volume found on cooling. The following were the results obtained by Wurtz:—

Experiment.	Pressure supported by Vapour.	Temperature.	Density of Vapour.
1 . . .	311 mm.	145°	6.7
2 . . .	307 „	145°	6.3
3 . . .	391 „	145°	6.6
4 . . .	148 „	137°	6.5
5 . . .	243 „	137°	6.5
6 . . .	234 „	137°	6.4
7 . . .	281 „	137°	6.5
8 . . .	269 „	137°	6.5
9 . . .	170 „	129°	6.6
10 . . .	165 „	129°	6.3

In these experiments the pressure supported by the vapour of the pentachloride varied from one-half to one-fifth of an atmosphere. Its density is 6.5, a number considerably higher than the maximum observed by Cahours at 182° C., but still some distance from the number 7.22, which is the theoretical density for the pentachloride when its molecule occupies 2 volumes. At the temperatures employed in these experiments the pentachloride still suffers some decomposition, though less than the decomposition it undergoes at its boiling point under atmospheric pressure.

In order to prevent the dissociation of the compound, Wurtz had recourse to a device founded on the views enunciated by Deville. Seeing that dissociation gradually diminishes as a compound finds itself under an increasing tension of one or both products of its decomposition, and finally ceases when this tension has reached a certain fixed amount for every given temperature, Wurtz conceived the idea of preventing the dissociation of phosphorus pentachloride by volatilizing it into a space containing already a large quantity of the vapour of the trichloride, one of the products of its dissociation. Into a flask with its neck drawn out to a point and carefully dried, he put a very small quantity of the pentachloride, and then an excess of the trichloride. The flask was then heated in a transparent bath of paraffin, and the weight of the mixed vapours determined in the usual way. The point of the flask was then broken under distilled water, and in the solution of phosphoric, phosphorous, and

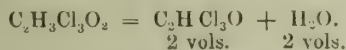
hydrochloric acids thus obtained, the amount of chlorine was determined by precipitating and weighing it as silver chloride. In several of the experiments the amount of phosphorus was also determined as magnesium pyrophosphate, to act as a check upon the chloride determination. In this manner the weight of pentachloride and trichloride in the flask at the moment of sealing could be calculated, and hence the vapour density of the former. Twelve experiments were performed with the following results:—

Experiment.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
Pressure supported by PCl ₅	mm. 194	mm. 338	mm. 168	mm. 271	mm. 343	mm. 174	mm. 411	mm. 394	mm. 214	mm. 413	mm. 318	mm. 423
Density	7.2	7.4	7.7	7.1	7.0	8.3	6.9	7.2	7.4	6.8	7.0	6.9

The mean of these numbers is 7.23, the theoretical density for a 2-volume condensation being 7.22. The temperature of the paraffin bath only varied in the twelve experiments from 160° C. to 177° C., and was very close to the temperature 182°, at which Cahours observed a density of 5.08. Würtz therefore concludes that in an atmosphere of phosphorus trichloride, phosphorus pentachloride volatilizes without decomposition, its molecule occupying twice the space occupied by an atom of hydrogen.

During the last year or two the controversy has been chiefly confined to the question of the dissociation of chloral hydrate. This compound, according to the exact determinations of Naumann, has a density of 2.83 at 78° C., and a density of 2.81 at 100° C. Its formula, C₂H₃Cl₃O₂, indicates a density of 5.72 compared with hydrogen. In the gaseous state the compound therefore occupies exactly twice the normal volume, and, accordingly, it is supposed to be dissociated at 78° C. into equal volumes of anhydrous chloral vapour, C₂HCl₃O, and steam, H₂O. Naumann found that when a quantity of chloral hydrate, more than sufficient to saturate the space above it, was heated to a given temperature in a tube over mercury, the tension of the vapour gradually increased for a considerable time. Thus, when the tube was heated to 35° C., the tension rose in an hour from 12 to 17 millimètres of mercury. At 78° C. the tension rose in 40 minutes from 261 mm. to 296 mm. The compound appears incapable, according to Naumann, of existing in the gaseous state even at ordinary temperatures; the vapour given off is the result of a chemical decomposition, which proceeds more slowly as the space above more nearly approaches the saturation point.

Troost, however, has endeavoured to show that chloral hydrate is not dissociated when it is volatilized. The method he employed depends on the fact that hydrated salts, which give up their water when heated in a space containing no aqueous vapour, suffer no decomposition when heated in a space already containing more aqueous vapour than they themselves emit at the particular temperature employed. If chloral hydrate, when heated, is dissociated into anhydrous chloral and steam, half the observed tension will be due to steam:—



If there is passed up into such an atmosphere a hydrated salt, such as crystallized potassium oxalate, the "dissociation-tension" of which is less than the tension of the steam at the temperature of the experiment, then the oxalate will not give up its water of crystallization, for it will find itself in presence of a larger quantity of steam than it itself could emit. The level of the mercury will accordingly remain unaltered in the tube. But if, on the other hand, the chloral hydrate exists as such in a state of vapour without dissociation, then the oxalate will give up its water of crystallization to the dry space, and the level of the mercury in the tube will fall. Crystallized potassium oxalate, according to Troost, has a dissociation-tension of 53 millimètres of mercury at 78° C.—i.e., the salt passed up into the vacuum of a barometer, and heated to 78° C., would give off sufficient steam to depress the mercury through 53 mm.

Into the closed end of a dry tube standing over mercury, and heated to 78° by the vapour of boiling alcohol, was passed a small weighed quantity of chloral hydrate, which totally volatilized. The tension of the vapour remained constant at 117 mm. Into the space occupied by the vapour a small quantity of the crystallized potassium oxalate was then introduced. If the chloral hydrate were completely dissociated at 78°, half the observed tension—viz., 58.5 mm.—would be due to steam; but since the dissociation-tension of the hydrate of potassium oxalate at 78° is only 53 mm., the latter would not give off its water of crystallization into the wet atmosphere, and the level of the mercury would remain the same. In the experiment, the introduction of the hydrated salt was followed by a gradual fall of the mercury, till the tension of the mixed vapours had reached 164—i.e., had been increased by 47 mm. Troost concludes that the tension would have increased by 53 mm. if the law of gaseous mixtures were rigorously exact, and that consequently the space occupied by the vapour from chloral hydrate at 78° was dry, and no dissociation had taken place.

Würtz immediately repeated these experiments. The quantity of chloral hydrate being so small in Troost's apparatus, the smallest quantity of hygroscopic moisture introduced with the crystals of potassium oxalate would depress the mercury in the tube through a large range. Würtz, being satisfied of the purity of the two hydrates employed, introduced about one-eighth of a grain of chloral hydrate into a barometer tube heated to 100° C. The tension of the vapour was about 370 mm. On passing up well-dried crystals of potassium oxalate, whose dissociation-tension, according to Troost, is 182 mm. at 100°, the mercury fell about 5 mm., and then remained at the same level, although the tube was kept heated for several hours. In

a similar tube Würtz made a mixture of air and steam such that the tension of the latter was equal to the tension of the steam in the dissociated vapour from chloral hydrate. On passing up into this carefully-dried crystals of potassium oxalate, a depression of about 4 mm. was observed after an hour. In a third tube containing dry air only at 100°, the introduction of the hydrated oxalate, dried as before, caused a depression of the mercurial column through 80 mm. after two hours and a half. Crystallized potassium oxalate, when free from hygroscopic moisture, does not behave in the vapour from chloral hydrate as it does in dry air, but just as it does in a mixture of air and steam.

(To be continued.)

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE REVIVIFICATION OF SPENT OXIDE OF IRON.

SIR,—In reply to the letter of Mr. T. D. Hall, in last JOURNAL, as to the unsatisfactory way his oxide has of catching fire, I expect he has had it in action too long (nine months), and it is possible that it is pretty well exhausted, so far as its purifying power is concerned, and I would recommend him to have a fresh supply. It may require to have some sawdust added to it, but I do not find it necessary. It should not be used in too dry a condition, and a little water added to make it something like dry lime should prevent its catching fire. When taken out of the purifier it should be watered and placed in a thin stratum, and kept constantly turned over. I think if Mr. Hall attends to this he will not have any further trouble.

March 24, 1880.

F. J. E.

SPENCE'S METALLIC COMPOUND AND ITS USE FOR PIPE-JOINTS.

SIR,—My attention has been drawn to a reference, in the JOURNAL of the 2nd inst., to a letter written by Mr. R. Morton, of the London Gas-light Company, to the *Journal of the Society of Arts*, on the subject of Spence's metal, and which is, I think, calculated greatly to mislead a numerous class of your readers—i.e., the Engineers of the various Gas Companies in England. As I am much interested in the metal, and have seen a great deal of its working since first it was discovered, I trust you will allow me to make a few remarks thereon.

Mr. Morton says he has, as yet, been unable to obtain a sound joint by its use. I am, of course, ignorant of the conditions under which Mr. Morton made his trial; but I have myself, by permission of the Engineer to the Edinburgh Water Trust, joined several ordinary spigot and socket pipes, running the metal into the joint like lead, only without staving or setting up, and the joints have been afterwards put under the greatest pressure obtainable in the Water Trust yard—viz., 400 feet of water—with a perfectly satisfactory result. This, coupled with the fact that nearly 50 Gas Companies in England continue to use the metal in laying their pipes, makes me wonder whether the fault does not lie with Mr. Morton or his assistants, and not with Spence's metal.

I may add that I was not aware that Mr. Spence or any of his representatives were in the habit of making 4-inch pipes, as the wording of Mr. Morton's letter would lead me to suppose.

93, West Regent Street, Glasgow, March 23, 1880.

J. L. A. HOPE.

THE RECENT GAS-LAMP TESTS AT BIRMINGHAM.

SIR,—Your last week's correspondent, the defeated competitor, has chosen deliberately to stigmatize as an error the public comparative experiment made at Birmingham on the night of Wednesday, the 10th inst., between my 200-candle globe lantern and burner, No. 9 on Mr. Hunt's list, and the quadruple arrangement of adamas flat-flame burners, No. 10 on the same list. He says, with considerable assurance, "the Wednesday night's error was much more prominently stated [in your report] than the Thursday's correction;" and, at the bottom of his letter, he volunteers the statement, for "the information of those who were not present, that the lateral light only is tested in these experiments."

Against these statements I beg most emphatically to protest; while I consider the motive of the writer is clear, and distinctly contradicts the preface of his letter, which leads one to assume that it is dictated by a desire "that a proper conception may be formed of the instructive experiments," &c.

If I were to permit myself to make use of a short American word which once raised the ire of Professor Tyndall when it was introduced to his notice by Mr. Pope, Q.C., as a convenient mode of concisely expressing his sentiments on a certain question which the Professor thought was surrounded by a great amount of unreality, I should use that word to express my opinion of your correspondent's anxiety in this direction. The trial on the Wednesday night was a public one, of which no notice was given to any of the competitors, and the result showed that my 200-candle Argand burner in a globe lantern gave over 30 per cent. more light, for the same quantity of gas, than the quadruple flat-flame burner against which it was tried. A representative of the JOURNAL and a great many Engineers of eminence assisted at it, and it was not a hurried one. I took no part in it in any way, nor was I present at the trials, although I was on another part of the ground; neither was I aware of the result of the trial till I read it in the JOURNAL. Your correspondent, on the contrary, was there, though I do not suppose he was allowed to take any part in the tests. He, however, evidently knew the results of previous, and probably not so perfect trials, which had been made by Mr. Hunt and his assistants. Naturally these private preliminary trials would not have been communicated to any of the competitors. They were, and must have been, distinctly private trials preparatory to the public one which Mr. Hunt was contemplating; and I would not insult either Mr. Hunt or his assistant, Mr. Colson, by imagining for one moment that information of the results of any of these trials had been given to any of the competitors, for if given to one they would have been given to all. Your readers who know them will, I am sure, cordially concur with me in this opinion. But by his own words your

correspondent betrays himself, for he says: "As the tests hurriedly made on Wednesday night with the two 200-candle power burners and lanterns were not in accordance with several previous tests [the italics are mine] made with the same lanterns," &c. And further on, after stating the result of another trial on Thursday night, at which I was not present, neither had any information about, made by Mr. Hunt, and forwarded to you for publication, he says, with the utmost assurance—as of a man who was present, in some way, at them—"This result was in close correspondence with the several previous tests." And yet with all this previous information obtained, your correspondent present at the official public trial, knowing the position of the shadow meter, at that trial, between my lamp and the quadruple one, does not say one word about error until you publish the result. Only then he calls it an error because the trial utterly demolished the statements which he has been making for some time past.

I say there was no error in the experiment of the Wednesday night, because I have made a great many careful tests of my 200-candle Argands, against such a quadruple combination of flat-flame burners as was then exhibited as being of your correspondent's invention, and I am able to corroborate the results of the Wednesday night's trial by these, my own experiments, as well as by the evidence of impartial and competent scientific men, whose results will shortly be given to you. More than this, your correspondent himself admits the truth of the experiment, and "accepts the consequences of having tests made [peculiar phraseology] with our burners of the medium lighting class;" although he endeavours to draw a herring across the trail by subtle explanations of why he makes his burners give from 6 to 12 per cent. less light than they ought to do.

I only say this, that when I saw the quadruple burner just before the trial, it was doing its very best; that it is the same kind of burner I have seen in various places, and is advertised to give the light of 200 parliamentary candles; and that it was tried at the public trial on Wednesday as it is used in the public streets.

Your correspondent's statement, "that only lateral light is tested in these experiments," if true, is only so as regards my 200-candle globe lantern and burner, and most distinctly not as regards the quadruple flame lantern and burner in competition with it. It happens that the only 200-candle lantern which Mr. Hunt possesses is of the globular form, and it was for him, and at his suggestion, that I designed this form. Although it is, in the opinion of many, more graceful than the original 12-sided cone lantern (used first by Mr. Corbet Woodall in the Waterloo Road, and afterwards adopted for Waterloo Place and Queen Victoria Street, London, Sackville Street, Dublin, and many other public thoroughfares in Lambeth and elsewhere), yet it necessarily follows that the rays of light reflected from the semi-circular white glass top fall very near the foot of the post.

During the estimation of the comparative illuminating power, the shadow meter had to be taken away from it, and carried much nearer the inferior light given by the quadruple flame burner. The greased disc was, therefore, out of the reach of these reflected rays from my globe lantern; but the contrary must necessarily have been the case with the quadruple competing burner. The lantern in which it was enclosed was of hexagonal form, similar in its most essential features to my original 12-sided lantern, provided with the now well-known white glass conical reflector, which I trust your correspondent will pardon me for saying I invented expressly for the powerful lamps I brought out in competition with the electric light. This enabled the much talked-of vertical rays from the burner to reach the disc with only the loss due to reflection from this excellent reflector.

Now, in the Wednesday night's trial the quadruple burner was rightly, I think, brought up as nearly as could be done (without an injurious pressure at the point of ignition) to the aggregate number of candles it was said to be able to produce; in fact, it was made to look its best. It, however, certainly did not reach the advertised standard of 200 candles; but when it was turned down, as it probably was in Thursday night's trial, the flame could not have presented the same rigid and brilliant appearance it did on Wednesday night. With a lower aggregate amount of light given, and less brilliancy, the destructive effect of pressure at the point of ignition required to give the flame a good shape was mitigated, and a higher result per cubic foot of gas consumed could be thus obtained, as most of your readers who have tried experiments with flat-flame burners doubtless already know. But the turning-down system, which benefits in one way the over-oxidized flat-flame, has quite the contrary effect upon the Argand burner, which has an almost inappreciable pressure at the point of ignition, and this because the air supply, regulated by the chimney, remains nearly the same, although the gas supply is diminished. If, however, it is desired to use my 200-candle Argand so as to produce a very high amount of illuminating power per cubic foot of gas consumed, I have the authority of Mr. Hunt, who has tried it, for saying that with a shorter chimney and a smaller consumption of gas than that required to produce 200 candles, it is capable of producing the astonishing result in illuminating power of 450 candles per cubic foot of 16-candle gas consumed. This is over 30 per cent. more light than that given by your correspondent's extraordinary "high lighting power" 80-candle flat-flame burner, which he does not consider well adapted to its work, neither do I. Mr. Heisch, Gas Analyst to the Corporation of the City of London, has also pointed out in the JOURNAL that, with slightly-increased consumption, the 200-candle Argand develops 450 candles to the foot with such gas as is supplied to the City of London.

So that if, in the Thursday night's experiment, the quadruple flat-flame burner, instead of being turned down, had been supplied with sufficient gas to have made it give the aggregate light it is advertised to produce—viz., 200 candles—the pressure at the point of ignition must have been raised, and a lower result per cubic foot of gas consumed than that given in the Wednesday night's trial would have been obtained. But I maintain the trial on the Wednesday night was, as far as I can see, a practical one in every respect; more so than that of the Thursday night. This latter test might also have been made in a manner, having regard to what can be done with a shorter chimney, on the 200-candle Argand, or giving it 50 feet of gas per hour with the same chimney. It would then have only confirmed the Wednesday night's trial.

I now beg leave to inform "those of your readers who were not present" that I exhibited a *real* 200-candle flat-flame burner and lantern of new construction. The burner was a new combination of my patent hollow-top circular slit steatite flat-flame burners, with a central flame and a sub-chimney. The two latter improvements give great brilliancy to the flat-flame burners. The lantern, which is supplied with air and ventilated entirely from the top, in a manner similar to that employed in my Argand lanterns, is provided with a porcelain reflector combined with a white glass reflector. This lamp, sent as soon as ever I heard there was to be a show of lanterns, was too late probably to be put in competition; but the burner of it was tried in the photometer. It gave a higher result, with greater brilliancy, than the quadruple flat-flame burner which was tried against my 200-candle Argand. I will provide you with a drawing of the lamp and burner next week.

Permit me also to observe that, without so loudly expressing my desire that the fullest information should be afforded to your readers relative to the important question of large Argands and large flat-flame burners, I have, at my own expense, and with the kind permission of the Engineer, fitted up a very perfect apparatus for making tests at one of the principal London gas-works. The gas supplied from these works is of that quality which is mostly consumed throughout the world; and for some considerable time past careful experiments have been conducted for me, and at my expense, with various kinds of Argand and flat-flame burners, by highly scientific and practical men, and also, quite independently of me, for his own information, by the Engineer himself. These experiments have now reached such a stage that I believe they can be shortly communicated to you.

In conclusion, I beg to say that, although I distinctly decline to have anything to do with "challenges," I shall continue to give, as I have always done, correct information to your readers of the results which they can obtain from my burners and lanterns. Further than this, if your correspondent can obtain—and I expect he can—the sanction of the Engineer of the works where my photometer is set up, he is welcome, as far as I am concerned, to have any trials made of burners and lanterns of his own invention in competition with my burners and lanterns, which I will send for the purpose, on condition only that he does not interfere with the test, will consent to pay one-half the cost of the trials, and forward to you the results for publication.

I apologize very sincerely for the length of this communication, assuring you that it is only forced from me by the manner in which I feel your correspondent has acted in the matter, and has been acting towards me for some time past.

Vincent Street, Westminster, March 27, 1880.

WILLIAM SUGG.

Legal Intelligence.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

MONDAY, MARCH 22.

(Before Lords Justices BRAMWELL, BAGGALLAY, and THESIGER.)

HAWKSLEY v. BRADSHAW AND ANOTHER.

Proceedings in this case, which has previously been referred to in the JOURNAL, were continued to-day on an appeal by the defendants from an order of the Lord Chief Justice of England and Justice Manisty. The petitioner, Mr. Thomas Hawksley, was, at the time of the action, the Chief Engineer of the Nottingham Water-Works Company. The defendants, Messrs. W. and A. S. Bradshaw, were printers and publishers of the *Nottingham Journal*. On May 12 last year, defendants printed and published an article which was alleged by the plaintiff to reflect on him in his professional capacity. It was alleged to impute that he was anxious to push forward, with all possible vigour, new works, which were not needful, would probably not be remunerative, and were not *bonâ fide* for the purpose of meeting public wants, or for any purpose consistent with the plaintiff's duty and honour and good character, but for the purpose of unfairly increasing the price of the Water-Works Company's undertaking to the Corporation of Nottingham on behalf of the inhabitants of the town, and for the purpose of increasing the plaintiff's emoluments as the Engineer of the Company, or otherwise, unprofessionally disgraceful and dishonourable. This article was alleged by the plaintiff to be falsely and maliciously printed and published by the defendants. He stated that his character had been damaged, and he claimed £1000 in respect thereof. In their statement of defence, the defendants justified the libel, and paid 40s. into court in satisfaction of the claim. The matter came before the Court below on the pleadings, the question being whether the defendants, having justified the libel, could, as an alternative defence, plead that they had paid into court 40s. in satisfaction under the Judicature Act. It was held in the court below that there was nothing in the Judicature Act which repealed or modified Lord Campbell's (Libel) Act. Before the passing of the Judicature Act, money could not be paid into court when a justification was pleaded, and it would be embarrassing to the plaintiff, to vindicate his character, that he must either take the money out of court, or else have it said that he shirked the trial. They, therefore, ordered the defence to be struck out, and the case to go down for trial on its merits. From that decision defendants now appealed.

Mr. GRAHAM appeared for the appellants, the defendants in the action; Mr. CAYE, Q.C., and Mr. DUNN for the respondent, the plaintiff in the cause.

Lord Justice BRAMWELL, in giving judgment, said that he could not concur with the decision of the Court below. It might be that these pleadings embarrassed the plaintiff, but were not embarrassing in the sense that they were embarrassing him as to the mode of dealing with them. It appeared reasonable to his lordship that these pleadings should be allowed, and he was therefore of opinion that the judgment of the Court below should be reversed.

Lords Justices BAGGALLAY and THESIGER concurred. The appeal was therefore allowed, with costs.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

TUESDAY, MARCH 23.

(Before Vice-Chancellor BACON.)

ATTORNEY-GENERAL V. HILL.

Mr. HEMMING, Q.C. (with him Mr. LANGWORTHY), in opening this case, stated that it was a bill and information by the Mayor, Aldermen, and Burgesses of the borough of Tamworth, and also by William Wileman, on behalf of himself and all the other ratepayers, against the Tamworth Gas-light and Coke Company, who were trustees of shares which they held for the benefit of the ratepayers. The plaintiffs stated that many years ago a subscription was raised for the purpose of relieving the town of Tam-

worth from part of the cost of the public lighting. About £500 was thus raised and invested, in the names of trustees, in shares of the Tamworth Gas Company, the primary object of the trust being that the income should be applied in the reduction of any sums which the inhabitants might have to pay for lighting the town. It seemed to have been contemplated that a time might come when gas would no longer be required, and therefore behind the primary trust it was stipulated that in such event the money should be applied for some other purpose for the benefit of the town. The money was raised as long ago as 1835, and from that time until a year or two since the dividends on the shares were regularly applied for the purposes of the primary trust, being set off against the payments due to the Gas Company. There appeared to have been some uneasiness in the minds of the representatives of the trustees, and in 1839 and 1871 agreements were obtained by which the Gas Company pledged themselves that the dividends on the trust shares should be applied for the purpose of the primary trust. But in 1871 differences of opinion began to arise between the Town Council and the Gas Company; and if the gas-lamps were lighted an hour longer than the Company thought they ought to have been, they immediately charged the Council with penalties. Upon this further disputes cropped up, and in 1873, in rendering their accounts, the Company gave the Council credit for the dividends on the shares, but placed about £30 of penalties on the other side of the account. This they were enabled to do, because, curiously enough, the trustees who held the gas shares had all died but one, who was, or had been Chairman of the Company. Then the Solicitor of the Company thought it was his duty to help his clients, and it occurred to him that, Mr. Bramall, the Chairman of the Company, being a very old man, it would be better to appoint new trustees, and he prepared a deed for the purpose, by which Mr. Bramall assigned the property to new trustees, who were all Directors of the Gas Company. But by that deed power was given to the trustees to apply the funds in any way they thought fit for the benefit of the town. While certain disputes then pending were going on, the Town Clerk wrote to Mr. Shaw, the Company's Solicitor, asking to see the deed which had been prepared; but the answer was that it was a title-deed, and he refused to show it. It was not until after the commencement of the litigation that the deed was produced, and when it was seen, the Charity Commissioners were appealed to, and they suggested that a scheme should be submitted to them, and that an end should be put to all necessity for litigation. To this the plaintiffs assented, but the defendants declined to agree to any scheme, on the ground that a charitable trust was still in existence, and that they were properly administering it. The defendants, by their answer, stated that the gas shares had been solely under the control of the Directors of the Gas Company, and that they had no intention of dealing with the shares in any manner other than that provided by the trust deed. They also submitted for the determination of the Court whether the shares constituted a charitable fund, but were willing, in the event of the Court so holding, to concur in any scheme for the proper application of the fund. The plaintiffs asked for a declaration that the shares should be applied in aid of the rates for lighting the town of Tamworth, and that so far as not required for that purpose they should be applied for the benefit of the inhabitants of the town, and in paying the costs of the suit.

Mr. MEDD (with whom was Sir HENRY JACKSON, Q.C.) appeared for the defendants, and submitted that the trustees ought not to be called upon to pay costs, as the whole of the facts relating to the trust were known to the plaintiffs from the first, and that as the defendants had always been ready and willing to perform the trusts of the deed, the present application was entirely misconceived. The defendants were not responsible for the validity of the deed, and it would be monstrous to call upon them to pay costs in the event of the Court deciding that the deed was invalid, they having simply consented to become trustees upon a proper deed being executed. The defendants had always been willing that the matter should be settled by arbitration, but the plaintiffs would not consent; and yet it was now said all the litigation had been caused by the defendants.

His LORDSHIP said the case was really undefended, because when the plaintiffs asked to see the deed of 1872, which declared the rights of the parties, the defendants peremptorily refused to produce it, and this refusal had led to the institution of the suit. He was of opinion that a public charity had been created, and that the objects of the trust would be frustrated if the costs were allowed to be deducted from the charity. The plaintiffs were entitled to a declaration that the gas shares were applicable to the purposes for which the trust was created, and there would be an order that the deed of 1872 be set aside on the ground of being an improper deed, and that the costs of the suit be paid by the defendants other than Mr. Bramall.

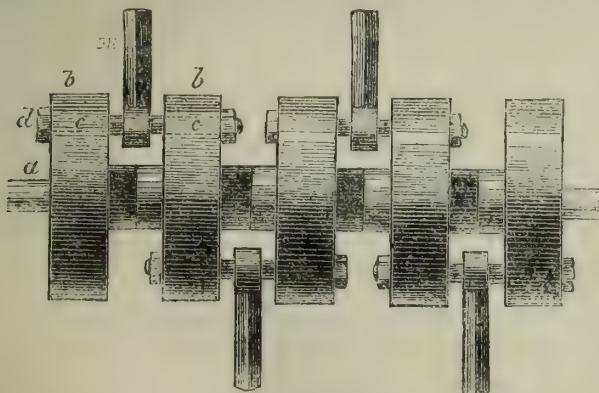
Order accordingly.

Miscellaneous News.

DURAND AND CHAPITEL'S COKE BREAKER.

There is now being fixed, and will shortly be at work at the Kensal Green station of the Chartered Gas Company, one of the above-named machines, which have been extensively introduced in continental works, and are in all cases, we hear, giving much satisfaction. One of the machines has also been in use, during the past winter, at the Crystal Palace District Gas Company's works, Lower Sydenham. There is also one at the South Metropolitan Gas-Works, Old Kent Road.

The machine altogether supersedes the system at present employed for breaking coke—viz., by crushing or pounding it. With it the coke is



broken up almost in the same manner as it would be by hand labour, the breakers proper (see above engraving) being a number of hammers similar to the coke hammers now generally employed in gas-works. The method

of performing the operation is, however, entirely different. Instead of the coke being spread out upon the ground, and consequently supported by a solid substance when it receives the blow of the hammer, it is struck, so to speak, in mid-air.

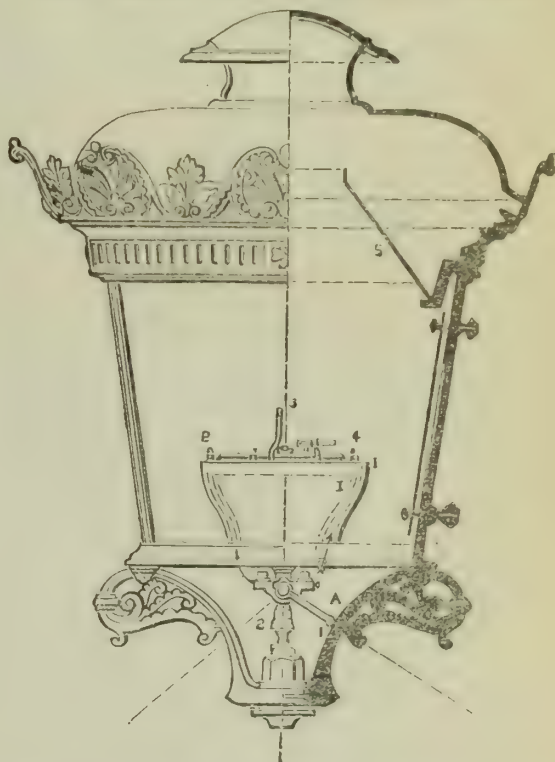
The following brief description of the machine will show how it operates. Upon a horizontal shaft, *a*, are fixed five circular plates of cast iron, *b b*, about 1½ inches apart. A hole is drilled near the circumference of each plate, at *c c*, and a long bolt, *d*, passed through and into a corresponding hole in the next plate, thus binding them together. This bolt carries the hammer, *m*, which is really the principal part of the machine. In a line with the hole in the second plate, and in its outer circumference, there is another hole, through which a bolt is passed connecting it with the third plate, and this bolt likewise carries a hammer. Three plates, therefore, serve for carrying two hammers, so that there are four hammers in each machine. The hammer is, strictly speaking, a kind of flail, made of steel or common cast iron, about ½ inch in thickness, and tapered off somewhat like a hatchet. One of its extremities is formed into a kind of handle, and this is held in position by the connecting bolt, upon which it turns freely; but when motion is imparted to the machine, causing the plates to revolve rapidly, these hammers have the appearance of being fixtures.

A hopper placed above the machine allows of the introduction of the coke, which, in falling, comes in contact with the revolving hammers, and is broken up and projected against a horizontal iron grating, by which the working parts of the machine are surrounded. The space between the bars of this grating may, of course, be regulated at pleasure.

From the foregoing description an estimate may easily be formed of the advantages to be gained by the use of this small apparatus, which weighs only about 7 cwt., and measures 4 feet in length by 3 ft. 3 in. in height. But, though small, its working capacity is very considerable, being equal to the breaking of as much as 230 chaldrons of coke per day. Very simple gearing, worked by a pony, suffices for driving the breaker, and with this motive power it will turn out nearly 4 chaldrons of coke per hour. Any kind of coke—hard or soft, gas or metallurgic—may be broken by the machine, the pieces being of very uniform size (but this, as has been said, can be regulated by means of the grating), with no greater production of breeze and dust than would result from hand breaking. The entire machine is enclosed in a wooden case, and, when worked by hand, turns out about 10 tons of coke per day; worked by a horse, or a 1-horse power gas or steam engine, 20 tons; by a 2-horse power engine, 30 tons; by a 4-horse power engine, 60 tons. Of this, from 90 to 94 per cent. is good coke, the remainder dust.

The machine was awarded a bronze medal at the last French Exhibition. It is being introduced in England by Mr. E. Garey, of the Continental Union Gas Company.

THE "PHARE" GAS LANTERN AND BURNER.



The above is an illustration of the lantern which was placed on the refuge in front of the Mansion House Station of the Metropolitan District Railway, and used for three months ending the 9th inst. The burner it contained was on the principle of those employed for lighting the Rue du Quatre Septembre, Paris. The average consumption of gas by it was, we hear, 380 cubic feet for the time during which it was lighted each night. This would give, on an average, about 28 feet per hour, including the gain by turning out the large series of six jets and lighting the single one; which, however, was only done occasionally, while at times the burner was alight all day.

Mr. Killingworth Hedges, C.E., of Queen Anne's Gate, Westminster, has introduced this burner into England, and has designed an arrangement by which a series of the burners can be turned down from the high to the low power at once. All that is necessary to effect this is a connection with the nearest telegraph wire, through which an electric current could be sent, and thus cause a small magnet to come into action and alter the position of the lever, *A*. The same magnet might also be arranged to shut the gas off altogether; but it would only be in cases where the burners were fixed at some distance apart, and too far for a man to go round at midnight, as in Paris, that this arrangement would be required.

In the part of the engraving showing the burner, an enlarged view of which was given in the JOURNAL for June 17 last year, p. 942, 1 and 1 are glass cylinders conducting air to the jets; 2 is the circle of six jets; 3 the single jet; and 4 the flash light. The figure 5 in the roof of the lantern shows the position of the reflectors placed therein; while, at the base, *A* is the lever by which, when it is moved from 1 to 2, the circle of six jets is extinguished, and the single central jet lighted.

laying down an extension of something over three-quarters of a mile of mains, but the negotiations that had been carried on concerning it fell through. The manufacturers who proposed to take the supply did not give a satisfactory guarantee that they would use the Company's water when the extension was made, and therefore the matter was in abeyance. They had sent out the material, which was good stock when the transaction could be completed. They had been able to diminish the office expenses at St. Petersburg, and they hoped there would be a further saving during the current year. The pumping expenses were naturally higher than in the previous year, the quantity of water delivered into the city being 312 million vedros, against 270 million vedros in the previous year. The Directors had naturally spent more on coals, and somewhat more in wages in the Engineer's department; but, although the amount laid out had been larger, the cost per million gallons of water was less than it was—in the proportion of 53 as against 65—showing that as the work increased it was being done more economically. The most serious item on the debtor side of the accounts was that for loss on exchange. The loss this year was, however, less in proportion than the former year. The exchange had risen about 8 per cent.—from 23d. to 25d.; in fact, it rose to nearly 26d. until the late wretched Nihilist attempted assassination, which had for the moment upset confidence. The exchange had not risen so far, however, as to make it worth while to alter the Directors' basis of calculation of 24d. to the rouble. Their assets were worth a little more than this. Reference was made in the accounts to a large number of debentures which had been issued. He had told them the history of this on former occasions. It was the balance of the sum owing to the contractors, and for which promissory notes were given to them. The notes became due, and, according to the arrangements made with them, debentures were issued in payment. The contractors were now the largest debenture-holders in the Company. This left a tolerably clean balance-sheet; there being very few outstanding liabilities except the heavy one for debentures. At the latter end of last year the Company's Manager at St. Petersburg sent in his resignation—not from any dissatisfaction between him and the Company, but simply for the purpose of undertaking business on his own account. In consequence of his retirement, the Directors had made certain arrangements by which Mr. Vernon, who was formerly their Accountant, had been made their representative at St. Petersburg. Mr. Carr, who was the Deputy-Engineer, they had put in charge of the engine department, and the Directors had every reason to believe that he was quite competent to do the work expected of him; and, in case of any difficulty, they had made arrangements by which he could refer to their late Manager, Mr. Mallison, whom they had appointed a sort of Consulting Engineer in Russia. The result of these transactions financially was that the Company would save a very considerable part of the late Manager's salary. With regard to their prospects, he was always very shy of prophesying, but he might mention for the Shareholders' information that the receipts for the month of January last showed an increase of 3000 roubles over the corresponding month of the previous year, the figures being 10,500 roubles against 7500 roubles. This was a very fair rate of increase. He had recently visited St. Petersburg, and he was pleased to find a considerable amount of building going on in their part of the town. A new bridge was being made across the river, and this had opened a part of the town which was very inaccessible before, and during last year he was surprised to find how many houses had been built and were in course of erection, all of which would bring revenue to the Company. They had also taken the opportunity of the expiration of some of the original contracts by which they supplied water to a portion of the inhabitants to revise them, and the result of that revision would be an average increase of revenue from each house. The Company were able to raise the rates in almost every case, though in one or two instances the revision entailed a diminution. On striking a balance, however, the Directors found they had been able to raise the rates considerably, which would result in a large addition to the receipts. It was too early in the season to enable the Directors to judge what would be the result of laying on new services during the year, but from the very fair state of the trade of the city, he thought they might look at any rate to something equal to last year. The Shareholders would see a note in the report concerning the debentures of the Company. The Directors arranged, without troubling the Shareholders, for the payment of the interest which became due on them to the 31st of December last; but in July next they would have to provide the capital for bonds falling due, to the extent of about £25,000. The Directors had not yet completed the arrangements as to what was to be done regarding the matter, and, therefore, he merely informed the Shareholders of the fact that they would have to make arrangements about them, and leave it to a future time to say what those arrangements might be.

Mr. W. SANGSTER seconded the motion. Colonel OMMANNEY said he had lately been to St. Petersburg, and had spent two days in going over the Company's works. He need not tell the Shareholders that everything stated by the Chairman and the report was perfectly correct. The works were in good order—in fact, three better sets of engines they could not find anywhere. What was to be looked to was the future of the Company. The debenture interest was, no doubt, heavy in proportion to the share capital, and would take some time to work round. He then referred to the pulling down of many of the wooden houses in the neighbourhood of the Company's works, and to their being replaced by others of a better class, and said this would all lead to the increased use of the Company's water, as the occupants of the wooden houses used to take from the Neva whatever water they required. The neighbourhood of their works was really the only part of St. Petersburg where there was any chance of buildings being erected, and he thought that in a few years the Company would find a very large increase in their rates and in the amount of water used. They had an excellent Manager and Engineer, while their local Director, Mr. Anderson, was most energetic.

The motion was carried unanimously. The retiring Directors and Auditors were then severally re-elected, and a vote of thanks was passed to the Chairman and Directors, to which the Chairman briefly responded, and the proceedings closed.

CAGLIARI GAS AND WATER COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held on Tuesday last, at the London Offices, 3, Lothbury, E.C.—ERASMUS WILSON, Esq., F.R.S., in the chair.

The SECRETARY (Mr. Rod. Mackay) read the notice convening the meeting, and the following report and accounts were presented:—

The receipts on revenue account for the past year amount to £19,218 1s. 1d., and the expenditure to £8709 1s. 2d., leaving a clear net revenue for the year of £10,508 19s. 11d.

The amount available for dividend, including the balance brought forward from the previous year, as shown in the balance-sheet, is £12,121 3s. 10d., out of which an interim dividend at the rate of 5 per cent. per annum was paid for the half year ending June 30, 1879, £3631. The Directors recommend a dividend at the rate of 8 per cent. per annum for the half year ending Dec. 31, 1879, amounting to £5825 12s., leaving a balance of £2664 11s. 10d.

The water receipts for the year show an increase of £226 over those of the previous year.

The gas receipts, from public and private lights, for the year, show an increase of £94. The loss from gas leakage has averaged 7½ per cent. of the make over the whole year.

After reducing the expenditure on capital account by £1000, as mentioned in the last annual report, the amount now stands at £151,889 8s. 1d., and the Directors recommend that the sum of £1000 be now carried from the revenue balance further in reduction of the capital expenditure account.

The Directors retiring by rotation are Mr. J. Orwell Phillips and Mr. Joseph Quick, who, being eligible, offer themselves for re-election.

Dr.	Revenue Account, for the Year ending Dec. 31, 1879.				Cs.
Maintenance of water-works—					Water—
Reservoirs and filters in Colognui	£92	1	4		The Italian Government, Province of Cagliari and Municipality of Cagliari.
Main to town	54	8	8		• £9,600 0 0
Reservoirs and mains in Cagliari	155	3	5		• By the 11th Article of the Concession, the fixed annual payment for the water supply in Cagliari is:— For the first 30 years, from 1867 to 1897, £29600; second 30 years, from 1897 to 1927, £7600; third 30 years, from 1927 to 1957, £5600.
Horse keep & miscellaneous	229	6	2		
Gas manufacture—					From sundry customers, viz.—
Wages	681	2	9		For extra supply in Cagliari.
Coals.	1,766	0	2		For supply beyond Cagliari.
Stores	313	8	1		Ditto to shipping
General charges in Cagliari—					Gas—
Salaries	1,230	1	3		Public lamps
Office rent, stationery, travelling expenses, &c.	234	14	3		Private lights
Rates and taxes in Cagliari	1,043	7	7		Products
General charges in London—					Transfer fees
Directors and Auditors' fees.	281	10	0		Sundry work and sales of material
Salaries and office rent	250	0	0		
Stationery, bill stamps, and petty disbursements	26	5	0		
Prem. on insurance of works	30	0	0		
Exchange on remittances	1,593	5	6		
Interest and discounts	478	7	0		
Sinking-fund.	150	0	0		
Reserve-fund.	100	0	0		
Total expenditure	£8,709	1	2		
Balance	10,508	19	11		
	£19,218	1	1		
					£19,218 1 1

Capital Account and Balance-Sheet.

Gas and Water-Works—		Capital, authorized by Memorandum and Articles of Association, 7500 shares of £20 each	
Total amount expended, including preliminary expenses, to Dec. 31, 1878, per last account	£152,547 6 5	7282 shares, subscribed to Dec. 31, 1879.	145,640 0 0
Less, written off in last annual report	1,000 0 0	Debenture bonds	7,500 0 0
	£151,547 6 5	Sundry debts due by the Company	967 3 6
Expended during year	342 1 11	Bills payable	190 18 7
Cash at Company's Bankers, London	636 19 4	Sinking-fund	2,669 7 3
Cash at Cagliari	39 0 4	Special reserve-fund	558 6 5
Sundry debts due to the Company	7,129 16 6	Revenue account, net profits—	
Bills receivable on hand	444 19 9	Balance, at Dec. 31, 1878.	£12,042 15 11
Special works executed	2,166 9 8	Less divs. paid for the year 1878	9,430 12 0
Stores on hand at Cagliari—			£2,612 3 11
Coals	382 11 10	Less written off to credit of capital expenditure per last annual report 1,000 0 0	
Products	144 13 10		1,612 3 11
Investment in share capital of Company (sinking-fund)	2,640 0 0	Year to Dec. 31, 1879.	10,508 19 11
Do. do. (special reserve-fund)	540 0 0		£169,644 19 7
Payment on account of dividend, Oct. 6, 1879	3,631 0 0		

The CHAIRMAN, in moving the adoption of the report, said he was not ordinarily given to congratulation, but he believed he might on this occasion congratulate the Shareholders and the Company on their very satisfactory progress. If he wanted any illustration of their success, and of the confidence which was placed in the Board, it would be found in the fact of so small a number of the Shareholders being present. In looking over the report, it would be seen that it was altogether of a satisfactory character, and the Directors trusted the progress which the Company had heretofore made would be steadily continuous. As a provision for this steady continuance, they had suggested some wholesome recommendations as to the disposal of the existing balances. In one paragraph of the report it was stated that the water receipts for the year showed an increase over those of the previous year; in another, it was stated that the gas receipts from public and private lights likewise showed an increase; while, in a third, it was pointed out that the leakage had very considerably diminished over what it had been previously, and was reduced, in fact, to such a minimum that it could not reasonably be objected to. The Shareholders would see also that, as to the disposition of their net income, after providing for a dividend for the year of 6½ per cent., they were enabled to carry forward a balance which permitted them to reduce the expenditure on capital account by £1000. Under these circumstances, he thought they must all agree that the Company and its affairs were in a very wholesome condition.

Mr. J. ORWELL PHILLIPS seconded the motion, and it was carried unanimously.

On the motion of Mr. H. P. STEPHENSON, seconded by Mr. JOHN AIRD, the following resolution was also unanimously passed:—"That the interim payment on account of dividend of the 6th of October last be and is hereby confirmed, and that a dividend for the half year to Dec. 31, 1879, at the rate of 8 per cent. per annum, less income-tax, be declared, payable on and after April 5, 1880."

The CHAIRMAN then proposed the re-election of Mr. J. Orwell Phillips as a Director of the Company. In doing so he said Mr. Phillips was so well known to every one connected with gas undertakings, and so thoroughly informed on every matter relating to that special enterprise, that he was a most valuable Director of the Company, and it was with much gratification that he (the Chairman) proposed his re-election.

Mr. J. J. BARROW seconded the motion, and it was carried unanimously, as was also one for the re-election of Mr. J. Quick, the other retiring Director.

Mr. PHILLIPS briefly acknowledged, on behalf of himself and Mr. Quick, the compliment paid them.

The retiring Auditors, Messrs. Cox and Bishop, were then re-elected, and a vote of thanks to the Chairman and Directors, for the able manner in which they had conducted the affairs of the Company, was passed unanimously.

The CHAIRMAN, in responding, assured the Shareholders that the Directors had most entirely at heart the success of the Company. They spared no effort in order that it might be made a thriving concern, and if it did not become one of the leading companies in connection with the supply of gas and water, it would be only because the city the Company had to supply was limited alike in population and in extent. The proceedings then terminated.

OTTOMAN GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held at the London Offices, 53, Cannon Street, E.C., on Tuesday, the 16th inst.—E. HORNER, Esq., in the chair.

The SECRETARY (Mr. A. J. King) having read the notice convening the meeting, the following report and statement of accounts were presented:—

The Directors herewith present the audited statement of accounts for the year ending Dec. 31, 1879.

The gas-rental for that period amounts to £7120 5s. 6d., and the net profit (after paying interest on debentures) to £2508 19s. 9d., which, added to the balance brought forward, makes the sum of £3160 17s. 10d., which the Directors propose to deal with as follows:—

A dividend of 7 per cent. on the preference shares . . .	£574 17 9
A dividend of 3 per cent. on the ordinary shares . . .	1500 0 0
To write off from the preliminary expenses account . . .	500 0 0
Leaving a balance to carry forward of . . .	586 0 1

£3160 17 10

And resolutions will be proposed at the general meeting accordingly.

The Directors retiring in due course are Edward Horner, Esq., and Stephenson Clarke, Esq., who offer themselves for re-election.

The Auditors, George Allin, Esq., and Charles Butt, Esq., offer themselves for re-election.

Dr.	Balance-Sheet, Dec. 31, 1879.	Cr.	
Capital	£50,000 0 0	Plant	£45,648 18 8
Do., preference shares, viz.—		Concession and preliminary expenses	12,000 0 0
1125 shares, £5 paid	5,625 0 0	Amount owing for public lights	2,270 12 5
900 shares, £3 paid	2,700 0 0	Sundry debtors	3,434 3 8
	£58,325 0 0	Stocks	5,146 18 3
Debentures	1,750 0 0	Office furniture	60 0 0
Sundry creditors	5,902 7 1	Cash	577 11 11
Profit and loss account—			
Amount brought forward	651 18 1		
Add for 1879	2,508 19 9		
	£69,138 4 11		£69,138 4 11

Profit and Loss Account, for the Year ending Dec. 31, 1879.

Cost of coals	£2,456 17 7	Gas-rental	£7,120 5 6
Wages and materials	955 8 0	Products	1,297 1 4
Salaries and office expenses, Smyrna	1,199 1 5	Net profit on chandeliers, fittings, meter-rents, &c.	560 12 2
Bad debts and allowances	74 8 6	Transfer fees	1 0 0
Exchange	449 7 0		
Repairs and renewals	357 7 1		
Debenture interest	105 0 0		
Directors fees	390 0 0		
Interest and discount	131 8 6		
Income-tax	66 12 5		
Rent, salaries, and office expenses, London	344 8 9		
Balance (profit)	2,508 19 9		
	£8,978 19 0		£8,978 19 0

The CHAIRMAN, in moving the adoption of the report, said the Shareholders would perceive that the accounts did not very materially differ from those which the Directors had presented before. This fact was, in some measure, satisfactory, seeing that the Company had suffered somewhat of a blow during the past year by the loss of the public lights, for which petroleum had been substituted, in the first circle of Smyrna—the Turkish quarter—the Company retaining the lighting of the second circle, or European quarter. It might not unnaturally have been imagined that this would have very materially affected the profits of the concern, but such was not the case, for the Company had not been affected very much. Even in their misfortune, they had some satisfaction in knowing that for the 200 odd lamps they had lost, something like 800 petroleum lamps had been required to light the place, and even with this number the lighting was not anything like so efficient as before, when the locality was illuminated by means of gas. When a very violent wind occurred, too, a large number of the petroleum lamps were extinguished, and he understood that on one occasion they were all blown out with the exception of 100. He believed it was a notorious fact that the new system of lighting was a job. Certain parties were largely interested in the sale of petroleum, and by this means it had been introduced, but he very much doubted whether the actual cost of lighting was not now quite as much as, if not more than when gas was used, inasmuch as, though the cost per lamp was less, the number of lights being two or three times as great as before of course increased the cost. He therefore thought it likely that a return to the former condition of things would take place. They were in negotiation for such an extension of the lights at the other end of the town as would bring up the number of the public lamps to as many as before. A certain extension of mains would be required, but the Company had the pipes in stock, so that it would necessitate a very small expense indeed to increase the lights. At the next meeting, therefore, he hoped the Directors would be able to report that they had not only as many lights as before, but rather more than that number, and he also hoped the Company would get back those they had lost, and thus be placed in a better position than that which they formerly occupied. The state of the accounts was almost unchanged. There had been an increase of £200 in the capital, in consequence of a Proprietor having fully paid up his preference shares. On the other side of the account, the concession and preliminary expenses had been reduced by £500—on the same scale as before. The result was that the net profit for the half year was £2508, which enabled the Directors to recommend the same dividend as the last, and to carry forward £586. Looking at all the circumstances, he therefore thought the report was very satisfactory, after such a disagreeable occurrence as the taking from them of part of the public lights.

Mr. A. J. DOVE seconded the motion.

Mr. R. H. JONES wished to point out that the Company were scarcely in a position to write off £500 from the preliminary expenses account out of the profits of the past year, inasmuch as the net profit was £2508, and the Directors proposed to pay dividends amounting to £2074 17s. 9d. There was, therefore, not quite sufficient to wipe off the £500, except by trenching on their past profits. This, however, was quite a justifiable thing to do.

The CHAIRMAN said the difference was so very small, seeing that the Company had a balance of £586, that he thought there could be no objection to their still pursuing the course they had hitherto followed, which he believed every one would admit was a very safe one.

Mr. G. W. SMITH said, as the Company were undertaking the public lights again, he supposed they were taking a different course to that which they took on a former occasion, when they sustained such a large loss by the Municipality of Smyrna.

The CHAIRMAN said he thought the people of Smyrna now knew very well that what the Ottoman Gas Company said they would do they would do. Mr. Muriel, who was there some years ago, established a character for fixity of purpose, and it was known very well that if they said they would cut off the public lights they would do so. Ever since then they had been paid pretty regularly. He believed it was a saying—he knew it was among the mercantile community—that the only concern which was paid in Smyrna was the Ottoman Gas Company.

Mr. D. BURTON said they paid £500 every year off the preliminary expenses, but what became of the money?

The CHAIRMAN replied that the plant kept on increasing, and if the Company had not obtained money from this source, they would have had to raise more capital. The Secretary, too, reminded him that they had paid off with this money a very large amount of the debenture debt. By doing this they virtually reduced the charges on the concern.

The motion was put, and carried unanimously, and the dividends recommended in the report were declared.

The retiring Directors and Auditors were then severally re-elected, and a vote of thanks was passed to the Chairman and Directors for their services during the past year.

The CHAIRMAN, in responding on behalf of himself and the Directors, expressed his acknowledgments for the compliment paid them by the Shareholders. Certainly their work was easy now compared with what it used to be. He hoped by degrees the Company was floating into a better state of things, and that the time would come when the Proprietors would get some better return on their capital than they at present received. He would take this opportunity of saying how much was due to their Engineer and Manager at Smyrna—Mr. H. W. Andrews—who was a very able and zealous servant, and indeed was everything the Company could hope to have. With his attention and resources they would no doubt eventually be in a better position than they were at present.

The proceedings then terminated.

SHEPPY GAS COMPANY.

The Annual General Meeting of this Company was held on Wednesday last—Mr. J. COLE in the chair.

The SECRETARY (Mr. A. W. Marks) read the following report of the Directors:—

The works and plant have been carefully maintained in a thoroughly efficient state, all necessary repairs having been carried out as the occasion for them arose. A new storage-tank for ammoniacal liquor has been constructed, and the old heat-shaft, which had become dangerous, pulled down and rebuilt.

There has been a further increase in the gas-rental, and the reduction in price for prompt payment has given much satisfaction to consumers generally. The local sale of coke, for domestic use, has been considerably augmented, and good prices have been secured for other residuals.

The reserve-fund account has been increased by the addition of the surplus profit on the first half of the year, and now stands at £2274 9s. 4d. With a view to the investment of a portion of this amount, it has been deemed advisable to invite the Proprietors of the 419 B* shares to pay up the uncalled £3 per share, and it is proposed that the sum thus raised should be at once invested in securities which can be immediately realized at any time.

The Directors recommend that dividends be declared at the usual rates for the second half of 1879. These, with the November dividends, will complete 4 per cent. upon the A shares, and 10 per cent. upon the B and B* shares, for the year.

Payment of the ordinary dividends will leave an unappropriated balance of profit of £241 9s. 7d., which it is proposed to deal with as follows:—When the profits of the Company were reduced for several years by the high price of coals, there remained back dividends unpaid, but due to the Shareholders when earned, equal to 5 per cent. upon the B capital. That is, 1 per cent. for 1872, 1 per cent. for 1873, 2 per cent. for 1874, and 1 per cent. for 1875; since which year the maximum dividends have been paid. Taking advantage of the recent prosperity of the Company, the price of gas for prompt payment has been twice reduced. The last reduction represents an abatement to consumers of over £600 per annum. The consumers have thus had the first advantage from the improved condition of the business of the Company. Under these circumstances, the Directors now feel themselves warranted in recommending the payment, out of this year's surplus, of the back dividend of 1 per cent., due in respect of the year 1872, such dividend to be paid with the ordinary one, and the remaining balance to be carried to the reserve-fund account.

A vacancy in the directorate, caused by the retirement of Mr. H. G. Clarkson, has been filled up by the election of Mr. S. G. Elliott. The retiring Directors this year are Messrs. G. Lockyer, A. J. Hearn, and S. G. Elliott, who, being eligible, with the Auditor, Mr. E. W. Brightman, offer themselves for re-election accordingly.

Dr.	Trade Account for the Year 1879.		Cr.	
Coals	£3186	17 11	Gas-rental £7154 19	
Purifying	35	16 5	Meter-rents 142 16	
Wages on manufacture and distribution	872	11 0	Fittings and stove hire 76 16	
Directors fees	100	0 0		£7374 12
Auditor's salary	15	0 0	Less discount	4311 6
Secretary's commission	277	8 0		
Manager's salary	200	0 0		£6942 15 1
Rent, rates, and taxes	264	4 5	Coke, tar, and liquor produced	£1556 13 1
Stationery, stamps, and incidentals	60	12 6	Less cartage paid	95 17 4
Repairs, renewals, tools, and stores	515	8 8		1460 15
Retort account	250	0 0	Coals sold at works	35 11
Bad debts	50	0 0	Water sold at works	2 11
Coals for sale	31	10 0	Gas-fittings	274 17
Gas-fittings and labour thereon	213	14 3	Transfer fees	2 1
Repair of roads, &c.	25	0 0	Rent charges	11 5
Interest	135	5 7	Rent of garden plots	17 2
Profit on first half year	1210	0 3	Miscellaneous	5 1
Profit on second half year	1308	12 7		
	£8752	1 7		£8752 1

The CHAIRMAN, in moving the adoption of the report, said it was a matter for congratulation that the Directors were enabled to put before the Shareholders so good a balance-sheet. The report fully explained the working of the Company during the past year, and it needed scarcely any remarks from him to commend it to their favourable consideration. The works and plant were in good condition, which had enabled the Company to meet the improved consumption without materially adding to their expenses. A new storage-tank had, however, been constructed. The gas-rental had gone on increasing, thus showing that the plan adopted by the Company of encouraging the prompt payment of accounts met with the approval of the majority of the consumers, and it had also been the means of getting in the money with more regularity. The coke trade had improved, and the increase which had taken place in the fittings and stove hire was no small item in the accounts, and added considerably to the prosperity of the Company. With respect to the dividends, the Directors not only recommended the declaration of the usual amounts as in former years, but also that a portion of the back dividends, which, owing to the high price of coals, had to be reduced, should be paid. They, however, thought it was not desirable to pay more than 1 per cent. additional upon the present occasion, and looking at the fact that the price of gas had been twice recently reduced, he did not think that consumers would have any cause at all to complain if this course were adopted. At former meetings considerable discussion had taken place with respect to the reserve-fund, the contention being that it ought to be invested, instead of remaining in the hands of the Company. The Shareholders had been quite right in directing attention to this matter, but up to the present time the Directors had not seen their way clear to carry the suggestion into effect. They now, however, proposed to call the remaining £3 due upon the 419 B* shares, with the view of investing the amount so obtained in securities which could be immediately realized, so that in the event of any accident occurring at the works, the Directors would have a considerable sum to fall back upon. The working capital would still remain sufficient to carry on the business of the Company, even should it go on increasing in the same ratio as it had done during the past few

years. The affairs of the Company were never in a better condition than at the present time, and those persons who were in the habit of buying and selling their shares, well knew how favourably they were looked upon by capitalists. This gave him much pleasure, as it showed that the Company was regarded as a sound investment. The Shareholders would no doubt give their hearty support to the adoption of the report, which, in his opinion, could not be considered as any other than an eminently satisfactory one.

Mr. HAYMEN seconded the motion.

In answer to Mr. Jacobs, the CHAIRMAN said the Directors proposed to invest the reserve-fund in Government securities. The amount realized by the call upon the holders of B* shares would first of all be paid into the London and County Bank, where it would remain at interest until the Funds were somewhat lower.

Mr. HAYMEN suggested whether, seeing the Company now had the money in hand, it would not be as well to pay off the £3000 mortgage on the works.

The CHAIRMAN explained that their Act required the investment of the reserve-fund in some good security, which could not be done if the mortgage were paid off. The fund could not be touched except in case of an explosion, or some such misfortune happening to the works.

After some further conversation, in which the proposals of the Directors as regarded the reserve-fund were fully endorsed, the motion was put, and carried unanimously.

On the motion of Mr. FILMER, seconded by Mr. BRETT, the dividends recommended in the report were declared.

The retiring Directors and Auditor were severally re-elected, and the customary votes of thanks having been accorded to the officials of the Company, the proceedings closed with the usual compliment to the Chairman.

BRISTOL WATER-WORKS COMPANY.

The Annual General Meeting of this Company was held on Saturday, the 20th inst.—Mr. F. Fry in the chair.

The SECRETARY (Mr. A. J. Alexander) read the notice convening the meeting, and the Directors report, which was as follows:—

The revenue from the water-rates for the year 1879 was £62,809 16s. 8d., being an increase of £1959 10s. 10d. over that of the previous year. The sum shown by the revenue account annexed to be applicable for dividend is £17,998 10s. 4d., and the Directors recommend that a dividend of 5 per cent. on the ordinary £25 and £30 shares be now declared. This, with the intermediate dividend of 5 per cent., will make the dividend for the year 10 per cent., and leave a balance of £1319 11s. 2d., out of which the Directors recommend payment of 2s. 6d. per share to the Proprietors of the ordinary £25 shares, on account of arrears of dividend, and leave £319 11s. 2d. to be carried forward.

The estimated value of the premiums on 322 £6 and 109 £1 10s. ordinary shares, for which credit was taken in the accounts of the previous year, has been realized by the sale of the shares on the market at £4 7s. 6d. and £3 7s. 6d. premium respectively, and the proceeds (£1776 12s. 6d.) are now added to the reserve-fund.

The increase of the revenue is satisfactory, notwithstanding that there has been a large falling off in the amount of rates payable for water supplied for building purposes.

The new engines at the Victoria pumping-station have been in constant work since the 16th of September last, and the stand-pipe on Durdham Down is completed and in use. These important works not only add to the efficiency of the service in the high-level districts, but place the Company in possession of a duplicate system for supplying water to Clifton, whilst the more economical working of the new engines is expected to lead to a saving of expenditure at this station. At Chelvey the new engines are at work, and, with the completion of the chimney now in course of erection, the contemplated works will have been virtually carried out.

The capital expended during the past year was £20,398 2s. 2d., and the length of main laid about six miles.

The Engineer, Mr. H. W. Pearson, reports that the works are in good condition. The retiring Directors are Mr. Leech, Mr. Jones, and Mr. Fudge, who are eligible, and offer themselves for re-election. The retiring Auditor is Mr. Grace, who offers himself for re-election.

(The authorized capital of the Company consists of ordinary and preference shares, mortgage bonds, and debenture stock, &c., to the amount of £773,326 19s. 1d. There had been expended on capital account on Dec. 31, 1878, £752,928 16s. 11d.; expended in the year ending Dec. 31, 1879, £20,398 2s. 2d.—total, £773,326 19s. 1d.)

Dr.—Revenue Account, for the Year ending Dec. 31, 1879.

Dec. 31, 1878—		
To Balance of revenue account to this date.	£17,088 16 4	
Less dividend paid, April 15, 1879.	£15,479 16 3	
Less paid April 15, on account of arrears of dividend	1,000 0 0	
	16,479 16 3	£609 0 1
Dec. 31, 1879—		
Water-rates	62,809 16 8	
Rents	505 2 6	
Transfer fees	28 12 7	
	£63,952 11 10	

Ca.—Revenue Account.

Dec. 31, 1879—		
By Office and engineering expenses—		
Salaries	£1,919 8 0	
Printing and advertising	223 6 10	
Incidentals and sundries	518 16 11	
	£2,661 11 9	
Collector's commission	1,559 19 3	
Pumping at Chelvey	393 9 7	
Expenses of working Victoria engine and maintaining Victoria, Durdham Down, Bedminster Down, Leigh and Knowle reservoirs	1,158 8 3	
Wages to men in charge of reservoirs and works in the country, repairs, and maintenance	305 12 4	
Wages to turncocks	996 6 2	
Rates and taxes	4,130 8 2	
Repairs	738 8 7	
Directors remuneration	800 0 0	
Auditors fees	42 0 7	
Interest on debenture stock	3,840 0 0	
Interest on loans	356 8 8	
Interest on preference stock to June	2,500 0 0	
Interest on preference shares, 1862	3,600 0 0	
Interest on preference shares, 1865	3,600 0 0	
Retained to pay half a year's interest on the preference stock to December	2,500 0 0	
Balance	31,449 19 1	
	£63,952 11 10	

The CHAIRMAN, in moving the adoption of the report, said he had little to add to what was stated therein. The silent streams of pure water pervading the city and suburbs were proofs of the importance and the usefulness of the supply afforded by the Company, and every year it became more and more an established necessity—a part of the daily life of their great city. This was proved by the Company having during the past year laid on connections with a larger number of houses than in any former year, and it gave good evidence of the soundness of the undertaking. The net receipts from water-rates had not been so large as in some former years; but this might be attributed to the bad times, for though the Company had laid on domestic supplies equal to about £2800 of rental, they had lost about £800 in diminished receipts from buildings and some other sources. But this substitution of one class of rental for another, though of no pecuniary advantage during the past year,

gave the Company a comparatively certain for an uncertain source of revenue, and he thought the Shareholders might hope that the receipts for water for building purposes would again improve. The expenses showed some increase, which was consequent on a growing concern. As stated in the report, the new works were nearly completed. The new engines at Victoria furnished more power, and by means of this the water was lifted over the top of the stand-pipe at the Durdham Down reservoir; and the additional pressure gained thereby would, no doubt, be an advantage to the high-level district.

Mr. C. J. THOMAS seconded the motion, which was put and carried unanimously.

Mr. NAISH said he found that in the balance-sheet there was an item of £4485 as a reserve-fund, which he considered to be a rather small amount for an undertaking having a capital of three-quarters of a million. He believed the Company's reserve-fund was only about five-eighths per cent. upon their capital stock. Of course there must be considerable wear and tear of machinery, and he had heard a gentleman, who was practically acquainted with the subject, say that even the pipes underwent a process of deterioration. He therefore thought the Company should have a more adequate reserve-fund than they had at present.

The CHAIRMAN said the reserve-fund could only be increased by taking money from the dividend, and he did not think it was desirable to do that. Everything at the works was kept in good order, and when repairs were required they were attended to, though very little was needed.

Dividends for the half year ending Dec. 31, 1879, at the rate of 5 per cent. on the £25 and £20 (£14 paid), and on the £6 (£3 paid) and £4 10s. (£2 10s. paid) ordinary shares, and a further dividend of 2s. 6d. per share on the £25 ordinary shares, towards making up the deficiency of previous dividends, were then declared.

The retiring Directors and Auditor were unanimously re-elected, and a vote of thanks having been passed to the Chairman, the proceedings closed.

THE METROPOLIS WATER-WORKS PURCHASE BILL.

During the recent discussions on Mr. Cross's Bill for the purchase of the London Water Companies undertakings much misrepresentation was indulged in when comparing the terms at which the Birmingham Corporation acquired the water-works supplying the town, and those proposed in the above-named Bill. We therefore reproduce two letters which have recently appeared in one of the Birmingham newspapers, setting forth the facts of the Birmingham purchase, and how it compares with the one proposed for London; and we do so the more readily as the first letter controverts the statement that it is so frequently made that the Birmingham Corporation Water Act of 1875 sanctioned a compulsory purchase of the water-works.

The first letter, published in the *Birmingham Daily Gazette* of the 24th inst., is from Mr. Henry Hawkes, of Northfield, who was Chairman of the Purchasing Committee up to the time when the Birmingham Water Bill, 1875, had passed the second reading in the House of Lords. In it he says: "In 1851 the Town Council took parliamentary power to buy, and for the Water-Works Company to sell their undertaking. On Dec. 4, 1874, a Committee of the Council was formed to prepare a Bill accomplishing this object, and to transfer the property to the Corporation, and the maximum purchase-money inserted therein was £1,000,000. On Feb. 26, 1875, I, as Chairman of the Corporation Committee, stated to the ratepayers in the Town Hall the objects of the Bill, and the anticipated price; and, thereupon, the ratepayers, by resolution, sanctioned such Bill. The measure came before the Select Committee of the House of Commons (of which Mr. W. H. Gladstone was Chairman), and it was opposed by the Water-Works Company on the ground that the power to purchase, acquired by the Corporation in 1851, had become obsolete; but, on the Parliamentary Committee intimating a desire to hear evidence on the question of price, the Company withdrew from further opposition, reserving such opposition for the House of Lords. On the 14th of June the Bill came on for second reading in the House of Lords, and its rejection was moved by Lord Hampton. I had the honour, in company with Mr. George Dixon and the Town Clerk, to place the case of the Corporation before the Duke of Richmond, Earl Granville, Lord Aberdare, Lord Lyttelton, Lord Leigh, and other peers; and, after some discussion in a full House, the second reading was carried. The next day I retired from the Committee and left the Council."

"Subsequently the Bill came on before a Special Committee in the House of Lords, presided over by Lord Penrhyn. The price named in the original Bill was now altered to £1,100,000, and Sir Edmund Beckett, the leading counsel for the Corporation, on the 20th of June, addressing the Lords Committee, accounted for the alteration in these words: 'What I said to the Corporation was this: Put in the very highest price that can reasonably be asked; it is desirable to put in as high a price as you can; and, if you put in a sufficiently high price, the Company may be content with it.' But, unfortunately, on the 6th of July, the Lords Committee came to the following decision:—'The Committee have come to the decision that, in consideration of the Birmingham Corporation having in the year 1854 obtained an Act enabling them to purchase the works of the Water-Works Company, they will pass the preamble of the Bill, giving the Corporation the power under these circumstances of acquiring the works of the Company; but the Committee will take care, in going through the clauses, that there shall be a stipulation to secure to the Company the full and fair value of the works.' The only contention which then remained to be disposed of was the price to be paid, and evidence was adduced to show that the capital of the Company is £756,000, whereof the following sums have been paid—viz., (1) £420,000 entitled to a maximum dividend of 8 per cent. per annum; (2) £201,600 entitled to a maximum dividend of 7 per cent. per annum; and the aggregate maximum dividend on the paid-up share capital is £47,712 per annum.' But all efforts to fix the sum failed; and the Lords Committee inserted a clause referring the price to arbitration under the Lands Clauses Act, 1845, unless the parties could agree."

"In my opinion this decision was tantamount to a defeat of the Bill, as, of course, it was always competent for the Company and the Corporation to agree to terms of purchase without being interfered with by Parliament, and I think, upon this decision having been arrived at, the Town Council should have withdrawn the measure; or, at any rate, it should never have been proceeded with before another meeting of the ratepayers in the Town Hall had been afforded an opportunity of rescinding their resolution of the 26th of February. This course, however, was not taken, and the Bill received the Royal Assent on the 2nd of August. The Town Council refused to submit the price to arbitration, and deputed Mr. J. Chamberlain to agree to terms with the Company. That gentleman and the Chairman of the Company at once fixed the sum of £1,362,275, representing the capitalized value, at 4 per cent., of £54,491 perpetual annuities for the purchase, it being borne in mind that the paid-up capital of the Company was only £756,000."

"In introducing the Corporation Bill to Parliament, Sir Edmund Beckett urged its adoption on the ground that the consumers would pay less for their water. His words were, 'You have, first of all, the saving of annual income in the variety of ways which I have been pointing out; you have the saving of prospective profits to the Water Company, and

you have, further, the fact, as a matter of experience, that in the great number of towns where the Corporations have gradually acquired the water-works, in most cases the rates have been reduced. . . . If the Corporation have the works and have the profits, *they must reduce the rates.* The works came into the hands of the Corporation on the 1st of January, 1876, and now, after the lapse of four years, I find the prices charged have not been lowered, but in many instances have been increased; and I observe that the Corporation has taken power to borrow additional sums of money, amounting to several hundred thousand pounds, in order still further to increase the capital account."

The second letter, dated the 24th inst., is from Mr. J. Satchell Hopkins, of Edgbaston. It was published last Saturday, and is as follows:—

Sir,—I do not purpose entering into the question discussed by the Borough Coroner in his letter which you print to-day—viz., the merits of the bargain made with the Birmingham Water-Works Company. There is, doubtless, much to be said in favour of the purchase of that Company, even on the terms explained by Mr. Hawkes; but as Mr. Chamberlain, not content to rest his case on its own merits, strives to heighten its effects by comparison with what he (if correctly reported) calls "the wretchedly bad bargain Mr. Cross is making," with your permission I will endeavour to put this comparison on a fair footing.

It is a well-known fact that the market price of the shares of the Birmingham Water-Works Company had nothing whatever to do with the price paid for the property. That price was based entirely on two considerations—(1) the capacity of the property for earning profit, and (2) the power of the shareholder to put that profit in his own pocket. The principle of the measure was, as, in fact (unless my memory is at fault), Mr. Chamberlain admitted recently in the House of Commons, identical with that of Mr. Cross's Bill—viz., the securing to the shareholder his present dividends, with compensation for future additions thereto. The sole question as between the two purchases is as to the application in each case of the principle common to them both. To introduce a comparison of market prices is to confuse the issue. The market price of a thing is affected in many ways, and it would not be difficult to show that any comparison between London and Birmingham in this respect is extremely fallacious. Let us look, therefore, at the two bargains from the same standpoint from which, until recently, we have been taught to look at one of them, and let us inquire what has been bought, and what has been given for it in each case.

In the case of Birmingham, a property was bought, which, by careful and good management, had been brought to almost the pinnacle of success. The ground had been covered, and the machinery, both of supply and distribution, was upon a scale which fully met the wants of the community. Further, the Company, by availing itself of its powers to raise its charges for water, had increased its revenues until it was in a position not only to pay the maximum dividends to which its Shareholders were by law entitled, but a commencement had been made towards paying back dividends for years wherein less than the maximum had been paid. In the last year of its independent existence the Company paid to its Shareholders in dividends the sum of £50,402. The price paid for the property was a perpetual annuity of £54,440.

Now let us look at Mr. Cross's bargain. He is proposing to buy the property of eight Companies. I am not on such familiar ground in dealing with these Companies, but I think I am correct in saying that of the eight, six are paying dividends which fall short of the maximum to which they are entitled by law. Two are apparently paying maximum dividends, and one of them seems to be paying something in the way of back dividends. Mr. Cross has ascertained that the present dividend-earning power of the eight Companies is £770,000 per annum, that this earning power is rapidly increasing, and that (at least) two Companies with largely-increasing incomes are entitled to £16,000,000 of "back dividends." The price which it is proposed to pay for these properties is an annuity commencing at £770,000, and gradually increasing until, in twelve years time, it will reach nearly £1,100,000. The present annual value of this annuity is calculated at slightly over £1,000,000.

Comparing the figures so far ascertained, we have:—

	Birmingham.	London.
Annual dividend-earning power	£50,402 ..	£770,000
Annuity given therefor	54,440 ..	1,000,000

In other words, for every £100 of income Birmingham gave £108 of annuity, while London for an equal sum is to give £130.

If the case were complete here, no doubt there would be ground for saying that Mr. Cross's bargain was a bad one, but it is not. In a word, the London Companies, though making great progress, have not yet attained to their full growth. They have large reserves of rating power, and they have a capacity for absorbing profit, in dividends, far beyond that possessed by the Birmingham Company at the time it was purchased. This has to be taken into account, and if a comparison is to be made between the two purchases, which shall be of any value at all, an element in the case of so much importance must not be overlooked. How to allow for it is, perhaps, a difficulty, but an attempt must be made. We must either estimate the value of the superior dividend-paying power of the London Companies, and add it to their present power, or we must deduct something from the Birmingham Company's dividend, so as to place the Companies on an equality. The latter process is the easier, because we have facts to go upon. Three of the London Companies are earning only 6½, their maximum being, I believe, 10 per cent.; two others earn 7½ per cent.; and a sixth 9 per cent. The Birmingham Company's maximum was 8 per cent. If we take a year in the Birmingham Company's history when it was paying 6½ per cent., we shall probably be under-estimating the future of the London Companies. In other words, the difference between the Birmingham Company in 1872, when it was earning 6½ per cent., and in 1875, when it earned 8 per cent., was probably less marked than that between the London Companies now and what they will become a few years hence if they have time given them to do as the Birmingham Company did. In 1872, then, the Birmingham Company paid in dividends £35,846, against the £50,402 of three years later. If we repeat our table we shall find it stand thus:—

	Birmingham.	London.
Annual dividend-earning power at a corresponding period in each case	£35,846 ..	£770,000
Annuity given therefor	54,440 ..	1,000,000

In other words, for every £100 of income Birmingham gave £155, while London for an equal sum is to give £130.

In my opinion the comparison, fairly made, as I have endeavoured to make it, shows the wisdom of trying to buy the London Companies at the present time before they have obtained their full strength, as the Birmingham Company was enabled to do in the last few years of its existence, and I do not think either the Government or their supporters have any reason to be ashamed of the "Metropolis Water-Works Purchase Bill."

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There has been extremely little doing in either the coal or iron trades during the past week, and for the last few days business has been practically suspended owing to the holidays, the Manchester Exchange having been closed from Thursday evening last until this (Tuesday) morning.

So far as there has been any opportunity of testing, the market prices have been weaker. All classes of round coal are to be bought from holders of stock at lower figures, although nominally quotations are about the same as last week, and may be given as under:—Best Wigan Arley, 8s. to 8s. 6d.; common Arley, 6s. to 7s.; Pemberton four-feet, 6s. to 6s. 6d.; and common round coal, 5s. to 5s. 6d. per ton at the pit. An upward tendency is maintained in engine fuel, owing to the lessened production of slack, which, at most of the collieries, will be advanced next month. There is now very little slack to be bought under 3s. 6d. per ton, and bulky, which is going more into consumption, owing to the scarcity of slack, is firm at from 4s. to 4s. 6d. per ton at the pit.

Iron in second hands continues to be offered at very low figures, and so much under makers quotations that producers, who are generally firm at their list rates, are securing very few orders. For Lancashire pig iron, delivered into the Manchester district, makers quotations remain at 70s. per ton, less 2½ per cent. for both foundry and forge qualities. Lancashire bar iron, for delivery into the Manchester district, is quoted by makers at about £8 10s. to £9 per ton, but there are plenty of sellers at as low as £8 per ton.

Most of the collieries and iron-works have been partially stopped during the week, for the holidays.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

We are in Easter week, and also at the close of the first quarter of 1880. Last week was the dulllest in business circles in the Cleveland iron district since September last year. The intelligence from America was very discouraging, but pretty much what might have been anticipated under the circumstances. In view of the extraordinary rise in iron, permanent railway work has been stopped. Instead of 14,000 miles of permanent way being laid down in the Western States, as anticipated, there will not be more than 5000. Hopes of a large American trade this year are, therefore, dashed. The same observation will apply to Continental business. This changed position of affairs in the iron district is reacting pretty strongly upon the coal trade. It reduces it almost to a certainty that prices will not get beyond the March quotations.

The shipments of coals coastwise have been to a large extent gas; gas coals are also being exported, more than in any other part of March, oversea. Two or three large contracts in gas coals have been concluded for the year at old rates. The principal demand for shipment is, as a matter of course, for best qualities. A pretty good trade is also doing for second-class sorts for the immediate locality; but inferior coals have a very poor place in the market. Seaborne house coals continue to be subjected to a very keen competition from the inland collieries—that is, for coasting. The house coal trade of Durham and Northumberland is extremely slack. A reduction of something like 9d. per ton has occurred. Coke also has fallen about 2s. per ton from the extreme advances. So long as the iron-works are fully employed, working off the orders booked in January and February, the demand for small coals will be maintained; but there is no disposition shown to go into long contracts.

Shipping business improved a little last week. More was doing amongst steamers; but in the coasting market freights still favour shippers. As I have stated before, they will continue to do so over the first half of the year.

It cannot be said that there is any improvement in chemicals. The markets at Newcastle and Liverpool are dull and inelastic. Soda is the only article that fully maintains its price. The lead market is quiet. It is void of every element of speculation. The demand for chemicals and fire-clay goods is well maintained. The cement trade is dull.

FATAL ACCIDENT AT THE CHESTERFIELD GAS-WORKS.—On Saturday evening, the 20th inst., two men employed in the making of sulphate of ammonia at the Chesterfield Gas-Works were suffocated through neglect of one of them to carry out the instructions that had been given as to the process employed. At the inquest on the following Monday, some very interesting evidence was given before the Coroner, a report of which we reserve till next week.

ASSOCIATION OF MUNICIPAL AND SANITARY ENGINEERS AND SURVEYORS.—On Friday, the 19th inst., a district meeting of this Association was held at Dewsbury. The proceedings were commenced by the Secretary, Mr. Graham Smith, C.E., reading a paper by Mr. E. H. Allier "On the Sewage Disposal of West Derby, near Liverpool." In the paper were given statistics showing that the proceeds from a sewage farm, when properly managed, may be made to cover its working expenses. Mr. B. O. Cross, the Borough Engineer of Dewsbury, afterwards read a paper dealing with the sewerage scheme now being carried out by that borough. This paper went fully into the subject of the design and construction of the various sewers and works, and other matters relative thereto, such as the population and death-rate of the district. The members of the Association then thoroughly inspected the works, and were generally satisfied with them and the various novelties which have been introduced into their design by Mr. Cross.

Register of Patents.

APPLICATIONS FOR LETTERS PATENT.

- 1202.—STEVENSON, G. E., Peterborough, Northampton, "Improvements in apparatus used in the manufacture of gas." March 20, 1880.
- 1220.—PIEPER, C., Berlin, "Improvements in and relating to gas-generators and in gas-burning furnaces connected with them." A communication. March 22, 1880.
- 1221.—WEST, J., Maidstone, Kent, "Improvements in apparatus for breaking coal, and for charging and discharging gas-retorts." March 22, 1880.
- 1238.—THOMPSON, W. P., Liverpool, "Improvements in gas-heating apparatus, or apparatus in which gas is burned on the Bunsen principle." A communication. March 23, 1880.
- 1253.—MORLEY, C. W., Regent's Park, London, "An improvement in gal-leries or globe holders." March 24, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 3904.—WOOLLEY, W. B., Birmingham, "Improvements in hydrocarbon stoves and lamps for lighting and heating." Sept. 29, 1879.
- 4798.—KIRKHAM, T. N., and HERSEY, T., Westminster, "Improvements in apparatus employed in the manufacture of gas." Nov. 25, 1879.

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TO CORRESPONDENTS.

H. C. O.—The owner of the engine, decidedly. The most recent case in point was one at Croydon last year, noticed in the JOURNAL, Vol. XXXIV. pp. 61 and 333.

T. A.—Too late for notice this week.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 6, 1880.

Circular to Gas Companies.

METROPOLITAN gas affairs occupy the most prominent place in the gas world. The Companies supplying London are remarkable for the extent of the area which they supply, and for the capital employed in them. The Chartered Company—we use the shorter term—is now the largest Gas Company in the world. They supply scarcely less than two-thirds of the Metropolitan area, and northern amalgamation is almost completed. That it is not fully completed is not the fault of the Chartered Company, who have used their best endeavours to bring round the Directors of the London Company to agree with opinions which are now generally entertained. That a small area in the middle of London should continue to be supplied by a Company whose works are distant, and perhaps are not the best adapted to supply mid-London, and who, moreover, work under what we might almost, with justice, call mediæval gas legislation, in the midst of the district of another Company working under all modern enactments, is an anomaly which is perhaps only to be found in the Metropolitan gas world. Some have thought that long ago the Directors of the London Company would have seen that their interest was to split up their district into northern and southern areas, the former of which would go naturally to the Chartered, and the latter to the Phoenix Company. The arrangements of the division of capital might have been made without difficulty. We see now how, by the system adopted by the valuator for the Government, the capital accounts of Companies can be regulated, and we have no doubt that Mr. E. J. Smith, the gentleman employed in negotiating the terms of the Metropolis Water-Works purchase, would settle without any trouble the value of the several portions of the London Gas Company's undertaking; and that which would naturally go to the Chartered could easily be valued. There is little possibility of extension of consumption or of improvement in profits in that part of the concern to which we are referring, and the Company might very well let it go to the Chartered at its natural value. As regards the southern portion of their

undertaking, the prospective increase of business would entitle them to advantages which they can only obtain by union with the South Metropolitan Company. It is, in our opinion, so eminently desirable that the Metropolitan gas supply should be divided into two districts, one south and one north of the Thames, that we earnestly recommend the London Company to join in the general arrangement which has now almost covered the Metropolis.

The Directors of the Phoenix Company perhaps never did a wiser thing than in joining the South Metropolitan Company. Some people thought the Company were eating humble pie; but they chose their own dish, and now they have allied themselves to a Company with whom a few years ago they might possibly have taken a leading part. It matters nothing, however. The amalgamation has been effected, to our great satisfaction, and, we think we may add, to the satisfaction of all concerned in the Company. The final meeting of the Phoenix Company will take place to-morrow, when, as a matter of course, the usual maximum dividends will be declared; but from and after the 1st of January last the scheme for the amalgamation of the Company with the South Metropolitan comes into force, and then the sliding scale begins to operate. We shall not here speculate on the financial prospects of the Company under the new régime. It must be successful, but how successful only the future can determine. What may be said, and with great emphasis, is, that the position of the late Company is immensely strengthened by the union just effected. As a matter of fact, the business of the Phoenix Company has been continually increasing, and, as the district which it formerly occupied fills up, it must necessarily be added to. We shall have no occasion to make further reference to the Phoenix Company. For the future its existence will be merged into that of the South Metropolitan, and to-day we have simply to record the dividends which will be paid under the old arrangements. It is scarcely necessary to mention that the final meeting of the Phoenix Company may be expected to pass off in a manner pleasant though just a little lugubrious. We are quite certain that there is not a Shareholder who will not regret the disappearance from the direction of the associated Companies of Mr. Edward Horner, a man of great capacity for business, and of long experience in the direction of the Phoenix Company. He will be missed whenever matters of importance to the combined Companies arise. The changes in the directorate of the Phoenix Company are of some importance, but they were inevitable. We are sorry to see that some of the very capable men who shared in the direction of this Company have, under the circumstance, been compelled to retire; but it was unavoidable. The South Metropolitan Company will be greatly strengthened by the accession they have received from the Board of the old Company. The proposed changes in the Auditors are also worthy of notice. We sincerely hope that Mr. Puckle will be unanimously elected to one of the posts rendered vacant by the retirements announced. We see with regret that Mr. Crookenden will retire from the secretaryship. He is still in the prime of life, with plenty of good work in him, and we are sorry that he does not find it consistent with his welfare to go on with secretarial duties.

The *entente cordiale* is about to commence. The Shareholders of the Phoenix Company meet at the Bridge House Hotel at two o'clock to-morrow, and the South Metropolitan Company's Proprietors were to have met at the Terminus Hotel at the same hour; but, under the circumstances, it was considered advisable that the Shareholders of the two Companies should have an opportunity of meeting on the first occasion which presented itself. The meetings have, therefore, been so arranged that one shall take place at the Bridge House Hotel at 2 p.m., and the other at the Terminus Hotel at 2.45 p.m. Thus the Shareholders of the two Companies which are now virtually one will have opportunity of meeting together and conferring upon the future of the union. It cannot be doubtful, for there is nothing to interfere with the progress of the South Metropolitan Company, except dear coal and bad times. With the Act for the acquisition of additional land for the erection of new works opens up a future "vague and im-mense," as a Frenchman would say, for the associated Companies. Nothing, however, can prevent the rapid development of the sale of gas in the vast area now supplied by the united undertaking.

The accounts of the two Companies, which for the last time are kept separate, show, in both cases, increasing prosperity. As mentioned above, the Phoenix Company pay maximum dividends, and have a balance left of £12,697. The South Metropolitan Company have also had a prosperous half year, and their profits and the price charged allow them to

pay a dividend of eleven and three-quarters per cent. on the "A" stock, and eleven per cent. on the "B" stock. This is in accordance with the arrangements made in the scheme for the amalgamation with the late Surrey Consumers Company. We are told that when the Bill promoted by the South Metropolitan Company is before Parliament, a determined effort will be made by the Local Authorities to reduce the initial price of gas, so as, if possible, to bring down the standard charge, and consequently lower the dividends. The attempt will be extremely unfair, for no Company have done so much to cheapen gas as the South Metropolitan. The Shareholders of this Company might then well be allowed to participate in the extra profits which could be made under a system which their advisers, we cannot say invented, but most certainly brought into use.

The Commercial Company, a report of whose half-yearly meeting will be found elsewhere, offers another illustration of the value of amalgamation, which might well be extended. The Company should hardly stand alone in an isolated position, but they flourish notwithstanding. They have the advantage of the sliding scale, which enables them, as we said last week, for the past half year to pay $11\frac{1}{4}$ per cent., and place £3445 to the reserve-fund. The continual increase in the demand for gas in the Company's district has obliged the Directors to extend their Poplar works, and for this purpose they require additional capital. Happily for the Shareholders, their last Bill slipped through Parliament without the imposition of auction clauses, so the new capital (£60,000) will be allotted *pro rata* among the existing Proprietors. This, we may remark, is no small gain to them, for shares in the Commercial Company stand at a very high premium. Judging from what passed at the meeting last Friday, not every Gas Shareholder is in love with the sliding scale, no matter what may be the dividends its application brings. Mr. R. Rawlinson, C.B., for instance, prefers a steady ten per cent., earned by making a fair charge for gas, to any fancy dividend gained by reducing the price. How far we agree with Mr. Rawlinson our readers know. Ten per cent., we may take it, is sufficient interest in a substantial concern like a Gas Company, which, properly managed, is as safe to yield profits as the Bank of England. We must, however, of course, congratulate the Commercial Company on their prosperity, and express a hope that it will be long maintained.

The meeting of the Alliance and Dublin Consumers Gas Company was held on the 31st ult. We have had the great pleasure of tracing up the condition of this Company from its period of serious depression in 1874, to a point of prosperity which has reached its acme at the present time. We may stop here for a moment to mention that the condition of the Company at present is entirely owing to the exertions of one man—Mr. W. F. Cotton, the Secretary and Manager, who joined the concern at a critical moment, and saved it from something like bankruptcy. Passing from this matter, we may proceed to a consideration of the present condition of the Company. They are able to pay maximum dividends for the past half year. The consumption of gas goes on increasing so much that a diminution of threepence per thousand feet in price only resulted in a decrease of £1800 in income. Now favourable coal contracts enable the Directors to announce a further reduction of fourpence per thousand feet, to take effect from the September quarter. Liberality like this has rarely been shown by Gas Companies, and certainly by no one which has had to pass through so severe an ordeal as the Alliance and Dublin Company. We are happy to see that the efforts of the Manager to introduce gas for other than illuminating purposes have been made completely successful. The number of gas-engines in use is 32; the gas-stoves let on hire now number 50, which, of course, is exclusive of those that have been sold. These results may not appear large, but, as a matter of fact, they are great for Dublin, in which city it is very difficult to introduce new ideas. A good many of the inhabitants, however, seem to have taken kindly to the use of gas for cooking and heating purposes, and we are certain that every person who uses an apparatus will induce others to follow in his train. An admirable example in the way of promoting the use of mechanical apparatus has been set by a Sewing Machine Company, who let out their machines for a month (taking security) free of any charge. Gas Companies would, of course, charge for what gas is consumed; but all we wish to point out here is, that the apparatus should be supplied to the consumer as cheaply as possible, and that the sale of gas should be the sole source of profit. The Dublin Company are doing so well, and their prospects are so encouraging, that it is quite unnecessary to make any further remarks here. We should have said above that the Company

have paid a very proper and substantial compliment to Mr. Cotton by raising his salary £250 a year.

The Sheffield United Gas Company held their usual half-yearly meeting on Thursday last, at which maximum dividends were, of course, declared, and a large balance was carried over. The price of gas in Sheffield is very low, and we could scarcely expect a further reduction, notwithstanding the fact that the reserve-fund of the Company is full. Since favourable coal contracts have been made, it may be anticipated that before the next meeting of the Company efforts will have been made to ascertain how far a reduction can be made in the price of gas. People in the North look to Sheffield as a guiding star. It is now one of the few Companies of any extent in the North of England left in possession of a gas undertaking, and it is their bounden duty to set an example which all Gas Companies should follow who wish to retain their property and position.

An exhibition of gas apparatus has been held during the past week at Ipswich, in which the leading part was taken by Mr. Ford Goddard, the sub-Engineer of the Gas Company. The exhibition was a decided success, and will, no doubt, persuade a large number of the inhabitants of Ipswich and its vicinity to resort to the use of gas in summer time for the purposes of cooking. It should be always fairly explained to consumers that the great advantages to be derived from the use of gas is during the summer months, when heat is only required for cooking purposes. When it is desired to boil a kettle or cook a dinner, all that is necessary is to turn a tap and put a light to the gas. As soon as the meal is cooked the gas may be turned off, and all further expense saved. These exhibitions of gas appliances are likely to prove of the greatest value to Gas Companies.

The notification of the Metropolitan Gas Referees for the ensuing half year has been issued. No alterations have been made in the summer half year's arrangements. The regulations for impurities are the same as in previous corresponding periods; and it is not to be expected that any changes will be made at present in the modes of testing the illuminating power of the gas. The arrangements settled by the original Referees remain in full force, and new tests for sulphuretted hydrogen are not at present accepted.

Water and Sanitary Notes.

THE fate of the Metropolis Water-Works Purchase Bill, under the changed aspect of political affairs, is likely, we think, to remain unaltered. Perhaps its chances of getting through the House of Commons will be rather improved by the accession to power of a Government of which Mr. Fawcett, if not a member, will be a strenuous supporter. Whoever may come into office, the Bill must be taken up at the point at which it was dropped by Mr. Cross. If the Metropolitan public are determined to have the water-works, they must pay for them, and they have been told what they are worth. The mode of payment is eminently favourable to the purchasers, and is equally satisfactory to the sellers. As matters now stand, the Bill will probably have to go over for another year; but the purchase cannot be long delayed. Even the present postponement may necessitate a new valuation, which will considerably raise the amount of the purchase-money. It is useless now to attempt to abate one penny of the terms. The Companies have given in their *ultimatum*, and nothing less than the terms settled in the Bill will be accepted. It will be a grievous misfortune for the Metropolis if this bargain be not carried out. We wait, of course, for an expression of opinion by the leading Metropolitan Authorities, which has not yet been given. As a matter of fact, we scarcely know what are their ideas as to the conditions of purchase. They, doubtless, will be somewhat alarmed at the amount of money which is asked for the water undertakings; but haggling is useless. The terms have been settled, and they, or none, must be accepted. Whoever may be the Home Secretary in the new Government which is imminent, he will have to take up the question; but with what result we are unable to foresee. Supposing the Bill to go on, it will be sent to a Committee of the House of Commons, who will decide its fate. The position of the Water Companies is, we think, impregnable; but what the Authorities may have to say, we must wait to learn.

The East London Water-Works Company held their half-yearly general assembly on Thursday last, when a dividend of six and a half per cent. per annum was declared. The increase in the Company's business may be inferred from the number of new houses built in their district, all of which, we believe, are supplied on the constant system, and

it is clear that the purchase of the undertaking would confer little or no advantage on the inhabitants of East London. The Company possess one of the most improving districts in the Metropolis, and it is quite certain that the valuers have not over-estimated the worth of this undertaking.

URBAN WATER SUPPLY.

WE resume in this article the consideration of the Yorkshire towns in respect of water supply, commencing with those in the sub-drainage area of the Colne, a feeder of the Calder. Most of these towns are at present either dependent on Huddersfield, or expect to be so, and the sources of supply are on the moors to the south of that town, where there is a large tract of upland receiving a heavy rainfall, which is conducted, chiefly by catchment drains, into magnificent storage reservoirs at a considerable elevation, and whence the water passes down by gravitation to service reservoirs near the towns. The whole system of works is estimated to yield a daily supply of nearly 4 million gallons. The supply is constant, and no doubt need be felt of its permanence, even after the longest droughts and successive dry seasons. The actual quantity consumed or wasted in Huddersfield itself is not, however, known, neither is there any information as to the quantity supplied to any of the dependent towns. It is believed that the average consumption in the town of Huddersfield and in the several districts outside the borough is from $1\frac{1}{2}$ to 2 million gallons per day, and the amount paid in the form of rent is something like £20,000, which would show a charge of about 7d. per thousand gallons. The cost of works would seem to amount to about £7 per head of the population to be supplied. A number of adjacent townships are included under the Huddersfield Acts, and are supplied more or less completely. It must be understood, however, that in many of them water is obtained to some extent from wells. Marsden-in-Almondbury has one-fourth of its houses supplied from the Huddersfield reservoirs, the rest being from springs. This is the case also to a smaller extent with regard to Kirkburton, Kirkheaton, Lepton, Meltham, South Crosland, Mirfield, and Longwood. Golcar is entirely supplied from Huddersfield. Batley, in the sub-drainage area of the Colne, has a catchment on the adjacent moors, near Holmfirth, and reservoirs for storing the water. The supply is constant, and amounts to 40 gallons per head per day. The cost of works has been more than £12 per head of the population, and the charge appears to average about 9d. per thousand gallons. The works are new, and are not yet completed. Batley was once joined with Dewsbury and Heckmondwike in its water arrangements; but in 1871 an Act was passed authorizing the present works, and leaving the towns independent. Ossett-cum-Gawthorpe, which has a large population, has a reservoir supplied by the Batley Corporation. The quantity of water taken in 1878 was only $6\frac{1}{2}$ gallons per head per day, but there is provision to increase to more than four times this quantity. The local works are new. No estimate is given in the Return of their cost, or of the charge for water.

A number of towns in the Calder Valley are named in the Return, but, except with regard to Upper Thong, they either have not any public works, or no information is given. Some of them, as Holme, Barkisland, Rishworth, Shelley, Altofts, Queensbury, Shelf, Shepley, Scammonden, Soyland, Thurstonland, Warley, Cartworth, Cumberworth, Nether Thong, Skelmanthorpe, Midgley, and Honley, are supplied more or less completely from wells and springs, but no reply has been sent by the Local Authorities to the questions asked as to quantity or charge. Holmfirth and a number of towns near Wakefield, of which Stanley and Alverthorpe are the largest, are not alluded to. Upper Thong is partly supplied from springs and wells by the Local Authorities, the water being collected into a reservoir. The quantity obtained and available is said to be equivalent to 105,000 gallons per day for the population of 2400, but the quantity actually supplied is only 11,200 gallons, or about 5 gallons per head per day. The works have cost a sum equivalent to £1 16s. 6d. per head of the population, and the charge, estimated from the rate, would seem to be only 4d. per thousand gallons, but this does not pay a fourth part of the annual charge for interest on borrowed money. Wooldale, the population of which is double that of Upper Thong, is stated to receive its supply from the same reservoir, but there is no account of quantity or charge. The works were not complete when the return was made. Wakefield, one of the largest of the Calder Valley towns, receives at present a supply of doubtful quality, partly from the River Calder, and partly from a well, the water

being pumped into a reservoir, and filtered by Spencer's iron carbide process. The supply has been upwards of 50 gallons per head per day, and the charge 6d. per thousand gallons, the works having been carried on by a Company. The Corporation have recently purchased the property of the Company at a cost equivalent to nearly £7 10s. per head of the population, and they are this session in Parliament seeking for powers to establish gravitation works. Normanton receives nearly 10 gallons per head per day from a colliery sinking, at a cost equal to nearly £4 10s. per head of the population, and the charge is about 9d. per thousand gallons. The works are, however, unfinished. There is one other town on the Calder—Farnley Tyas—mentioned in the Return. A reservoir constructed to store the water of natural springs supplies about 6 gallons per head per day. The works are in the hands of the Earl of Dartmouth.

Below the confluence of the Calder with the Aire there are four considerable towns on the latter river—Pontefract, Knottingley, Snaith, and Methley. Of these, Pontefract is largely supplied from wells, the water being pumped into a reservoir. The daily supply is about 25 gallons per head, but more is obtainable. The cost of the works has been about 40s. per head of the population, and the charge is 10d. per thousand gallons. Methley has private wells and no works. Snaith and Knottingley are not referred to in the Return. Rawcliffe and Ferrybridge, smaller towns, are also not noticed.

We come next to the drainage area of the Don, on which is also a large manufacturing population distributed in forty towns, of which Sheffield, Rotherham, Barnsley, Dewsbury, and Doncaster are the most important. Sheffield, under the management of a Company, has a gigantic system of reservoirs, which retain the surplus waters of the Upper Don and its tributaries. One of these, of the largest containing power, has been completed for some years, but is not yet utilized. The town has a constant supply of 20 gallons per head per day. The works have cost about £7 per head of the population, and the charge is 8-4d. per thousand gallons. Barnsley, the next most important town, is supplied by water collected from a gathering-ground of 1750 acres, and stored about nine miles from the town. The supply is constant, and amounts to more than 40 gallons per head per day. The works have cost £6 per head of the population, and the charge is at the rate of 6d. per thousand gallons. Barnsley also supplies Monk Bretton, Worsborough, Dodworth, and part of Darton. To the former town the water is sold by meter to the Local Authorities, at the rate of 1s. per thousand gallons, but the quantity taken is stated to be less than a gallon per head of the population per day. This is probably an error. The local works have cost about 30s. per head of the population. Worsborough receives $7\frac{1}{2}$ gallons per head per day, at a charge of 1s. per thousand gallons. The local works have cost at the rate of 17s. per head of the population. At Darton the supply is only $4\frac{1}{2}$ gallons per head per day. The works have cost 17s. 6d. per head, and the charge is also about 1s. per thousand gallons. Dewsbury is, with Heckmondwike, now supplied from the Dunford Bridge reservoirs, retaining the waters of the Upper Don. It was formerly combined with Batley, but since 1876 has been independent. The supply is intermittent, and regarded as insufficient. In winter it amounts to 24 gallons per head per day, but in summer is only half that quantity. Additional works are in progress. At Heckmondwike the daily supply is stated to be 30 gallons per head, but irregular. The cost of works to Dewsbury has been rather more than £3 per head, and to Heckmondwike £4 5s. The charge at Dewsbury, as estimated by the rates, is 10d. per thousand gallons, and at Heckmondwike only 5d. This requires explanation. Ravensthorpe is supplied from Dewsbury with 10 gallons per head per day at the charge of 13d. per thousand gallons. The cost of local works was 18s. per head of the population. Rotherham is a large town supplied from a gathering-ground of 2300 acres of moor land, the water being collected into large storage reservoirs, which also supply several other smaller places. The supply is 30 gallons per head per day, and the cost of works rather more than £4 per head of the population. The charge is only $4\frac{1}{2}$ d. per thousand gallons. Rawmarsh receives 8 gallons per head per day from Rotherham, at a charge of nearly 10d. per thousand gallons. The local works cost about 30s. per head of the population. Greasborough is partly supplied from Rotherham, but no details are given in the Return. Chesterfield is supplied by a Company from reservoirs, but no information is afforded concerning it. The Chesterfield Water Company also supply Newbold and Dunstan, Dronfield, Whittington, Brampton, and Walton. At Dronfield we are told that about 5 gallons

per head are received, but the supply is only constant in the lower part of the town.

The list of towns left unsupplied, and dependent on local wells within the sub-drainage area of the Don, is very large. It includes Penistone (where, however, works are in contemplation), Thurlstone, Flockton, Askerne, Emley, Gunthwaite, Swinton, West Clayton, Hepworth, Hoyland, Crowle, and Tickhill. The town of Doncaster is supplied from the River Don with 30 gallons per head per day. The works are in construction, and no details are given in the Return. Clay Lane receives, per head per day, 16 gallons of water obtained from springs and a brook, collected into a reservoir and filtered. The cost of works has little exceeded 20s. per head, but the charge is not stated. Mexborough receives 6 gallons per head from a Company drawing water from artesian wells. The cost of works has been small, but no charge is stated. Wombwell has a system of catchwater drains recently constructed, and is also supplied from wells. No figures are given in the Return. Wath-upon-Deane has 12½ gallons per day from a Company. There are, besides, several towns not included in the Return.

The River Derwent drains a large part of the oolitic country on the eastern bank of the Ouse, but there are few towns in its drainage area. Malton, the largest, is supplied from springs, the water being pumped into a reservoir. The supply is 13½ gallons per head per day, the cost of works was about 15s. per head of the population, and the charge is 6d. per thousand gallons. Pickering is supplied by a Company; Hinderwell, from wells and an adjacent stream. No information is given concerning them, and the other towns in the district are not referred to.

On the estuary of the Humber there are several towns, but only two of great importance. These are Hull and Grimsby. Hull is supplied from wells of considerable depth, reaching the chalk. As much as 45 gallons of water per head per day is delivered. The cost of works has been £1 14s. 3d. per head of the population, and the charge is only 3·2d. per thousand gallons. Large as the supply is, the Corporation have before them schemes for increasing the quantity. Grimsby, like Hull, is dependent on wells, part of the supply being pumped into a reservoir. The supply is constant, and at the rate of 22 gallons per head per day. The cost of works has been nearly £2 per head of the population, and the charge is 4·7d. per thousand gallons. The town of Barton is supplied by wells, but has no works. Cleve and Cleethorpes are supplied from the Grimsby works. Patrington is not included in the Return.

There are some towns on the Yorkshire coast that are properly considered as outlying members of the Ouse drainage system. Scarborough is the most important. Formerly supplied by a Company, the works have recently been purchased by the Corporation. Wells and springs are the sources of supply; and additional wells are being sunk. The allowance is 33 gallons per head per day, and the supply is constant. The works are stated to have cost rather more than £3 per head, but this will be increased. The charge has been 7½d. per thousand gallons. Whitby is supplied by a Company from springs, the water being collected into a service reservoir. The supply is constant, and amounts to 24 gallons per head per day. The cost of works has been at the rate of £1 8s. 6d. per head of the population, and the charge for water is 5·3d. per thousand gallons. Filey receives a constant supply of filtered water from a Company, but no figures are given in the Return. Bridlington has 25 gallons per head per day from deep wells. The works have cost about 45s. per head, and the charge, as calculated from the amount of the rates, is nearly 2s. per thousand gallons. Hornsea is supplied from wells, but there are works in construction. Hinderwell is supplied by wells and a brook, the water from them not being filtered.

In the Hull river drainage area are the towns of Beverley, Driffield, Cottingham, and Broughton. All these towns are dependent on wells, and no information concerning details is given in the Return. There are also towns on the Ancholme, which flows into the Humber, but they are not included.

It will be evident from this account that a very great difference exists as to the quantity and cost of water supply in these important manufacturing districts; but it is equally certain that the returns are imperfect and unsatisfactory. From the condition of the country, the water supplied is chiefly obtained from catchment areas, rarely from wells, and hardly anywhere from rivers. The daily supply varies greatly in amount, and the charge is also very different in different places.

THE THAMES SEWAGE INQUIRY.

THE arbitration case between the Conservators of the Thames and the Metropolitan Board of Works has now come to a close, so far as concerns the hearing of evidence and the speeches of the learned Counsel. From first to last, twenty-five days have been given to the inquiry, and there can be no doubt that it has been of a singularly painstaking and exhaustive character. The next step consists in the presentation of a report to the Board of Trade by the Umpire and the Arbitrators. At the last sitting, Sir Charles Hartley, the Umpire, observed: "It now only remains for me to say 'that we shall report to the Board of Trade, after having 'carefully weighed all the evidence which has been brought 'before us.' Mr. Pope, Q.C., the leading Counsel for the Conservators, asked Sir Charles, 'Have you considered 'whether it ought to be a joint report?' to which the reply given was, 'We hope so, if possible.' Mr. Bramwell, the Arbitrator appointed by the Metropolitan Board, thereupon remarked that he had thought it would be competent for either Arbitrator to send in a separate report. 'It seems to 'me,' continued Mr. Bramwell, 'that in an inquiry like 'this, it is not unreasonable that the opinion of each member 'of the tribunal should be before the Board of Trade, if 'there should be a difference between us.' 'If Captain 'Galton and myself agree,' Mr. Bramwell went on to say, 'the benefit of Sir Charles Hartley's opinion should be had 'in addition to the opinions of my co-Arbitrator and myself.' Mr. Pope also suggested that the Board of Trade, would most likely prefer to have the joint opinion of the three authorities, and Mr. Bramwell added, 'It would be a misfortune if, 'when we have an Umpire of the position and attainments 'of Sir Charles Hartley, his opinion were not to be had.' Captain Galton believed that a report from the Umpire was contemplated by the framers of the Act.

A joint report, or three several reports, will thus be laid before the Board of Trade, and that department will then have to come to a decision. At the present moment it will be interesting to observe what is the actual contention between the Conservators and the Metropolitan Board. Mr. Pope, who had the final word, stated in his concluding address that the Arbitrators were not called upon to decide whether certain obstructive banks in the River Thames near the great outfalls were actually composed of matter discharged from the sewers. The question, as put by the learned Counsel, was whether the mud-banks had "arisen" from the flow of the sewage. A distinction was to be drawn between "banks formed of sewage," and "banks formed "because of the discharge of sewage," and it was the latter point on which the case for the Conservators was made to rest. The Thames was described as a river highly charged with natural detritus, into which a large quantity of sewage matter was discharged from the outfalls. The result was compared to something like the A. B. C. process, in which there was a mixture of clay and other ingredients with sewage, the effect being to precipitate certain materials which otherwise would remain suspended. It was contended that the flocculent matter of the sewage, on coming in contact with "the finely-attributed matter" in the Thames, became attached to the latter, and, under these circumstances, the combined sewage matter and detritus formed a deposit. We think it must be acknowledged that this contention is rather weak. In the first place, it reverses the precipitating process, sewage being poured into a mixture of clay and water, instead of the latter being poured into the sewage. This might not matter if a due proportion were observed, instead of a relatively small quantity of sewage being put into a large volume of river water, the sewage being expected to play the part of a precipitating agent. But a more serious objection consists in the fact that the flocculent matter of the sewage is lighter than the detritus which it is said to precipitate. Clay may serve to sink sewage, or that part of sewage which is lighter than itself, but how the sewage is to sink the clay is not so apparent. Mr. Pope based his argument on a statement by Mr. Hawksley—who was a witness for the other side—that the detritus entangled in it about one-eighth of its weight of organic matter. "Of course," said Mr. Pope, "if you get a particle weighing one-eighth more, the same "forces which gave the original particle flotation would fail "to float the particle which weighs this additional one-eighth; "therefore, down it would go." The explanation startled Mr. Bramwell, who exclaimed, "Surely, can that be so?" "Is it not so?" rejoined Mr. Pope. Mr. Bramwell thought not, any more than sticking one pound of cork on to eight pounds of wood could be expected to make the whole affair sink. Mr. Bramwell's reading of Mr. Hawksley's evidence was that flocculent matter, which otherwise would not go

down, would be taken down by the attrited matter which would sink, and Mr. Hawksley reckoned that the flocculent matter would amount to one-eighth the attrited matter to which it became attached.

Dismissing Mr. Pope's scientific theory, we observe that his position may be maintained without it. This gentleman argued that the sewage outfalls might give rise to mud-banks, even though it were difficult to prove that the mud-banks contained an appreciable quantity of sewage matter. Addressing the Arbitrators, he said: "I desire to guard myself against the necessity of asking you to consider whether these banks are composed of material which comes from the sewers." The learned Counsel even admitted that if he had to prove the banks to be composed of material brought down by the sewers, he "should have to meet a considerable difficulty in accounting for so large a quantity." "But," he said, "when you are dealing with a limited quantity of discharge, of a character the peculiar action of which is such as has been described, then we are dealing certainly with facts which have arisen from the discharge of the sewage outfalls." The "peculiar action," we have already seen, is a fallacy, but the argument that the sewers can create mud-banks without infusing into such banks any large amount of sewage, is still admissible. Any check which is given to the flow of the river, whether by an abrupt bend in its course, or by the sudden entrance of a volume of water nearly at right angles, would suffice to create an eddy, and a certain amount of slack water such as would favour the deposition of earthy matter. That the large volume of water discharged into the Thames from the outfall sewers has somewhat changed the régime of the river is a possible thing, and the disturbance may influence the formation of shoals. But while a bank is thrown up in one place, a channel may be cut deeper in another, and it may be urged that an addition to the volume of the river at the time of the ebb is more likely to aid the scour than to increase the deposit, even though the tributary be fouler than the main stream. Mr. Pope, however, contends that the sewer outfalls have altered the character of the banks to be found in the Thames. These, he says, are no longer composed of sand or river detritus, but filthy mud, which can only be removed at considerable cost. That there was mud on the foreshore in former times, Mr. Pope admits, but he denies that mud-banks were formed in the bed of the stream until the great sewer outfalls came into existence.

The question, of course, relates to "the origin of the banks," and it will be seen that the case for the Conservators is framed very cautiously on this point. "I do not ask you to say that these banks are composed of sewage," observes the learned Counsel; "I do not ask you to present any report upon the question of pollution, or any of the other large questions which are involved, no doubt, in this inquiry, and which, sooner or later, will have to form the subject matter of investigation." "On the part of my clients," continued Mr. Pope, "I ask you to say that these banks have arisen from the outflow of sewage at the Metropolitan Board of Works outfalls." Mr. Pope explained that he made use of the word "arisen" as not meaning "composed" of sewage, but as "caused" by the outfalls. "Thus," he argued, "if it be true that the introduction of sewage does create a state of things producing deposit where such deposit would not otherwise have taken place, then, unquestionably, these banks have arisen from that sewage outfall, and the parties ought to be responsible for creating them." The argument is that the banks may be formed "by sewage," although they are not actually "of sewage."

Mr. Bidder, in his concluding address for the Metropolitan Board, given on the day preceding Mr. Pope's address for the other side, observed that the question at issue was a very simple one in its statement, but a very complicated one in its determination. The question was whether or not three banks, situated respectively at Crossness, Barking Bight, and Margaretness, were originated by the sewage outfalls of the Board. Put in more precise language, the question was: "Do these banks arise from the sewage outfalls or from other causes, or partly from the outfalls and partly from other causes?" Mr. Bidder made the following admission: "There is no dispute in point of fact that these banks have formed, and that they began to be apparent shortly after the opening of the outfall sewers of the Board." It was conceded that there was a *prima facie* case against the Board. But Mr. Bidder contended that the evidence now brought forward served to show that this was one of those cases in which it is not safe to trust to first appearances. There were the outfalls, and there were the banks, but Mr. Bidder denied that there was any connection between them. He had an explanation to give, and it was as follows, addressed to the Conservators:—

"You went and dug a big channel on the opposite side of the river, you cleared away the shoals that drove the tide into these banks, you thereby enlarged the channel, but at the same time you drew the stream away from them, or caused slack water, and by causing slack water you caused deposit. That is the whole story," said Mr. Bidder.

Of course the banks could not have come into existence without materials to form them. According to the investigations of Mr. Keates, the Chemist to the Metropolitan Board, the outfall sewage in its normal condition contains 23 grains of suspended matter per gallon, and this estimate is supported by other authorities. According to Sir Joseph Bazalgette, the average daily flow of sewage at the outfalls in the ten years 1869-78 has been 122 million gallons, containing, according to the above estimate, 184 tons of suspended matter. But it is admitted that nearly two-thirds of this quantity is organic, so that the daily discharge consists of 122 tons of organic and 62 tons of mineral matter, representing an annual quantity of 44,000 tons in the former case, and 23,000 tons in the latter. In fifteen years—which is rather an excessive period to reckon upon—the quantities become respectively 660,000 tons and 345,000 tons, the latter being the mineral matter. Mr. Bidder, quoting Mr. Hawksley's evidence, varies the figures a little, making the organic matter in fifteen years equal to 650,000 tons, and the mineral to 352,000 tons. The larger portion of the organic matter of course disappears, and it must be allowed that a considerable portion of the mineral matter is carried away seaward. As the three banks contain 1,368,000 cubic yards of deposit, equal to about as many tons, it is obvious that the figures just cited can only partially account for the formation of the banks. It must be remembered, however, that the 23 grains of solid matter per gallon consist of that which is dry, and if we add as much moisture as would bring the solid matter of the sewage to the same condition as the mud-banks, we get an increased quantity. Mr. Keates stated that, in order to raise the figures from the dry to the wet condition of the suspended matter, an allowance of 56 per cent. of water should be made. That is to say, the suspended matter, previous to being dried, contains 56 per cent. of water. This would rather more than double the contribution from the outfalls to the banks. According to the reckoning adopted by Mr. Keates, the utmost quantity of matter which the outfall sewers could contribute to the banks in the course of a year, including a due proportion of organic matter, would be 24,000 tons. If we raise this to the wet condition, we get something like 60,000 tons, which in fifteen years would be 900,000 tons. But this is supposing that everything which comes from the outfalls goes to the three banks in question, which is, of course, absurd, especially as the evidence for the Conservators tends to show that a large amount of deposit in other parts of the river is also due to the discharge from the outfalls. The period of fifteen years is likewise too long, as the drainage works have not been in full operation all this time. On the other hand, it may be said that the abnormal condition of the sewage must be taken into account as well as the normal, so as to include the extra quantity of suspended matter to be found in the sewage when a heavy rainstorm follows a dry period. Still the quantity of material is inadequate to account for the formation of the banks, and it will be seen how Mr. Pope has endeavoured to meet this difficulty by the theory that the sewage matter helped to precipitate the natural detritus floating in the river. The quantity of this detritus is large, as shown by the analyses of Dr. Tidy and Mr. Keates in respect to the water flowing over Teddington Weir. To this may be added earthy matter washed away from the saltings in the lower part of the Thames, and brought up to Barking Reach by the flood tide.

A somewhat telling argument used by Mr. Bidder had reference to the additional quantity of solid matter given to the Thames by the action of the outfalls. The flow of the river past the outfalls in the twenty-four hours may be taken approximately as 230 times greater than the volume of sewage discharged into the stream during that period. As there are 23 grains of suspended matter in a gallon of the sewage, there is thus one-tenth of a grain added to the suspended matter in each gallon of Thames water. But each gallon of the river water already contains eight grains of suspended matter, so that the actual addition is only one-eightieth of the quantity which previously existed. Mr. Bidder ridiculed the idea that eight grains would float, while eight grains and a tenth would sink. The argument depends very much on the assumption that there is a complete distribution of the sewage throughout the passing volume of the river water, which is far from being the case; but the facts, nevertheless, bring forcibly into view the capacity of the Thames for

dealing with so large a volume of sewage as that which London discharges into the stream.

This arbitration case, as it is technically called, has taken the shape of a most elaborate inquiry into the effect of the sewage outfalls on the navigation of the Thames. It seems odd that the question should simply relate to the Thames as a navigable river; but even on that footing the inquiry has served to bring out a mass of facts which cannot fail to throw light on the sanitary problem. The chemical evidence was of a very comprehensive character, and the data produced by Mr. Keates as the result of his prolonged and laborious researches will doubtless afford a valuable source of information in respect to the chemical constitution of rivers. The inquiry also marks an epoch in the history of the Thames itself, and the facts now on record, both chemical and engineering, will serve for reference on future occasions, so as to determine what changes the river may be undergoing. Concerning the probable issue of these proceedings, as embodied in the decision to be given by the Board of Trade, we can only offer speculative remarks; but, taking a fair view of all that has been urged on either side, it is difficult to conceive that the evidence can lead to any strong decision against the Metropolitan Board. To some parties it may appear as if the case for the Conservators had entirely broken down, but it seems scarcely probable that the Metropolitan Board will have a complete victory.

Communicated Article.

THE THEORY OF DISSOCIATION.

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V.

The results obtained by Würtz with chloral hydrate and potassium oxalate have been questioned not only by Troost, but by Berthelot, another keen opponent of the atomic theory. The difference between the latent heat of vaporization of chloral hydrate and that calculated from the latent heat of anhydrous chloral and of water seemed to him to indicate that chloral hydrate exists as such in a state of vapour. From his experiments, Berthelot concluded that a small amount of heat—nearly 2 calories—is disengaged by the gaseous combination of steam and anhydrous chloral to form gaseous chloral hydrate occupying 4 volumes.

Würtz then performed another series of experiments, in which he showed that anhydrous potassium oxalate took up moisture in an atmosphere of chloral hydrate at 100°. He found that when the tension of steam present was considerably greater than the dissociation tension of crystalline potassium oxalate, the mercury slowly rose in the tube, showing that under such conditions as these anhydrous potassium oxalate took up water from the atmosphere surrounding it. Würtz employed two similar tubes placed side by side and heated equally. One of them contained the vapour from chloral hydrate, the other a mixture of air and steam in such proportions that the tension of the steam was equal to the tension of the steam in the first tube if the chloral hydrate there were dissociated into chloral and steam. Anhydrous potassium oxalate was then brought into each tube, and the rise of the mercury observed in each case. It was found that the absorption was well marked, and nearly the same in both cases, thus showing that the vapour from chloral hydrate behaves like a mixture containing half its volume of steam. A similar result was obtained when an artificially moist atmosphere of chloroform and steam was used in the comparison tube.

In reply to Berthelot, Würtz actually brought the vapour of anhydrous chloral and steam in contact at a high temperature in an apparatus somewhat similar to that used by Deville in his experiments on ammonia and hydrochloric acid. The two vapours, after passing through spirals coiled round a central flask, all plunged into boiling water, meet in the flask in which is placed the bulb of a delicate thermometer, graduated in tenths of a degree C., and from which a tube conducts the mixed vapours away. At ordinary atmospheric pressure and 100° no variation in the thermometer could be detected when steam and anhydrous chloral met in the flask. The experiment was repeated under 10 mm. of mercury pressure— $\frac{1}{10}$ of an atmosphere—and at 61°, and again at 28 mm. pressure and 100°. No rise of temperature was observed in either case. Würtz found that it was necessary to work with perfectly pure chloral, for the least trace of hydrochloric acid coming into contact with steam caused a rise of temperature in the flask.

These experiments failed to convince his opponents. Berthelot, after several attacks on his adversary, published some determinations of his own, in which he found a rise of temperature on bringing anhydrous chloral vapour and steam together. In a thin glass cylinder was suspended a thin glass globe with four tubes sealed into it. Two of these tubes served to bring the heated vapours into the globe, the third dipped beneath the level of some cold water in a beaker, and the fourth allowed the bulb of a delicate thermometer to pass to the centre of the globe. A second thermometer, exactly similar to the first, was placed outside the globe, and within the cylinder; and a jet of steam was blown through the cylinder, raising its temperature and that of the globe to 100°. On now passing steam

and chloral vapour into the globe, the inner thermometer rose, and remained nearly 1° higher than the outer thermometer for ten minutes, during which time some 25 grams of chloral were distilled and condensed in the beaker of cold water.

This experiment, described before the French Academy at the beginning of the present year, has just been answered by Würtz. The apparatus used by Berthelot allows drops of liquid to run down the tubes which convey the two vapours into the central globe. When liquid chloral and water, at their boiling points, come into contact, a rise of temperature ensues, the two combining with disengagement of heat. Since this heat cannot be immediately absorbed by the formation of vapour, the liquid is heated up for a few moments above its boiling point. Hence it is essential to prevent any drops of liquid entering the central flask. With this object in view, Würtz furnished his serpentine tubes with bulbs at their lower extremities, to collect any condensed liquid and prevent it flowing with the vapour into the globe. He also made them of sufficient diameter to prevent any increase of pressure, and consequent advance of temperature in the globe, which might arise from friction in narrow tubes. Through this new apparatus, heated with steam in a copper jacket, Würtz passed a current of pure chloral vapour. The thermometer marked 99.45° C. A current of steam was now sent through the second spiral, and allowed to mix with the chloral in the globe. The thermometer fell from 99.45° to 99.4°, at which point it remained constant for ten minutes. On passing steam through the globe alone, the thermometer marked 99.4°.

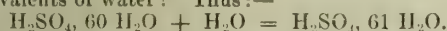
Other experimenters have also in recent times been at work on the question of the dissociation of chloral hydrate. Wiedemann and Schulze have submitted the vapour to diffusion, and have found it to behave like a mixture of steam and anhydrous chloral. Naumann, by careful fractional distillation, has succeeded in getting two liquids richer in water and in anhydrous chloral respectively than the hydrate distilled. Moitessier and Engel have also made a very systematic study of chloral hydrate. In the first place they showed that when the hydrate was heated to its boiling point in the closed end of a U-tube over mercury, the tension of the vapour produced was greater than that of the atmosphere—a fact most easily explained on the supposition that the vapour was a mixture. Shortly afterwards the same chemists published a new method of distinguishing between a simple vapour and a mixture. Their idea was to distil chloral hydrate with a volatile substance, which in the liquid state only dissolves one of the products of dissociation. Chloroform, they found, answered the purpose. On distilling well-dried chloroform and chloral hydrate in a retort, a turbid distillate was collected, which, after standing, separated into a layer of chloroform, holding anhydrous chloral in solution, and into a layer of water, which gradually became charged with chloral hydrate by reacting with the anhydrous chloral in the chloroform below. By continually drawing off the chloroform from the bottom of the condenser, the recombination of the chloral and water was almost entirely prevented; and on allowing the distillation to proceed with fresh supplies of chloroform, nearly all the water originally in the hydrate was separated. Moitessier and Engel conclude that at 61°, the temperature of the experiment, chloral hydrate is completely dissociated in an atmosphere of chloroform vapour. By a second series of experiments, they have showed that at 47° chloral hydrate is completely dissociated in an atmosphere of carbon bisulphide. Neither boiling chloroform nor boiling carbon bisulphide has any chemical action on chloral hydrate. Having verified the fact of the dissociation of chloral hydrate when volatilized, Moitessier and Engel examined the effect produced by heating the hydrate in the presence of one of the products of its decomposition. When the hydrate was heated in a tube at 100°, which already contained the vapour of anhydrous chloral, it volatilized, and its vapour was found to have a density corresponding with 4 volumes—i.e., it was completely dissociated into anhydrous chloral and steam. This was found to be the case so long as the tension of the atmosphere of anhydrous chloral was less than the dissociation tension of the hydrate. A similar dissociation took place when the hydrate was heated in an atmosphere of steam, the tension of which was less than the dissociation tension of the hydrate. At 60° anhydrous chloral has a tension of 212 mm. of mercury, whereas chloral hydrate has a tension of only 146 mm. at this temperature. When some chloral hydrate was introduced into a tube containing anhydrous chloral vapour at a tension of 200 mm. and at 60°, the level of the mercury remained unchanged. The hydrate neither decomposed nor volatilized in the presence of one of the products of its decomposition at a tension greater than its own dissociation tension. Again, into the tube containing anhydrous chloral vapour at a tension of 200 mm. and 60°, a small drop of water was introduced. The mercury rose in the tube, showing that the water and anhydrous chloral had entered into combination, the hydrate being a stable, unvolatile body under the conditions of the experiment, where the tension of the anhydrous chloral in the tube was greater than the tendency of the hydrate to decompose.

The dissociation of ammonium sulphhydrate into ammonia and hydrogen sulphide, a fact of some interest to gas managers, has also been experimentally determined by Moitessier and Engel. Ammonia and hydrogen sulphide will unite at low temperatures in equal volumes to form ammonium sulphhydrate—a crystalline solid. When dry ammonia and hydrogen sulphide were brought together over mercury at 50° C., no contraction took place. A piece of charcoal, previously ignited, was now passed up into the vessel. An absorption of gas by the charcoal took place, till about one-quarter only of the original volume of gas remained. The charcoal was then removed and passed into a vacuum over mercury. On heating the end of the tube the absorbed gases were expelled from the charcoal,

which was then removed. The gases so expelled deposited crystals on the side of the tube as it cooled. The residue consisted of free ammonia, for it was completely absorbed by pumice soaked in sulphuric acid. The gas left in the first vessel after the removal of the charcoal also deposited crystals on cooling. The residue was not absorbed by sulphuric acid. It appears that ammonia and hydrogen sulphide do not combine at 50° C.—in other words, ammonium sulphhydrate is completely dissociated at that temperature; for charcoal absorbs more ammonia than hydrogen sulphide when placed in a mixture of equal volumes of these gases, whereas if combination had taken place equal volumes of the two gases would have been taken up. These chemists have also shown that water will serve to separate ammonia from the dissociated gases. Into a mixture of ammonia and hydrogen sulphide, in a tube over mercury at a low temperature, a few drops of water were introduced, and the whole of the gas was absorbed. Into a similar mixture at 50° a few drops of water, previously heated to 50°, were introduced, and only a portion of the gas was dissolved. On transferring the residue to another vessel it was found to be nearly pure hydrogen sulphide. Again, on gradually warming the solution formed by treating the two gases with water in the cold, hydrogen sulphide was first disengaged in a nearly pure state. As the readers of the JOURNAL are aware, this separation of ammonia and hydrogen sulphide by hot water is employed in Hills's process for revivifying gas liquor. The liquor, heated a few degrees below 100°, gives off most of its carbonic acid and hydrogen sulphide while it retains most of its ammonia, and when sufficiently causticized is employed for absorbing more carbonic acid and hydrogen sulphide from crude gas.

Such are the experimental facts. It would be difficult to imagine much stronger evidence in favour of the dissociation of vapours which have an abnormal density, than the experiments which have been described at length in these papers. Nevertheless, Deville, Berthelot, and Troost maintain their attitude of hostility to Avogadro's law, and refuse to consider dissociation as the explanation of all cases of abnormal density. "I admit," says Deville, "neither the law of Avogadro, nor atoms, nor molecules, nor forces, nor particular states of matter. I absolutely refuse to believe everything that I can neither see nor even imagine, and I declare my position to be unaffected if every complex body is decomposed before it is vaporized. You must prove it to be so."

There are, as we have seen, very few facts in favour of the view that any molecule in the state of vapour can occupy four times the space occupied by an atom of hydrogen. The facts most relied on by the opponents of Avogadro's law are those connected with the vapours of ammonium salts. It seems to be established that when an ammonium salt is volatilized, it can withstand a temperature at which ammonia by itself suffers a partial decomposition; and that when hydrochloric acid and ammonia are brought together at the boiling point of mercury a slight rise of temperature is produced. But these facts are not inconsistent with the truth of Avogadro's law; the presence of hydrochloric acid in the immediate neighbourhood of the molecules of ammonia may preserve their stability although actual combination does not take place, and the slight rise of temperature may be due either to a very small fraction of the mixed gases entering into combination, or to some physical action between the separate molecules. An addition of water to sulphuric acid already diluted with 60 equivalents of water causes a slight rise of temperature. Does this rise of temperature indicate that a more complex molecule is formed by a chemical reaction between a molecule of water and a molecule of a hydrate of sulphuric acid containing 60 equivalents of water? Thus:—



The bond of union between the hydrate and the sixty-first molecule of water may differ not in kind but only in degree from that between a molecule of sulphur trioxide and a molecule of water; but it is more probable, as Favre has pointed out, that the disengagement of heat is due to a molecular attraction different from chemical affinity; that the molecules of sulphuric acid and water do not unite and condense themselves into a true molecule, but act on one another at a distance. It may be that a similar reciprocal action takes place between the molecules of hydrochloric acid and ammonia when mixed together at 350°, and that the effect of this attraction is to increase the stability of the two molecules. It is unnecessary to suppose that the molecule of ammonium chloride can exist as a stable compound in the state of vapour.

SALE OF SHARES IN THE REDHILL GAS COMPANY.—Last Wednesday five £5 shares in the above-named Company were sold by auction, and realized the large sum of £65, being 160 per cent. premium.

LITTLEHAMPTON WATER SUPPLY.—The Littlehampton Local Board of Health having applied to the Local Government Board for a loan of an additional £9000 for the purposes of water supply, Mr. Arnold Taylor, one of their Inspectors, held an inquiry on the 25th ult. into the application, to which there was no opposition. In the course of the inquiry it transpired that the total yield of water from the local wells is now 118,000 gallons per day.

THE AWARD IN THE HEYWOOD LOCAL BOARD WATER-WORKS ARBITRATION.—Our readers may remember that at the end of last year we noticed the proceedings in the arbitration commenced to determine the amount of compensation to be paid to Mr. Hutchinson, of Green Booth Mills, near Rochdale, for the water taken by the Heywood Local Board under their Act of 1877. Mr. Hutchinson claimed £66,000. He alleged that his water had been reduced from an average of 7½ feet per second to 4½ feet per second, and claimed compensation for this and other losses. The points raised were, first, the value of the water as power; secondly, the value of the alterations made at his mills so as to enable him to work as he did previously; and thirdly, the value of certain portions of land which he has lower down for erecting manufactories. The award was received at the last meeting of the Board, the Arbitrator (Sir Henry Hunt) settling the amount at £12,000.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

SPENCE'S METALLIC COMPOUND AND ITS USE FOR PIPE-JOINTS.

SIR,—I am sorry that your correspondent, Mr. J. L. A. Hope, should think my letter, on the subject of "Spence's Patent Metal," addressed to the Secretary of the Society of Arts, and referred to by you in your issue of the 2nd of March, "calculated greatly to mislead . . . the Engineers of the various Gas Companies of England." I wrote, as the letter itself says, "in the interests of my professional brethren," the very gentlemen Mr. H. desires should not be misled. I know that from them at least I get credit for honesty of purpose in so doing. In my letter I unfortunately used the word "pipes" instead of "joints;" but doubtless all who read it, including Mr. H., knew very well what was meant. I would repeat that about half of the joints were "made under the immediate supervision of Mr. Spence's representative, and not one of them stood the test." They were made precisely as Mr. H. says those which he tried were made—two at least of the number under Mr. Spence's own eye.

It is only just, perhaps, to state that when Mr. Spence saw the result, he said he thought there was something wrong with the "metal," that he would take it (about 10 cwt.) away and replace it. That was on the 11th of February, on the evening of which day the "metal" was introduced to public notice at the meeting of the Society of Arts, and since which time I have not seen or heard from Mr. Spence. R. MORTON.

London Gaslight Company, Nine Elms, S.W., April 5, 1880.

SIR,—Mr. Morton's experiments having been called in question by your correspondent, Mr. J. L. A. Hope, I feel constrained to relate my experience with regard to Spence's metallic compound.

On hearing of the success which had attended its trial elsewhere, I made preparations for jointing up about 150 yards of 24-in. main, which it so happened that I had to lay, for a temporary purpose, above ground. The work was begun under the immediate supervision of Messrs. Spence's representative, who, on leaving, expressed his entire satisfaction. Since its completion it has been tried under a gas pressure equal to 4½ inches head of water, with the result that every joint leaks—the loss as registered through a meter amounting to 48 feet per hour, or at the rate of 1152 cubic feet per day of 24 hours.

In addition to this, some shorter lengths of 4-inch and 12-inch pipes were jointed up, also under the superintendence of Messrs. Spence's representative, and with a similar result. Not a joint was found to be sound under a gas pressure equal to 6 inches head of water.

CHARLES HUNT.

Birmingham, April 2, 1880.

THE RECENT TRIAL AT MANCHESTER OF WEST'S AND FOULIS'S SYSTEMS OF DRAWING AND CHARGING RETORTS.

SIR,—The number of the JOURNAL for the 23rd of March, I notice, contains letters from Mr. Foulis and Messrs. Woodward and Sons, respecting the comparative trials recently made with Foulis's hydraulic machinery and my apparatus at Manchester. As these letters contain misrepresentations, I suppose with a view to disparage my system, I am bound to answer them.

Mr. Foulis considers the results are hardly to be credited. Other engineers of eminence have also been surprised at the results I have obtained from time to time during the last two years; but, after visiting Maidstone and other places where my apparatus is in operation, have been fully satisfied that the improved mode of working has been the means of producing these results. Mr. Foulis admits that he has never claimed to make more gas per retort, or increase the yield per ton of coal, and gives as his opinion that it cannot be affected to any great extent by machinery, and that his only endeavour was by machinery to relieve the heavy work of gas-making so as to save both labour and money, &c. It will be observed that Mr. Foulis admits he has only been trying to save labour and money by his machinery, in which endeavour he is to be commended; but the question arises, has he succeeded in either?

It is well known to the gas world that ponderous and very expensive machinery, actuated by steam and other power, for drawing and charging retorts, has been invented and tried in large works, but in no case has been found able to charge the retorts equal to hand labour, either for efficiency or economy, and has, I believe, in every instance, except in Manchester, been discontinued. Even at Beckton, where, I believe, the hydraulic stoker was worked under the direct supervision of Messrs. Woodward and Son, its use has been given up; and according to the information I have received from several sources, the apparatus has not been introduced at the Glasgow works (the home of the inventor), except to a very limited extent, and I heard very recently that the whole of these works were again on hand-charging. I claim, by the aid of my machinery, to produce more gas per ton of coals, of higher illuminating power, and at less cost for machinery and plant than the old system, at the same time effecting a great saving in labour, and after years of study and costly experiments I have succeeded beyond all expectations, and a long period of practical working has more than confirmed the correctness of my experimental results.

Mr. Foulis fails to see how the extra volume of gas was obtained. Now, it is well known by all engineers and chemists who have experimented with coals in the laboratory that, on account of the care bestowed in breaking and spreading them evenly over the surface of the retorts and distilling them rapidly, a larger volume of gas of higher illuminating power is obtained than can be produced in practice on the old plan of working. Knowing this from experience, I resolved to try and make gas on as scientific and simple a plan in the retort-house, and first began by preparing my coals for more perfect distillation by breaking them, and afterwards, with my machine, spreading them in a perfectly even layer over the flat surface of D-retorts. In this way I was enabled to obtain just the same results as in the laboratory experiments. The work of breaking is done by a specially-designed

coal-breaker and engine combined, which receives the coals direct from the waggons or carts, and breaks, elevates, and delivers them into hoppers directly in front of the stacks, at the desired height required for charging each row of retorts—this heavy work of breaking and lifting being done by steam or other power.

I think, after what has been stated, that the gas world should know more clearly upon what conditions my apparatus was introduced, and the special arrangements made for carrying out these extensive comparative trials at Manchester. I will, therefore, give a brief outline of what has been done, knowing that the large circle of Engineers and friends to whom I am personally known will accept them as a statement of facts, which can also, if necessary, be further corroborated by referring to the Gas Committee of the Corporation of Manchester.

The Committee in the spring of last year decided to visit London and Maidstone for the purpose of inspecting gas-works, and ascertaining if there were any improvements in apparatus for making purer and cheaper gas. Fifteen of these gentlemen inspected the working of my apparatus in minute detail. They at once saw that the heavy work was accomplished by the machinery as before described, and that my light-charging machine, which runs into the retort upon three wheels, does away with the necessity of using heavy and expensive machinery for this purpose. After their visit they decided to substitute my apparatus for Foulis's machine in No. 1 retort-house, at the Rochdale Road works. The retorts, benches, and chimneys being in a very dilapidated state, a large portion had to be rebuilt. New D-retorts, ascension-pipes, and mouthpieces were provided, and White's valves supplied, but there was not to my knowledge, as your correspondents assert, any additional rails laid for the coal stores in connection with this house. The Committee resolved that my apparatus should be thoroughly tested, and arranged to detach No. 1 house from the other part of the works. This was done by an alteration in the exhaustor-house, the addition of two Livesey's washers, and the raising of the tower scrubbers (which had to act partly as condensers), one set of old purifiers and one of the four meters completing the arrangements.

To avoid any misunderstanding, the Committee had special instructions prepared for those gentlemen who had charge of the comparative trials, which, for securing accuracy of results for experiments of such magnitude, could not be improved, and they reflect the greatest credit upon the Gas Committee of Manchester. Besides the officials on these large works, they had others from the Gaythorn station, and a staff of clerks from the Town Hall, and in all cases two sets were employed to take observations and fill up the special forms provided, and these were sent under seal to Mr. Jackson at the Town Hall each evening, signed by those in charge of the experiments.

It was decided that six kinds of cannel and coal should be used, and arrangements were made with the Railway Companies and Colliery Proprietors for the delivery of about 800 tons per day, which were to be distributed in equal proportions of weight and quality in the coal stores connected with each system under trial. All the coals in stock were previously whitewashed.

The charges for carbonizing for each system were to commence after the coals were tipped from the railway waggons into the stores, and included all expenses until the coal was tipped and quenched in the yard.

The illuminating power was taken by four experimenters as frequently as possible with a new 60-inch Letheby-Bunsen photometer (made by Alexander Wright and Co.), and the test-burner used was the London standard 20-candle bat's-wing.

All the meters and valves were sealed, and, finally, the connections were severed in the engine-house, so as to isolate the exhaustor for No. 1 house.

The indices of the station-meters, together with the temperature and the barometric pressure, were taken hourly, night and day.

The number of foremen and men employed, together with wages paid, were taken daily, and the actual time occupied in drawing and charging the retorts was carefully noted, and the results turned out as you have recorded in the JOURNAL for March 16.

Messrs. A. Woodward and Sons, Engineers, of Manchester, are the representatives and makers of Mr. Foulis's hydraulic stoker, and being on the spot for the last five years, have had unlimited right of entrance to the works during the whole of the time, for the purpose of inspecting, repairing, and improving the apparatus, and have been coaching it along and keeping it in repair until recently. Mr. Woodward is still a frequent visitor at the gas-works, often has men working there, and during the erection of my machinery made a number of inspections. Some one has also been actively writing upon the subject to a member of the Committee, and some of the Committee have received a statement of what was supposed to be an accurate account of the comparative working of the two systems. This was circulated before my apparatus was completed, but those who concocted it were ashamed to, or dare not attach their signatures to such a misrepresentation. The Committee, however, have some clue to the perpetrators.

It should also be mentioned as to these experiments, that it had been known for months past that they would be made when the winter season was over, and the Committee, the Manager of the works, and Messrs. Woodward and Sons had naturally been doing all in their power to get the three houses in as perfect a condition as possible, and everything was in very good order for gas-making. When the Committee decided the day for commencing the trials, I suggested that Messrs. Woodward and Sons be officially invited to be present. They were there when the operations commenced, and it was observed that the experienced skilled men at Foulis's machines displayed an amount of activity seldom seen in workmen; and no wonder, for they were especially interested in securing good results, and the returns prove that they did their very best, as the figures far exceed anything obtained during the whole of the previous five years working. It must also be understood that the Manager and officials of these works have had years of experience of its working, and these were not consulted as to the desirability of adopting my apparatus. It is also well known that a large majority, if not all, used their influence on the side of the Manchester-made machinery. Against this great force, occupying a fortified position, I had to manipulate in No. 1 retort-house with men employed on the works. These had to be trained, and for this purpose

I had a foreman and four men in each gang, and although some of these men had been working my apparatus for weeks, after the first day of the experiment my working was upset by the Corporation men demanding certain concessions, and, to my surprise, based one of their demands on an increase of wages that had been given, without my knowledge, a short time previously, to the hydraulic stoking men, who, they stated, were receiving at the rate of 7s. 6d. per day, whereas they (the men employed with my apparatus) were only getting 5s. The Committee discharged all these men, and the retorts stood for ten days. The stokers, however, asked to be taken back, and I reorganized my plan of working, knowing that it could be well afforded. I gave them very light work, the firemen having only to attend to five fires each. On re-commencing the experiment, I found the retorts had suffered considerably, all the joints being open, and very much cracked. These, however, were stopped, and after working under pressure a few days we got them quite tight.

It is also suggested that I had an advantage by the adoption of White's valves, but I regret to say that I could not get the advantage of this valuable adjunct to the retort-house in consequence of the defective state of the exhaustor, which compelled me to work with an excess of pressure on the retorts.

Much more might be said, but I am afraid you will think my letter already too long. In conclusion, I wish to state that when I first contracted with the Corporation for the supply of my apparatus, I had no idea the Committee would call upon me to so minutely compete with the hydraulic machinery, seeing that they had already had some five years experience of its working under varying conditions. The Committee, however, decided that thorough and complete comparisons should be made between the two systems, and to this, of course, I had not the slightest objection, knowing that it would give me another opportunity of demonstrating the advantages of my apparatus; and I may say, further, that with my long practical knowledge of the working of my apparatus, I have no hesitation in guaranteeing that by the use of my system, the ordinary working results over a long period will be fully equal to those obtained during the Manchester experiments.

Maidstone, April 3, 1880.

JOHN WEST.

THE RECENT GAS-LAMP TESTS AT BIRMINGHAM.

SIR,—Mr. Hunt has kindly called my attention to an unintentional inaccuracy in my letter of last week in the paragraph mentioning the high result, per cubic foot of gas, he had obtained with one of my Argand burners in his experiments. It was not, he says, 4.5 candles per cubic foot of gas consumed, but 4.32 candles, and the gas was not 16-candle, as I stated, but 16.75-candle gas.

I regret, with regard to the latter correction, that the present standard of comparison, the spermaceti candle, does not permit us to speak with nearly that scientific accuracy which is desirable in relation to the standard illuminating power of any gas. What I meant by 16-candle gas was a gas such as is usually considered 16-candle gas, and which may be, and in fact generally is, a fraction of a candle more.

As it was the same quality of gas that he (Mr. Hunt) used for testing both Argand and bat's-wing burners, the comparison between them will remain the same, so far as the quality of the gas is concerned—viz., whether it was 16 or 16.75-candle gas—but, with regard to the effect of the correction on the illuminating power obtained, per foot of gas consumed, I have to say that, in making my comparison, I did not, for fear of lengthening my already very long letter, claim the deduction from the result obtained by the bat's-wing burner which I might have done—viz., at least 10 per cent.

In making accurate comparisons between the photometrical results obtained from Argand and bat's-wing burners, a correction must be made so as to neutralize the error in the readings of the divisions on the photometer-bar, which is always in favour of the bat's-wing. One part of the theory on which the divisions on the bar are based assumes that the light from the burner or candle under examination shall equally illuminate every part of the circumference of a circle drawn round about the burner or candle as a centre, the distance between the burner and the disc being the radius of the circle. The Argand, being a circular sheet of flame, fulfils this condition; but the bat's-wing, being only a sheet of flame across the diameter of a circle, does not. The greatest amount of light is given with the flat of the flame to the disc, but this is always the position of the bat's-wing flame during the course of experiments.

According to my estimate of the magnitude of the error caused by the loss of light in every other direction, in the instance in question, the proper correction made will leave the comparison of light obtained, per cubic foot of gas consumed by each of the burners, very nearly as stated in my letter, the true difference between the two burners being 35 per cent. instead of 30 per cent.

I regret, however, very much that I came away with a wrong impression of the results Mr. Hunt obtained. The reason probably is that when I heard his statement, I suppose my attention was too much attracted to the fact that he had obtained in a simple manner what I thought at the time was a similar result to those obtained, independently of each other, by Mr. Heisch, Chief Gas Examiner to the Corporation of the City of London, and myself, but in two other different ways—Mr. Hunt shortened the chimney; Mr. Heisch slightly increased the consumption of gas per hour over what I had fixed for the quantity to be consumed; while I have been working for a long time to obtain a like result by increasing the supply of atmospheric oxygen, without increasing the quantity of gas, and without altering the chimney. I have already succeeded in so far improving the original 80-candle burners used in Waterloo Place and Queen Victoria Street, by a re-arrangement of both the air and gas supply, that with 4 or 5 feet (according to the quality of gas) increase in the original hourly rate of consumption I have produced 100 instead of 80 candles. The knowledge of these facts led me, I feel certain, to believe that Mr. Hunt said 4.5—a similar result to that obtained by Mr. Heisch and myself—instead of 4.32 candles.

I never intended, either, to convey the idea that the gas supplied to Birmingham was only equal to just 16 candles. On the contrary, the mention of the fact that the gas in the town is tested by the same standard burner (viz., the Gas Referees burner) as the gas supplied to

the City of London, will at once lead your readers to the conviction that, to keep it well over the standard, the Corporation necessarily give about 17-candle gas.

Vincent Street, Westminster, April 2, 1880.

WILLIAM SUGG.

SIR,—I have to ask for a little indulgence while I make a few further remarks on the above subject. I will not argue with your correspondent when he attempts to explain away that part of the Birmingham tests which tell in favour of my apparatus and against his own—the Birmingham authorities will be able, no doubt, to defend their experiments. The position which Mr. Sugg appears to wish to support is the one he took up some time since, when he staked his reputation on the statement that his Argand burner and shadowless lantern was the best system for street lighting for “common and cannell gas;” and that it would yield “over 30 per cent. more light than any other with the like consumption of gas.” I, on the other hand, staked my reputation on the statement that “the flat-flame was the only practicable burner for street lighting,” and that it would yield, “in actual use, as much light as the Argand with common gas, and more with cannell gas.”

As Mr. Sugg often quotes from burner tests to prove his case, I will here quote the following from the Birmingham tests:—

	Candles per Foot.
Sugg's best 80-candle Argand was shown to yield . . .	3.41
Bray's medium lighting power, 80-candle clusters . . .	3.01
Bray's high lighting power, 80-candle single burner (the result given in by Mr. Hunt)	3.51
Sugg's 200-candle Argand	3.95
Sugg's 200-candle flat-flame, tested to give 200-candle power	3.04
The same burners tested at very low pressure	3.24

From this it is seen that the best 80-candle Argand does not equal my best 80-candle flat-flame, and that the latter is only 11 per cent. below the 200-candle Argand. This result, being with common gas, is the most favourable for the Argand, as it is obtained from common gas, and without any deductions for the defects which I shall mention shortly, and which lessen the lighting power immediately the burner is put into use. The flat-flame burners shown by Mr. Sugg, which are an imitation of our lamp burners—i.e., such as we introduced in the beginning of last year, of the slit-union type of large capacity and lighting power—yielded, when doing best, 9 per cent. less than our high lighting power burner. Therefore, whatever superiority Mr. Sugg's Argand shows over my flat-flames, beats his own considerably more.

As to the lamp tests, it is important to note that the lantern in which the Argand was tested was not the Sugg shadowless, but the globular one designed by Mr. Hunt, which yields a much greater amount of light. When thus favourably tested, and both apparatus rated to consume exactly 46.75 feet of gas per hour, the lights were shown to be equal when the shadow meter was 73 ft. 2 in. from Bray's flat-flame lantern, and 76 ft. 10 in. from the Sugg Argand lantern. Only the side light was tested; and when your correspondent is reminded that the disc was protected on each side by a funnel, he will see that his statement to the contrary cannot be correct.

The above results, with both burners and lanterns, though the tests were with common gas, which is favourable to the Argand, do not support Mr. Sugg's statements, and if he can see anything of victory in them it must be of the nature indicated by Napoleon I., when, after a noted battle of another kind, he exclaimed, “Another such victory, and I am undone.” The results are, however, more favourable to the writer than those he bases his calculations upon for the statements he makes regarding the light of flat-flames as compared with Argands in actual use.

I am not going to charge Mr. Sugg with doing it purposely, but by drawing public attention exclusively to the lighting value of his apparatus, as tested by ordinary photometric means, he keeps out of sight the main portions of the subject. The most important matter is the practical utility of the apparatus; and on this point Mr. Sugg is completely silent. Nor does he make any allowance for the diminished lighting value of the Argand, when brought into actual use, caused by the lack of top and bottom light, which amounts to nearly 20 per cent.; nor for the fact that it cannot be governed to work within 10 per cent. of its best, because of its sensitiveness to the slightest increase of pressure; nor for the chimney becoming smoked, or becoming partially opaque by use when it does not happen to break. These grave defects he never touches upon in his letters, though I have repeatedly pointed them out to him; and he never makes allowance for them in his published statements.

As I wish to give Mr. Sugg every opportunity to satisfy himself regarding my apparatus, and as I do not intend to have much correspondence, I will say, once for all, that if he disputes the correctness of the Birmingham tests, I am prepared to make a joint application with him to Mr. Hunt to be allowed to test ourselves any points he may wish.

I am obliged to Mr. Sugg for his offer to allow me to test my apparatus against his on his photometer, &c., but the obligation would have been greater had the offer been made in more considerate language. I must remind him, however, that there is an offer still open which I made at the Paisley gas apparatus exhibition. I should like to know if he gives up the thought of attempting to prove his case with Scotch gas. I may say also that I have an apparatus for testing lanterns, burners, &c., and Mr. Sugg might make tests upon it without having to ask the favour of any person but myself to do so. If he will come to Leeds to have the tests made, and pay half the cost of any alterations that may be necessary for the test, and half the fees of the adjudicators, I should be glad to take part in such an arrangement. Or if he declines to come to Leeds, I will pay half the costs of apparatus, &c., in any convenient place that may be mutually arranged for. I think now there appears to be some prospect of this dispute being settled in a manner that will add to the knowledge of the profession and the public, and to the dignity of the parties contending.

I have also to say a word about the flat-flame burners and lantern shown by Mr. Sugg at Birmingham, of which he has promised to send you a sketch. This apparatus is in all its essential features an infringement of my first lamp patent, No. 1454 of 1879, and is to be found in

my drawings almost exactly as Mr. Sugg has produced it, and every part is distinctly specified. I should not have alluded to it here had he not taken this step to make the matter public. I am surprised that he has done so before giving me his views, seeing that I have communicated with him personally before taking the necessary legal steps to protect my rights.

Blackman Lane, Leeds, April 3, 1880.

GEO. BRAY.

P.S.—I find I have omitted to give credit to Mr. Sugg's Argand for a result Mr. Hunt appears to have obtained, which was not published, but which Mr. Sugg mentioned in his letter. The result is higher than has ever before been announced, and, if verified, I shall rejoice to hear of this further achievement in the gas industry.—G. B.

Legal Intelligence.

LIVERPOOL BOROUGH SESSIONS.—THURSDAY, APRIL 1.

(Before Mr. J. B. ASPINALL, Q.C., Recorder.)

APPOINTMENT OF A PUBLIC ACCOUNTANT OF THE LIVERPOOL CORPORATION WATER ACCOUNTS.

An application was this day made for the appointment of a competent Accountant to examine the Liverpool Corporation water accounts, pursuant to the Act 10 & 11 Vict., cap. 261, sec. 127.

Mr. SEGAR (instructed by the Solicitor to the Liverpool Land and House Owners Association) appeared for the applicant, Mr. John Murphy, the Secretary of the Association; Mr. M'CONNELL (instructed by the Town Clerk) appeared for the Corporation.

Mr. SEGAR said he had to make an application, under the Act named, for the appointment of a competent Accountant to examine the Liverpool water accounts, an abstract of which had been filed with the Clerk of the Peace. The application was made at the previous sessions, but the abstract not then having been filed, the Recorder had directed that the application should be renewed these sessions.

Mr. M'CONNELL opposed the application on the ground that the accounts having been made out could be inspected by any ratepayer, and that it was unnecessary to have an Accountant appointed.

The Recorder said he considered he would be justified in appointing an Accountant, as he had frequently done so in the case of the Gas Company upon the application of the Corporation. He did not quite see how the Corporation could fairly object to the application, considering that they annually applied in the case of the Gas Company, and no complaint was made as to the expense the appointment of an Accountant necessarily involved. He (the Recorder) thought the consumers of water had as much right to have the accounts examined as consumers of gas, and he considered that the Corporation had been fortunate in not having previously had their accounts examined. He would make an order for the appointment of Mr. M'Quie. The order could be drawn up by the parties and submitted to him on the following day.

EASTBOURNE COUNTY COURT.—THURSDAY, MARCH 25.

(Before Mr. A. MARTINEAU, Judge.)

THE LIABILITY OF WATER COMPANIES FOR ACCIDENTS CAUSED THROUGH BROKEN MAINS.

In the JOURNAL for Nov. 25 last year, a report was given of the hearing of a case in which a fly proprietor named Bylett summoned the Eastbourne Water-Works Company for damage to his horse and consequent loss of time, the amount claimed being £50. The evidence then given was to the effect that plaintiff was driving down Devonshire Place on Oct. 3, when his horse stumbled, and on examining the ground it appeared that the road had given way under the tread of the horse. The plaintiff alleged that, owing to the Water Company's pipe being leaky at that particular spot, they were liable to the damages claimed, as the water had washed away the subsoil and left the crust, on which the horse unfortunately trod. At the first hearing a question was raised as to the liability of the Local Board, and his honour gave leave to amend the summons by making them co-defendants.

Mr. E. JONES again appeared for the Water Company; and Mr. J. H. C. COLES was instructed on behalf of the Local Board.

Mr. JONES reminded his honour that after all the evidence had been tendered at the October sitting of the Court, he thought it desirable to adjourn the case, in order that the Local Board might be made parties to the cause.

Mr. MARTINEAU: I certainly thought there was no liability on the part of the Water Company, but before I said so I suggested that the Local Board should be joined to the Company as co-defendants. I thought in this way it might be shown who was responsible, and my suggestion has been carried out.

Mr. COLES: That has been done, but we have not received particulars.

Mr. MARTINEAU said since he had given that decision his attention had been called to a case in the law reports against the Mayor of Carlisle, in which the question was as to whether the Local Board, on whom the duty devolved of repairing a road, were liable to an action by a person who had suffered damage, as he alleged, by their negligence. It was held in this case that the liability cast upon the Board must be proved in the same way as against a parish—namely, by indictment. It might seem very hard on a person who was seriously injured by somebody's negligence that he could not obtain redress; but the section was exceedingly clear upon the point.

Mr. COLES: It may save time if I here take a preliminary objection that we have received no notice of action.

Mr. MARTINEAU said the Water Company maintained that they had done their duty in reinstating the road, and he did not see any evidence of negligence on their part. But when he made the two parties co-defendants, he thought the Local Board and the Company might fight out the matter of liability between them. He should not have made the suggestion had it at the time occurred to him that the plaintiff's only remedy was by indictment. He thought the rules about motions were essential, because it would be exceedingly hard on public functionaries, unless they had an opportunity given them of making amends for any injury, supposing they were liable. He did not think the defence was exactly a technical objection, but rather a substantial one.

Mr. LAMB said he could not see that it was too late. If it was necessary for the notice to be given, he still had a month.

Mr. COLES: No, you have not. The case was first heard in October last, and the six months will be up.

Mr. MARTINEAU said he was of opinion that, as far as the Water Company were concerned, they were not liable; and, as to the Local Board, the objection raised by Mr. Coles was a fatal one. He should, therefore, give a verdict for the defendants in each case, and was sorry to say with costs, for it was really a hard case.

Mr. LAMB: I should have liked to have argued the question of liability.

Mr. MARTINEAU: I should have very much liked to have heard you, Mr. Lamb. It is a much more interesting point of law than often comes before a county court.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

Lieut.-Col. Bolton's report on examinations made of water supplied by the Metropolitan Water Companies during the month of February, though dated the 10th ult., was not issued till last Wednesday. In it he says that the state of the water in the Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated) was good from the 1st to the 8th of February, when it became very turbid, and remained in a bad condition until the 25th; it was then indifferent in quality, and continued in that condition for the remainder of the month. The highest flood state of the river at West Molesey during the month was 5 ft. 8 in. above summer level, and the lowest 3 inches above summer level; the rainfall being 1.90 inches. The water in the River Lea was generally bad during the month. [These remarks refer to the condition of the water previous to filtration.] The water at all the intakes was in very bad condition during the month. The filtration was, however, generally efficient, the water supplied by the Companies having been clear, bright, and properly filtered, except as regards the Lambeth and Grand Junction Companies, who for a few days delivered water of a slightly turbid character, as, pending the completion of the works now in progress by them, they have not the means of properly dealing with the water from the Thames in times of such heavy floods as prevailed during the month.

The report then goes into details in respect to the several Companies, as follows:—

Kent Water-Works Company.—During the year 1879 this Company extended the constant supply to about 1000 houses, making the total number under constant supply 13,777. The Company have completed the construction of a covered reservoir at Farnborough to hold 1,400,000 gallons, and have made considerable progress with the new pumping-station in the same parish. The mains to connect these new works with the Metropolitan district are completed. A duplicate main, 14 inches in diameter, has been laid down between Plumstead and Greenwich.

New River Company.—During the year 1879, 3352 additional houses were laid on, 199 of which were furnished with a constant supply, and 1433 houses formerly supplied were pulled down for street improvements. The total number of houses having supply at the close of the year was 129,554, and of these 15,133 (being inhabited) had service on the constant system. Three of the five new filtering-beds at Hornsey have been completed and set to work. The borings at Ware and Turnford, having both secured the means of further water supply from the chalk, were carried through the gault and through thin beds of lower greensand. They then entered, and were respectively terminated in Upper Silurian and Devonian rock. The sinking of the new well at Enfield for further supply from the chalk has been carried down to a depth of 110 feet. The ordinary extensions of the Company's pipes in various directions during the past year have added about 8 miles to the length of pipes, and raised the total to 704 miles, exclusive of 15 miles of special extensions laid, but not yet in use. 631 additional hydrants were fixed during the year. This Company are quite prepared to give constant supply when called upon to do so by the Public Authorities, and are giving it to 15,143 houses in their district.

East London Water-Works Company.—This Company give constant supply to 100,848 houses out of 122,746 houses supplied by them. During the past year they have laid on 3633 new houses, and have transferred 8829 houses from the intermittent to the constant system. The Company have been engaged in the re-construction of one section of their filter-beds on more approved principles, and it will contribute to the greater purity of the water supplied, as evidenced by the analysis for January, one bed having been at work for some time. During the past year the Company have completed the construction of, and have now in use a large tank at Buckhurst Hill capable of containing 7000 gallons. This is kept in reserve in case of fires at night, or when the engines are not at work, being situated on the highest ground in the above neighbourhood, and placed at a sufficient altitude to command the houses around. The Company are rapidly proceeding with the construction of a set of four filters and two 100-horse power engines at Lea Bridge, which will be put in use during the month of May, and be then enabled to meet any increased demands on the part of the consumers. The auxiliary works at Sunbury and Hanworth were not in use during the past month. The supply of this Company is drawn from the impounding reservoirs at all times, and the intake is closed during floods.

Southwark and Vauxhall Company.—Steps have now been taken by this Company to give a constant supply on several large new estates, as follows:—Rotherhithe New Road estate, 600 yards; Goose Green estate, 1590 yards; Peckham Road estate, 1700 yards; giving a total length of main on constant supply of 3890 yards. The complete efficiency of the Company's filter-beds has been maintained during the year. Various important repairs have been carried out on the engines, boilers, and plant at the several stations; and a new sand-washing engine has been erected, to facilitate the washing of the sand for the filters at Battersea. At Hampton, new and separate steam-pipes have been fixed to the engines at the new works, a new cylinder-cover has been furnished to one of these engines, and a new piston supplied for the main pump. A new working-out main has also been fitted at this station to engine No. 2 in connection with the 36-inch main. The Company have a Bill in Parliament this session to obtain powers for the construction of subsiding and covered reservoirs, new main, and works, with a view to meet the anticipated increasing requirements of their district. A line of 12-inch main has been commenced, and is in course of being driven in the Deptford Lower Road, in anticipation of changing this district to the constant supply; as also a 9-inch main in place of the 7-inch in Grange Road, Bermondsey, with the same object. When completed, this will give about 2120 yards of constantly charged mains in addition to the other several mains so charged, and which are available for fire purposes as soon as the Metropolitan Board of Works fix the hydrants thereto. Important alterations to the 30-inch main at Kennington Church have been made, necessitated by the Metropolitan Board of Works taking into use the extra sewer.

West Middlesex Water-Works Company. This Company are giving constant supply to a number of houses on the application of the owners, and are extending the system as required. They are also giving constant supply to all new estates and buildings, and where new services are laid down constant supply is made compulsory. The Company also commenced to give on the 1st of January constant supply, under the Metropolitan Water Act, to a considerable district in St. Pancras parish. 1178 houses were put on constant supply during the past year, making the total number of houses receiving constant supply 5516. The Company have increased the depth of their filtering medium by adding a large quantity of new Harwich sand to the filter-beds at Barnes. They have also raised the inlet pipe to the south reservoir, and fixed a splash-plate 9 feet in diameter around the stand-pipe, so that the water in falling over the bell-mouth upon this horizontal plate becomes broken up before falling into the reservoir, thereby causing aeration. A marked improvement in the quality of the water supplied by the Company is consequently now

apparent. They are increasing the storage capacity of their subsiding and unfiltered water reservoirs by taking in the whole of the spare land adjoining the present western reservoir at Barnes, and forming it into the reservoir, thus increasing the area of the western reservoir by 9 acres, making the area of this reservoir 17 acres, or a total area of all three reservoirs of 29½ acres. The reservoir capacity will thus be increased by 34½ million gallons, making the total capacity of all the subsiding and storage unfiltered water reservoirs 91½ million gallons. These works are so far advanced, it is anticipated the water will be flowing into the reservoir some time this month (March).

Grand Junction Water-Works Company.—No steps have as yet been taken by this Company to give constant supply to their district. The Company have completed the construction of a storage reservoir at their Hampton works to contain 45 million gallons of water uncontaminated by floods, and have commenced at these works the construction of three filters capable of filtering 4 million gallons of water per day, and a covered reservoir to contain 2 million gallons of filtered water. They contemplate in connection with these works the erection of pumping machinery, by which to supply a very large portion of their low-level district direct from Hampton, instead of from Kew Bridge as at present. A new line of 30-inch main has been laid from Isleworth to Notting Hill (thus completing the whole of the new line to Hampton), and is being continued to Twickenham with this object. At the Kew Bridge works, in addition to the new filter of ½-acre, completed last year, one of the existing filters has been subdivided, and reservoirs constructed beneath to contain filtered water, and another filter has been subdivided with a view to its being similarly treated with such reservoirs for filtered water to be provided at a future time. In the neighbourhood of Grosvenor Square and Bond Street, the Company have laid duplicate mains to a considerable extent for the better supply of the high services.

Lambeth Water-Works Company.—This Company have for a long time past been giving a constant supply to their outlying districts at Esher and Molesey, and also in various courts and alleys in and about their town district; and in the October of 1878, began the systematic introduction of a constant supply, which will be continued until the whole district is brought under it. The first division thus supplied was the area from Kennington Park to the Elephant and Castle, the Walworth Road, and across Grosvenor Park and other streets to the point of commencement in the Kennington Park Road. This district contains 1880 houses, and the total number of houses on constant supply is now 7340. The Company served notices in September last on the owners and occupiers within a second division for constant supply, which came into force on the 1st of January. The locality thus to be supplied is all in the parishes of St. Mary, Newington; St. George-the-Martyr; St. Mary Magdalen, Bermondsey; and St. Giles, Camberwell, in the county of Surrey. This area contains about 7400 houses, and at Dec. 31 upwards of 1400 of them had had their fittings altered so as to be in accordance with the Board of Trade rules and regulations, while the remainder were being rapidly altered and constant service laid on. The water-pipes and fittings in all new houses are fixed in conformity with the Board of Trade regulations, so as to be ready to receive constant supply when the division of the district in which they are built is brought under it. The new filters and works at Thames Ditton, commenced in November, 1878, have now made considerable progress. These works consist of a service reservoir and four filters, each having a sand filtering surface of 1 acre; the construction of engine and boiler houses; and the erection of a pair of 90-horse power engines and pumps; also the building of boundary walls and railings. The construction of these important works will be completed towards the end of this year. When these works are completed and in operation, the total filtering surface of this Company will be about 8 acres, and they will have the power of filtering their water efficiently at all times. The boring put down at the Ditton works reached the chalk at a depth of 385 feet from the surface, and water rose to a height of 8 feet above the ground level, and continues to flow to the same height. It is estimated that from 1 to 1½ million gallons of water per day might be obtainable from this source. A boring has also, during the past year, been sunk at the Company's works at Molesey, and the chalk was reached at a depth of 426 feet. The water in this case also rises to the ground surface, but does not flow over at that level. These waters, mixed with the water from the Thames, would form an excellent auxiliary supply, and the putting down of wells at both these places is under consideration. A main, 5½ miles in length, of 18-inch, 13-inch, and 12-inch diameter cast-iron pipe, is being laid down from the Company's reservoir at Crown Hill, Upper Norwood (high-water level of reservoir, 316 feet above Ordnance datum), to Wimbledon, to improve the supply of this growing district. The laying of this main is fast drawing to completion.

Chelsea Water-Works Company.—This Company are now giving constant supply to nearly 1000 houses and factories, and are fully prepared to extend the system as required. All new estates and new lines of streets are being so supplied, though, judging by the very few applications made for such supply, there appears to be no desire on the part of public authorities or private individuals for constant service in the district. A system of auxiliary mains has been adopted by this Company. These mains, which are of large diameter (principally 24-inch and 18-inch), have been laid for the purpose of increasing the pressure, and of enabling the Company to extend constant supply as and where required. They have proved very satisfactory in every respect, and completely answer the purpose for which they were laid, as they are not only capable of conveying a larger quantity of water to the district, but have increased the pressure for high services where most required. The subsiding reservoirs at West Molesey, taken into use at the end of 1877, enable the Company to supply effectually filtered water at all times. This Company are now equal in efficiency to any of the Companies drawing their supply from the Thames, and the improvement in the quality of the water now supplied, especially during the period of floods, is of a very marked character.

Lieut.-Col. Bolton adds: From the foregoing remarks it will be seen that all the Companies are moving in the matter, and giving constant supply under the provisions of the Metropolitan Water Act, 1871, in a portion of their districts, except the Grand Junction Company. The Act provides power to compel the Companies to give constant supply, as and when the public authorities may see fit to demand it; but no Company is compelled to give such constant supply if it can be shown by them that after the expiration of two months from the time of service of the requisition, more than one-fifth of the premises in such district are not provided with the proper fittings, in accordance with the regulations made under the above-mentioned Act. The number of miles of streets which contain mains constantly charged, and upon which hydrants for fire purposes could at once be fixed, in each district of the Metropolis, is as follows:—Kent, 85 miles; New River, 201; East London, 85; Southwark and Vauxhall, 115; West Middlesex, 70; Grand Junction, 35½; Lambeth, 70; Chelsea, 56; making a total length of 717½ miles. The Water Companies are ready to affix hydrants thereon when required by the authorities. The total number of hydrants erected is at present 5384, of which 2982 are for private purposes, 555 for street-watering, 1336 for public use, and 475 in Government establishments.

COMMERCIAL GAS COMPANY.

The Half-Yearly General Meeting of this Company was held on Friday last, at the Cannon Street Hotel—RICHARD BRADSHAW, Esq., presiding. The SECRETARY (Mr. H. D. Ellis) having read the notice convening the meeting, the Chairman affixed the seal of the Company to the register of stockholders, and the minutes of the last general meeting were read. The following report and accounts were taken as read :—

The Directors submit the accounts for the half year ended Dec. 31, 1879. The revenue account shows a net profit for the half year of £45,820 9s. 2d. Deducting therefrom £1575 for interest on debenture stock, there remains the sum of £44,245 9s. 2d., of which, having regard to the sliding scale prescribed by the Company's Act of 1875, and the price of gas charged during the half year (reduced, as announced at the last meeting of the Proprietors, to 3s. 3d. per 1000 cubic feet), the sum of £34,600 is available for dividend.

The Directors recommend the payment thereof of dividends at the rate of £11 5s. per cent. per annum upon the old stock, and £3 5s. per cent. per annum upon the new stock, both less income-tax, and that the balance be carried to the reserve-fund.

The sum of £6200 will, in accordance with the Company's Act, be added to the reserve-fund, and invested in Government securities, and the balance of the new profits, £3445 9s. 2d., will be carried to the next half year.

To provide for the increasing demand for gas, the Directors have found it necessary to extend the Company's means of supply, and have accordingly entered into contracts for the construction of a new tank and the erection of an additional gasholder at the Poplar station. To meet the outlay thereby incurred, and to provide for the other requirements of the Company, further capital will be wanted, and resolutions will be submitted to the meeting, authorizing the Directors to raise the sum of £60,000, by the issue of new stock to that amount, payable on the 1st of July next.

The Directors have appointed Mr. H. D. Ellis as Secretary in the place of Mr. E. J. Southwell, deceased, and a resolution will be submitted to the meeting as to his remuneration.

The following Directors, Thomas Morrison Fairclough, Esq., Henry Laurence Ham-mack, Esq., and Thomas Wrake Ratcliff, Esq., retire by rotation, and, being eligible, offer themselves for re-election.

George Hsley, Esq., one of the Auditors, will also go out of office by rotation, and, being eligible, offers himself for re-election.

No. 1.—STATEMENT OF CAPITAL (Stock) on Dec. 31, 1879.

Acts of Parliament relating to the Raising of Capital.	Dividend Authorized with Gas at an Initial Price of 3s. 9d.	Paid up.	Remaining to be Paid up and Unissued.	Total Amount Authorized.
Commercial Gas Act, 15 & 16 Vict., cap. 155	10 per cent.	£450,000	..	£450,000
Ratcliff Gas Act, 18 Vict., cap. 12	Ditto.	100,000	..	100,000
Commercial Gas Act, 38 & 39 Vict., cap. 200	7 per cent.	70,000	£210,000	280,000
		£620,000	£210,000	£830,000

No. 2.—STATEMENT OF LOAN CAPITAL on Dec. 31, 1879

Acts of Parliament Authorizing the Loan Capital.	Description of Loan.	Rate per Cent. of Interest.	Total Amount Borrowed	Remain-ing to be Borrowed.	Total Amt. Au-thorized.
Ratcliff Gas Act, 18 Vict., cap. 12	Mort. or Bd.	5 per cent.	..	£20,000	£20,000
Commercial Gas Act, 38 & 39 Vict., cap. 200	Deben. stk.	4½ per cent.	£70,000	210,000*	280,000
* At interest not exceeding 5 per cent.			£70,000	£230,000	£300,000
Total share capital paid up (see No. 1)			£820,000		
Total loan capital borrowed (see No. 2)			70,000		
			£890,000		

Dr.

No. 3.—CAPITAL ACCOUNT.

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Expenditure.	Certified Receipts to June 30, 1879.	Total to Dec. 31, 1879.
To Expenditure as on June 30, 1879	£667,650 16 7	£667,650 16 7
Balance	22,349 3 5	22,349 3 5
	£690,000 0 0	£690,000 0 0

No. 4.—REVENUE ACCOUNT, for the Half Year ended Dec. 31, 1879.

To Manufacture of gas— Coals, including dues, carriage, unloading, and trimming (see account No. 8)	£57,285 17 1	By Sale of gas— Common gas, per meter, at 3s. 3d. per 1000 cubic feet	£106,716 18 10
Salaries of Engineers, Superintendents, and other Officers at works	1,827 1 0	Public lighting and under contracts, common gas (See statement No. 10.)	10,386 13 11
Wages (carbonizing)	12,789 0 0		£117,103 12 9
Purification, including £1309 0s. 9d. for labour	3,981 13 9	Meter-rental	2,113 18 2
Repairs and maintenance of plant and works, materials, and labour (less £72 18s. 11d. received for old materials)	11,481 0 7	Residual products— Coke, less £1534 9s. 5d. for labour	£17,814 3 4
	£87,364 12 5	Breeze, less £77 19s. 6d. for labour	330 0 4
Distribution of gas— Salaries and wages of Officers (including Rental Clerks)	£2,172 6 3	Tar	6,086 7 10
Repairs, maintenance, and renewals of mains and service-pipes, including labour	4,334 11 4	Ammoniacal liquor, less £4 4s. for labour	8,411 11 10
Repairs and renewals of meters	1,409 13 4		32,592 3 4
	7,916 10 11	Miscellaneous receipts, viz.— Rents	£78 1 6
Public lamps— Lighting and repairing	1,955 12 11	Interest	61 12 3
Rent, rates, and taxes	3,582 12 9	Transfer fees	42 12 6
Management— Directors allowance	£1,600 0 0		182 6 3
Company's Auditors	75 0 0		
Salaries of Secretary, Accountant, and Clerks	775 10 10		
Collectors commission	854 11 8		
Stationery and printing	559 6 10		
General charges	374 19 9		
	4,219 9 1		
Bad debts	737 17 10		
Law charges	80 1 8		
Superannuations	233 6 8		
Official officers	81 7 1		
	£106,171 11 4		
Balance carried to profit and loss, net revenue account (No. 5).	45,820 9 2		
	£151,992 0 6		£151,992 0 6

No. 5.—PROFIT AND LOSS (NET REVENUE ACCOUNT).

Interest on debenture stock	£1,575 0 0	Balance, June 30, 1879	£52,744 5 0
Balance available for dividend carried to balance-sheet	63,939 14 2	Less amount available for dividend, for half year ending June 30, 1879, and paid	33,050 0 0
			£19,694 5 0
		Balance from revenue account (No. 4)	45,820 9 2
	£65,514 14 2		£65,514 14 2

No. 6.—RESERVE-FUND.

Balance on Dec. 31, 1879	£30,944 3 7	Balance on June 30, 1879	£30,461 13 7
		Dividend received	482 10 0
	£30,944 3 7		£30,944 3 7

No. 7.—INSURANCE-FUND.

Balance on Dec. 31, 1879	£9,347 11 1	Balance on June 30, 1879	£9,347 11 1
	£9,347 11 1		£9,347 11 1

No. 8.—STATEMENT OF COALS.

Description of Coal.	In Store, June 30, 1879.	Received during the Half Year.	Carbonized during the Half Year.	In Store, Dec. 31, 1879.
	Tons.	Tons.	Tons.	Tons.
Common	7,100	75,227	69,472	12,855
Cannel	1,712	4,775	5,038	1,449
	8,812	80,002	74,510	14,304

No. 9.—STATEMENT OF RESIDUAL PRODUCTS.

	In Store, June 30, 1879.	Made during the Half Year.	Used during the Half Year.	Sold during the Half Year.	In Store, Dec. 31, 1879.
Coke—Chaldrons of 36 bushels*	1,648	95,986	30,021	62,960	4,653
Breeze do. do.	613	8,645	..	6,738	2,520
Tar Gallons	173,400	651,654	..	679,454	145,600
Am. liq.—Butts of 108 galls.	3,318	24,427	..	26,316	1,429

* Under "Weights and Measures Act, 1878."

No. 10.—STATEMENT OF GAS MADE, SOLD, &c.

Description of Gas.	Quantity Made. Meter Register.	QUANTITY SOLD.			Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lights.
		Public Lights and under Contracts (estimated).	Private Lights (per Meter).	Total Quantity Sold.				
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	767,568	50,715	656,720	707,435	8,143	715,578	51,990	4,680

of Works on behalf of the consumers. Every time the consumer had a benefit the gas company received a benefit, and he might say that it was a matter they were compelled to accept. He advised his Directors to accept it, and he was quite sure that if Mr. Rawlinson's Company had done the same thing, they would not have had that gentleman at the meeting condemning that which had been so satisfactory on both sides. This was the fifty-second half year the Shareholders had passed him a vote of confidence and thanks, and every time it had tended to encourage him, and he was sure that such a vote was always an incentive to the officers of a company.

The SECRETARY, in reply, said he felt that, at this very initial stage of his labours, the prosperity of the Company, upon which he believed the vote of thanks was based, was very little owing to anything he had done, and he would take the vote as indicating what he might expect in future if he deserved it.

The proceedings then terminated.

SHEFFIELD UNITED GAS COMPANY.

The Fiftieth Ordinary General Meeting of this Company was held on Thursday last—Mr. J. HOBSON (in the absence of Mr. F. T. Mappin, the Chairman of the Company) presiding.

The following report and accounts were presented:—

Since the last meeting nothing has occurred upon which it is needful for your Directors to make any comments in this report.

The accounts which your Board have now to submit to you show that, notwithstanding the reduction of 2d. per 1000 cubic feet which came into operation at the end of September, the profits for the half year ending the 31st of December last are only £335 10s. 0d. short of the maximum dividend for that period, and that, after payment of such dividend, there will remain to carry forward to the credit of the half year now current the sum of £17,737 5s. 11d.

Your Board consequently recommend that there shall be paid a dividend for the half year after the rate of 10 per cent. per annum on all the Company's paid-up capital, which will be as under, viz.:—

On £135,000 class A stock	£6,750 0 0
On £209,053 10s. class B stock	10,452 13 6
On £99,700 class C stock	4,985 0 0
On £12,937 new ordinary £10 shares (second issue), £4 per share paid up, being 4s. per share, or	2,587 8 0
On 11,462 E shares of £8 10s. each, £2 per share paid up, being 2s. per share, or	1,146 4 0
	£25,921 5 6

The maximum price of gas for the half year was, to Sept. 30, 2s. 6d., and from that date 2s. 4d. per 1000 feet.

Capital Account, for the Half Year ending Dec. 31, 1879.

Receipts.	
Class A stock, fully paid up	£135,000 0 0
Do. B do. do.	209,053 10 0
Do. C do. do.	99,700 0 0
12,937 new ordinary £10 shares (second issue), £4 per share paid up	51,795 0 0
11,462 E £8 10s. shares, created May 6, 1878, £2 per share paid up	23,924 0 0
Amount raised on mortgage	15,300 0 0
	£536,725 10 0

Expenditure.

Land, buildings, parliamentary and other expenses, works, and machinery (including mains to June 30, 1855) to June 30, 1879	£401,749 6 34
Less depreciation	1,924 15 0
	£402,824 11 34
Ditto, extensions to Dec. 31, 1879	841 2 11
Mains from June 30, 1855, to June 30, 1879	£76,438 4 9
Less depreciation	481 3 9
	75,957 1 0
Ditto, extensions to Dec. 31, 1879	2,379 2 11
Meters to June 30, 1879	£30,901 8 7
Less depreciation	772 10 8
	30,128 17 11
Ditto, extensions to Dec. 31, 1879	519 6 0
Balance	24,072 7 11 1/2
	£536,725 10 0

Revenue Account.

Receipts.	
Balance brought from last account	£18,072 15 2
Half year's gas and meter rents due this day	60,497 18 6
Amount arising from the sale of coke, tar, waste lime, and ammonia water	19,953 4 1
Amount realized from the manufacture of sulphate of ammonia, sale of gas-fittings, and work done (after deducting all charges), and house and other rents	4,401 19 11
Interest received from investments of the reserve-fund, bankers, and others	1,628 16 0
	£104,584 13 8

Expenditure.

Half year's expenditure in the production of gas	£60,560 6 6 1/2
Paid mortgages for interest during the half year	365 16 6
Balance	43,658 10 7 1/2
	£104,584 13 8

General Balance.

Balance of revenue account. £43,658 10 7 1/2	Ledger balances, and accounts owing to the Company	£59,211 9 2
Ledger balances, and accounts owing by the Company	Stores in hand	18,036 12 6
Balance of capital account . 24,072 7 11 1/2	Balance due from Bankers	29,155 15 1
	Balance due from Cashier	1 14 0
		£106,105 10 9
Reserve-fund, invested June 30, 1879		£63,194 14 11
Amount transferred from revenue, Oct. 9, 1879		3,860 6 1
		£67,055 1 0

The CHAIRMAN, in moving the adoption of the report, said the Shareholders would observe that the balance to carry forward was £17,737 5s. 11d., against £18,072 last half year. This was a slight decrease, but they should bear in mind that there was a real reduction for the past half year, particularly for the last quarter, of 3d. per 1000 feet in the price of gas—a thing unprecedented in the business of the Company. Still, £17,000 was no small item to be carried forward on the revenue account. The reserve-fund, as the Shareholders knew, was full. The business of the Company had increased about 4·30 per cent. during the past half year, and the increased demand had caused them to use 4889 tons of coal more than in the corresponding period of 1878. The consumption of gas was still increasing, and this must be very satisfactory to all the Shareholders. The most important matter lately transacted was the letting of the contracts for coals, and he was glad to say that, notwithstanding the great prosperity in the iron trade, and the rise in the price of coke, the Company had made favourable contracts for coals for the ensuing year. This was

a very important matter for the maintenance of the dividends. With regard to the works, a number of retorts were being most advantageously re-set in beds of seven, instead of five or six, and this would make it more economical for the Company in the manufacture of gas. The Company were not progressing very fast, but still they were going on steadily. A new tank and gasholder were being constructed, and the Company would thereby be able to meet the increased demand for gas that each winter produced. The Directors found that the general warehouse business of the Company in Shude Hill kept extending, and they had arranged for securing additional land which would in due time be occupied. Plans for new buildings were in contemplation, and he thought it would be of interest if the Shareholders knew that these extensions were to be made. They must not be too desirous of paying up their shares, as there was a sum of £24,072 7s. 11d. still to expend before a call could be reasonably expected. There was £18,300 yet on loan, and some of that would soon be falling due, and would have to be paid off; but he hoped the Directors would be able to meet it.

The Rev. G. SANDFORD seconded the motion, and it was unanimously adopted.

On the motion of the CHAIRMAN, seconded by Mr. T. WATERHOUSE, dividends for the half year to Dec. 31, 1879, were declared as follows:—5 per cent. on the A, B, and C stocks; 4s. per share on the new ordinary £10 shares; and 2s. per share on the E shares.

A vote of thanks was unanimously accorded to the Chairman, and the proceedings terminated.

EAST LONDON WATER-WORKS COMPANY.

The following is the report of the Directors, presented to the Proprietors at the Half-Yearly General Assembly held on Thursday last:—

The half year's accounts to Christmas last are herewith submitted to the Proprietors.

The revenue from water-rates stated therein is £1757 less than appeared in the accounts presented last year; this diminution is to be attributed to the depression of trade and the severity of the season. The progress of the Company is apparent from the increase of houses laid on, there having been 3836 additional supplies during the year 1879.

The expenditure for maintenance and repair of mains, &c., is £2355 in excess of the corresponding amount of last year, while the whole expenditure for maintenance and management is £583 less than the amount in 1878. The expenditure on capital account amounts to £30,027 19s. 11d., leaving a balance of £5028 7s. 1d. unexpended. The completion of works undertaken will exceed the amount now in hand.

The Company's works, machinery, and property are all well maintained, and in good order. The water pumped during the half year was 5,664,055,088 gallons, showing an increase of 51,753,217 gallons over the corresponding period of 1878. This increase is to be attributed in some degree to the excessive waste consequent upon the extension of constant supply, the long-continued frost involving serious damages to mains, together with the culpable action of tenants in running water continually to waste to avoid freezing during the severe weather.

Three Directors go out of office by rotation—viz., Messrs. Coope, Davis, and Barnard—but all are eligible for re-election. They have given the notice required by the Company's Act of Parliament. One of your Auditors, Mr. W. Bird, also goes out of office by rotation, but is eligible for re-election.

The Directors recommend that a dividend at the rate of 6 1/2 per cent. per annum, clear of income-tax, on the ordinary stock be declared, payable on the 10th of July next in the usual manner.

Dr.—REVENUE ACCOUNT, FOR THE HALF YEAR ENDING DEC. 25, 1879.

Maintenance.	
To Maintenance and repair of impounding and service reservoirs, works, and pipes, or for obtaining and storing of water, including the cost of materials and labour	£2,491 9 5
Maintenance and repair of mains, pipes, fittings, meters, and works connected with the distribution of water, including the cost of materials, labour, and renewals	5,971 19 9
Pumping and engine charges, including the cost of coals, wages, &c.	6,738 3 5
Filtration, including the cost of materials and labour	1,895 2 5
Salaries of Engineer and Clerks, and wages of Inspectors and Turncocks	4,804 1 10
Rents of houses and lands, accrued due to date, and owing by the Company	768 8 6
Abstraction of water—Thames and Lea	2,000 0 0
Rates and taxes, exclusive of income-tax	9,780 5 9
	£34,449 11 1

Management.

Allowance to Directors	£1,071 17 6
Allowance to Company's Auditors	21 8 9
Salaries of Secretary, Accountant, and Office Clerks	1,267 4 7
Superannuation of servants of the Company	413 12 11
Commission to Collectors	3,133 10 11
General establishment charges	1,638 12 4
Law and Surveyor's charges	34 2 0
Official Auditor and Water Examiner	100 19 6
	7,621 8 6

Re-construction of Middlesex filter-beds, subject to apportionment between revenue and capital on completion of the work	3,512 10 0
Dividend and interest account for transfer of profits	58,662 12 1
Balance carried to next account, to provide for losses	4,500 0 0
	£108,746 1 8

Cr.—REVENUE ACCOUNT.

By Balance brought from former account	£4,500 0 0
Less sums written off as losses, viz.:—	
Empty houses, houses cut off, and bad debts	1,986 8 5
	£2,513 11 7
Water-rates accrued to Dec. 25, 1879	104,200 2 1
	£106,713 13 8
Rents of houses and lands accrued to date, and owing to the Company	1,141 18 6
Fees received for registration of shares, transfers, &c.	26 7 6
Charges for laying on water	864 2 0
	£108,746 1 8

ALLIANCE AND DUBLIN CONSUMERS GAS COMPANY.

The Half-Yearly General Meeting of this Company was held on Wednesday last—EDWARD FORTRELL, Esq., J.P., in the chair.

The following report and accounts were presented:—

The Directors have pleasure in transmitting to the Proprietors the annexed statement of accounts and balance-sheet for the half year ended Dec. 31, 1879, duly audited.

The total revenue derived from the working of the half year amounts to £127,696 3s. 4d., the expenditure, inclusive of bond and debenture interest, &c., being £87,944 12s. 2d.; showing a net gain on the half year of £39,751 11s. 2d., from which the Directors recommend the payment of dividend at the rate of 10 per cent. per annum, free of income-tax. After the payment of dividend a balance of £10,251 11s. 2d. will remain to be added to previous balances, thus making a sum of £45,614 3s. 9d. to be carried to next account.

The Directors being satisfied that the prosperous condition of the Company warrants a further concession in the price of gas, have determined upon a reduction of 4d. per 1000 cubic feet in the city, the townships of Rathmines, Pembroke, Blackrock, and Kingstown, to take effect from the September quarter.

During the past half year the Directors have entered upon a new branch of business—viz., letting on hire gas cooking and heating apparatus. It is anticipated that a considerable increase in the sale of gas for day consumption will be effected by the introduction of this system.

The Directors regret having to record the death, during the half year, of one of their colleagues, Edward McCreedy, Esq. They have appointed to his seat at the Board

Charles Lawler, Esq., a gentleman who for many years has taken a deep interest in the Company's business.

Three Directors retire by rotation—Edward Fottrell, Esq., J.P., David Drimnie, Esq., and M. Brooks, Esq., J.P., M.P. Being eligible, they offer themselves for re-election.

The vacancy caused in the auditorship by the retirement of Charles Lawler, Esq., will be filled up at the meeting.

Dr.—Capital Account, for the Half Year ended Dec. 31, 1879.

	Expended this Half Year.	Total to Dec. 31, 1879.
Expenditure to June 30, 1879	..	£727,781 19 8
Expenditure on manufacturing plant, machines, storage works, and other structures connected with manufacture (not in place of old ones)	£4,225 5 9	
New mains and service-pipes (not being in place of old ones), including laying same, paving, and other works connected with distribution	1,691 0 2	
New meters (not in place of old ones), including fixings, &c.	1,012 2 4	
Horses, carts, &c.	349 12 2	
Parliamentary expenses	682 10 2	
		7,960 13 7
Total expenditure	..	£735,742 13 3
Balance of capital account	..	1,701 16 9
		£737,444 10 0

Cr.—Capital Account.

	Certified Receipts to June 30, 1879.	Received during Half Year.	Total Receipts to Dec. 31, 1879.
Share capital	£589,944 10 0	—	£589,944 10 0
Bonds and debenture stock	147,500 0 0	—	147,500 0 0
	£737,444 10 0	—	£737,444 10 0

Dr.—Revenue Account.

To Manufacture of gas—			
Coals, including dues, carriage, unloading, and all expenses of depositing same on works	£50,658 11 7		
Purifying materials, oil, water, and sundries at works	782 12 4		
Salaries of Engineers, including Chief Engineer, Superintendents, and Officers at works	1,476 0 0		
Wages at works	7,882 7 1		
Repairs and maintenance of works and plant (including renewal of retorts), machines, apparatus, tools, materials, and labour	8,555 12 0		
	£69,355 3 8		
Less old materials sold	191 14 8		
		£69,163 8 4	
Distribution of gas—			
Salaries of Surveyor, Chief Inspector, Inspectors, Assistant Inspectors, and Clerks in Light Office	£1,284 3 11		
Repair, maintenance, and renewal of mains and of service-pipes, including materials, laying and paving, and labour	2,380 7 0		
Repairing, renewing, and refixing meters	1,621 12 7		
		5,296 3 6	
Public lamps—			
Lighting and repairing		347 14 4	
Rents, rates, and taxes—			
Rents	£795 8 5		
Rates and taxes	3,198 12 8		
		3,994 1 1	
Management—			
Directors allowances	£675 0 0		
Salaries of Secretary, Accountant, and Clerks, Office-keepers, and Messengers	1,119 13 6		
Collectors commission	995 19 7		
Stationery and printing	244 17 3		
General establishment charges and incidentals	768 12 2		
Company's Auditors	30 0 0		
		3,834 2 6	
Law and parliamentary charges		221 17 10	
Bad debts		584 18 2	
Abatements and allowances, &c.		865 10 9	
Annuity account		500 0 0	
		£84,807 16 6	
Balance carried to profit and loss account		42,888 6 10	
		£127,696 3 4	

Cr.—Revenue Account.

By Sale of gas—			
Gas (444,530,100 cubic feet), at 4s. 3d., 4s. 6d., and 5s. per 1000 cubic feet	£96,649 4 10		
Public lighting and under contracts	5,334 12 5		
		£101,983 17 3	
Rental of meters		2,779 0 0	
		£104,762 17 3	
Residual products—			
Coke, less labour and cartage, &c.	£13,642 18 5		
Breeze	856 8 2		
Tar	4,217 11 0		
Ammoniacal liquor	2,522 7 2		
Spent oxide	588 3 9		
		21,827 8 6	
Rents		204 0 6	
Transfer fees		40 10 0	
Ship Dispatch, money received		861 7 1	
		£127,696 3 4	

The CHAIRMAN, in moving the adoption of the report and accounts, said the receipts for the past half year, compared with those for the corresponding six months of the previous year, showed a diminution of £1800. This was, however, consequent upon a reduction of 3d. per 1000 feet in the price of gas, and the fact that the sum was so small showed there had been a continued increase in the use of gas. During the last half year 2000 tons more coal had been carbonized than in the same period of 1878, while an increased quantity of gas had been sent out. It was clear, therefore, that as the price of gas went down, the consumption became more extensive. The Directors, as the report stated, were encouraging the use of gas-stoves and gas-engines. There were now 32 of the latter in full operation in Dublin, and the Company had lent on hire about 50 gas-stoves or ovens, in addition to those which had been purchased. The Directors were now about to further reduce the price of gas, and in taking this step they were quite confident they could safely do it. They had extended their coal contracts, and knew exactly what their raw material would cost, and they believed it was to the interest of the Company as well as to that of the consumers that the price should be kept down when-

ever it could be prudently done. At the meeting of the Corporation last January some very angry expressions were uttered about the Company not reducing the price of gas. Since he had become Chairman, the rule had been followed of not answering statements made outside their general meetings. The Directors believed it was best to follow this rule, otherwise a complete reply could have been made to the statements put forth. Some members of the Corporation appeared to be glad to have the chance of making a little tirade against the Company. The Corporation were not such large consumers of gas as might be supposed. They used it at their head-quarters and at their different stations, but he did not regard the city gas-lamps as Corporation lights. The Corporation, no doubt, were the paymasters, but the 3300 lamps through the city were, in truth, separate customers, inasmuch as each had a separate service-pipe. No doubt the Corporation paid for these lamps, but when they talked of getting a liberal allowance for prompt payment, he must say that the Company were not very pressing, for the Corporation at present owed them for four quarters gas, amounting to more than £11,000. He thought, under these circumstances, the Corporation ought to be more lenient in their statements about the Company. He might add that all the talk and agitation in the Corporation last December and January did not in the slightest degree urge the Directors towards reducing the price of gas. They had made their calculations, and considered the question solely on its merits. The electric light scare came and went according as it was wanted, and the Directors felt bound to show what gas could do in the way of lighting, and do at a much less cost than that of the electric light. Accordingly, they put up a range of very fine new lamps in Sackville Street, and left them there long enough to let the Corporation judge the effect. No move, however, was made on their part towards paying for them, and, of course, the Directors, in the interests of the Shareholders, ordered the lamps to be taken down, as they could not continue supplying the gas for nothing. Naturally the citizens regretted the loss of the lamps, which formed a splendid spectacle, and effected a great improvement in Sackville Street. Since the last meeting of the Company new works had been erected at Bray, on a site secure from the encroachments of the sea, and the Company were now enabled to supply gas to that town without any interruption. In 1874 the Company took parliamentary power to raise £50,000 of capital, evidence having been given before the Select Committee that this sum was required. Since 1874, by the judicious use of the money which came into their hands—the "hanging balance"—the Directors had hitherto dispensed with raising any capital; but the time had now come when it was necessary to do so, and the Shareholders would be called to attend a special meeting at some future day to sanction the proceeding. The manner of issuing the additional capital was at present before the Board, and the Shareholders might take his word that the issue would be carried out in such a way as not to interfere with the present value of their property. In conclusion, he had to mention that the Directors would, in accordance with the notice given, submit a proposition to increase the salary of their Secretary and Manager, Mr. W. F. Cotton. Mr. Cotton had given a great deal of his time and attention to the works and business of the Company—in fact, he devoted himself day and night to their interests—and the Directors conceived that now, when they were enabled to keep up the dividend to 10 per cent., and reduce the price of gas, Mr. Cotton's services should be suitably recognized.

Mr. CREE seconded the motion, and in doing so expressed his entire approval of the efforts made by the Directors to utilize gas for other purposes than lighting. He believed there was room for very great development in this direction. He approved of the proposed reduction in the price of gas; while as to the differences with the Corporation, he saw no reason for hostility. The Corporation ought to be prepared to pay a fair price, and the Company, he was sure, were willing to charge only a fair one. With regard to Mr. Cotton, he was satisfied that no salary, within a reasonable amount, that could be paid to this gentleman would be too great compensation for the ability and untiring devotion which he displayed in the management of the Company's affairs.

Mr. S. CREEGH doubted whether it was expedient to reduce the price of gas just now. The Company did this once before, and the crisis in the coal trade which followed left the Shareholders without dividend for two years. Such a crisis might occur again, and he thought the Directors ought to pause before making any reduction.

The CHAIRMAN said before the Directors decided on reducing the price of gas they went fully into the question. They had contracts for a supply of coal for two years certain, and they felt quite safe in making the reduction. Besides, they had power to increase the price if the necessity ever arose.

The motion was put, and carried unanimously, and a dividend at the rate of 10 per cent. per annum declared.

The CHAIRMAN then moved, and Mr. CROSTHWAIT, J.P., seconded—"That the salary of Mr. W. F. Cotton, the Secretary and Manager, be increased by £250 a year."

Mr. R. BRUNKER, in supporting the motion, said he was convinced the proposed increase of Mr. Cotton's salary was simply a just reward of his invaluable services. Mr. Cotton acted in the twofold capacity of Secretary and Manager, and in the service of the Company he had manifested an ability and energy that rarely had been equalled, and certainly could not be surpassed. In 1874 the undertaking was on the verge of ruin. Mr. Cotton at that time took the affairs of the Company in hand. He undertook the duties of Secretary and Manager, and his presence was felt in every department of the concern, and now the Shareholders were receiving 10 per cent. dividend, which their Chairman gave them an assurance that day would be kept up. When Mr. Cotton began his duties they were not half so arduous as they were now. There had been a vast increase in the rental of the Company, imposing additional labour and responsibility upon him, and under these circumstances he (Mr. Brunker) repeated that the Shareholders would be merely doing Mr. Cotton justice in increasing his salary.

The motion was unanimously agreed to.

Mr. COTTON briefly returned thanks, assuring the Shareholders that they might rely upon his continued zeal and devotion to their interests.

The retiring Directors were then re-elected, and Mr. R. Brunker and Mr. G. Cree were each proposed to fill the post of Auditor to the Company. Upon a division, Mr. Cree was declared to have obtained the larger number of votes; a scrutiny was, however, demanded on behalf of Mr. Brunker.

The proceedings closed with a vote of thanks to the Chairman.

GERMAN CONTINENTAL GAS COMPANY.

We have been favoured with a copy of the twenty-fifth annual report (year ending Dec. 31, 1879) of the Directors of this Company, and the following condensed translation of the introductory description therein given of the present condition of the Company, and of the main features of their operations during the past year, will, we trust, be of interest to our readers:—

The report commences by stating that the general tenor of its introductory portion continues to be of the same character as that of its two immediate predecessors. The general depression and the decrease of gas consumption resulting therefrom were strongly marked in Germany.

Although towards the close of the year some branches of business seemed to revive, the improvement was balanced by increased slackness in other branches. The decrease of consumption in the second period of the year was therefore considerably greater than in the first period. At the German stations the decrease was 2.93, as against 0.31 per cent. the previous year. At the foreign stations the decrease was 7.91, as against 7.17 per cent. the previous year. The gross increase, which is the smallest ever recorded, was only 1.67 per cent., against 2.53 per cent. in 1878, and 3.26 per cent. in 1877. The cold weather and bright days from the middle of November almost to the end of the year had a considerable influence on the total result. There was an improvement in the Russian rate of exchange, which greatly influences the Company's profits. The average was 206, as against 205 in 1878, 210 in 1877, 256 in 1876, and 272 in 1875. In other respects the year 1879 was not very remarkable. The electric light panic has, the report states, now finally subsided. The shares of the Company having been quoted at 123 on Nov. 21, 1878, when they were at their lowest, stood at 139 on Dec. 31, 1878, and during last year gradually worked up to their usual price. On Dec. 31, 1879, they were again valued at 165. The Directors have, by the publication of pamphlets, by communications to the newspapers, and by answering innumerable inquiries, done everything in their power to assure the Shareholders, and to prevent losses to them by the Company's shares falling in value; yet they were unable to prevent large sales taking place. The shares sold have, however, in some cases been bought back at enhanced prices by the vendors. This confidence in the future of gas manufacture has by no means been caused by failure of the electric light. On the contrary, the latter is being technically developed and improved. The confidence in gas is to be attributed to a better knowledge having been gained as to the different purposes for which each method of illumination is best adapted. The electric light will never be suitable for the purposes for which gas is principally sold, on account of the mechanical and physical difficulties in the creation and conduction of electric currents. It may be hoped that the public will now become regardless of all the sensational American reports, which never cease to predict the ruin of gas lighting. The experiments made last year by the Prussian Ministry of Commerce in the use of electric lighting, at the extensive works at the port of Ruhrort, did not fulfil general expectation. The Royal Harbour Commissioners have, in consequence, recently entered into a fresh contract for gas with the Company.

Trials of the electric light have had some beneficial effect on gas lighting, more attention being now given to the production of large burners of very high illuminating power. The grand experiments made in this direction in Paris and in London fully prove that gas is suitable even for the most intense illumination, and is less expensive than electricity. Public lighting is, however, carried on so economically in Germany, that the Company scarcely expect to profit much by this class of improvements.

With respect to the competition of gas with petroleum, the report is not so favourable as in the case of that with the electric light, although the contest has not become greater. Better times are expected to bring the return of a number of consumers who have left the Company. Nothing had hitherto been expected from the duty which was imposed last year on petroleum, nor is any future benefit looked for.

The increase in the number of consumers, especially for private houses, has not ceased; yet the average yearly consumption of each burner decreased in still greater proportion than the total number of burners increased, partly because of the reduction in the number of hours worked daily, but chiefly on account of the saving of light everywhere practised. On railways the decrease thus caused was larger than anywhere else, the station-masters being interested in the economy effected thereby. The above may be said to account for the decreased consumption observable throughout Germany and Austria. In Warsaw, as in Germany after the war, business was brisk, and a large number of new establishments were erected. A considerable increase therefore took place in that city.

At present there are prospects of an extensive use of gas for cooking and heating purposes. The Company had previously endeavoured to promote this class of consumption, having considerably lowered the price of gas used for the purpose, and also for gas motors, and they are still endeavouring to develop the use of gas in this direction. Great improvements in the construction of burners, stoves, cooking apparatus, and ovens, have been made, especially in Denmark, by which it is proved beyond doubt that in the future gas will be found by far the cheapest fuel for cooking, and, under certain circumstances, for heating also. The gas-fire has the further advantage of being convenient and clean. There are towns in Denmark in which a third or half of the entire quantity of gas consumed is used for cooking purposes. The Company have engaged an Engineer especially for this branch of their business, and intend soon to send him to Denmark. It is very difficult to introduce new applications of this nature, ladies being very conservative. In spite of this, the substitution of gas for petroleum may be expected at no distant date.

The gas-meter works at Dessau were, in consequence of the depression in trade, very little employed; only 358 new indices were made and 173 repaired, and 401 were altered to the metric system, which is 170 less than last year. The manufacture of brass fittings, mentioned in last year's report, increased largely, and was further extended to simple lighting apparatus, rheometers, lanterns, &c. The net profits realized in this department were 14.18 per cent., against 7.66 per cent. last year.

In all 9496.30 marks were expended in medical assistance, insurance against personal accidents, pensions, &c. No accidents or interruptions to working occurred. The private insurance account was only called upon to bear the small charge of 232.75 marks, for covering a loss by spontaneous combustion of coal. The balance of this account is at present 96,503.02 marks.

The slackness in trade rendered unnecessary the appointment of a second Engineer to succeed the late Mr. M. Voss. Mr. O. Möhr was the sole Chief Engineer employed during the year.

It is well known to the Shareholders that the Directors have for several years had under consideration an alteration in the old lighting contracts, according to which the works would be handed over gratis to the respective communities at the end of the contract periods. On the 22nd of January a clause altering this arrangement was added to the contract with the Municipality of Ruhrort. The above stipulation is still in force only in the contracts with Mülheim-on-the-Ruhr, Krakau, and Lemberg, the gas production of which is only 12 per cent. of the whole. All the other works will remain the property of the Company in perpetuity.

The consumption of gas has been classified as follows:—

	Cubic Metres.	Per Cent.
Street lighting	2,674,368	= 14.09
Public buildings	1,777,632	= 9.37
Private houses	8,645,318	= 45.55
Manufactories and railways	5,521,965	= 29.09
Cooking, heating, and gas motors.	360,349	= 1.90

Total 18,979,632 = 100.00

For the first time the consumption for cooking and heating purposes, and for gas-engines, has been separately classified, as it may be interesting

to follow the future progress in this respect, although the quantity has been partly estimated approximately, no meters being in use for some cooking apparatuses. It may be pointed out that there has been a considerable increase in the consumption of gas for street lighting, and a decrease in the consumption at railway-stations, cotton-mills, and iron and steel works. The quantity used for gas motors increased from 107,828 cubic metres to 141,099 cubic metres. Their number is at present 102, of about 209-horse power.

The working results of the different establishments are next examined; with the remark, that any decrease in consumption not specially accounted for is to be ascribed to depression in trade.

	Production. Cubic Metres.	Number of Burners.
1. Frankfort-on-the-Oder 1878	1,330,430	.. 14,969
Do. do. 1879	1,276,397	.. 15,124

Decrease 54,033 Inc. 155

The slight increase in 1878 has thus been followed by a decrease. The profits are, however, larger, owing to more "Niederschlesische" than English coal having been used, and several economies having been introduced, especially as regards generator furnaces. Permission has been obtained for the erection of a branch establishment on the newly acquired site in Fürstenwalder Strasse.

	Production. Cubic Metres.	Number of Burners.
2. Mülheim-on-the-Ruhr 1878	867,540	.. 11,411
Do. do. 1879	815,870	.. 11,517

Decrease 51,670 Inc. 106

The decrease was, therefore, greater than in 1878 or 1877, which is chiefly owing to the diminished consumption at the railway-stations, in workshops and iron-works, and for the public lighting. The results were the more unsatisfactory, as the Companies were obliged, by the terms of their contract with the Municipality, to make a large reduction in the price of gas to private consumers from Jan. 1, 1879, and in the price of gas for public lighting from April 1, 1879. This alone accounts for a decrease of 11,870.26 marks. The lowest point in the consumption seems, however, to have been already passed, as the coal trade, which is of the greatest importance to Mülheim, is reviving, and there is also an improvement in the iron trade.

	Production. Cubic Metres.	Number of Burners.
3. Potsdam-Neuendorf. 1878	1,566,075	.. 17,347
Do. do. 1879	1,545,004	.. 17,824

Decrease 21,071 Inc. 477

Of this there was produced at Potsdam 1,313,405 cubic metres; at Neuendorf, 231,599 cubic metres—total, 1,545,004 cubic metres.

	Production. Cubic Metres.	Number of Burners.
4. Dessau. 1878	644,725	.. 10,650
Do. 1879	656,715	.. 10,943

Increase 11,990 Inc. 293

This increase is attributable to the extension of public lighting and of consumption by mills.

	Production. Cubic Metres.	Number of Burners.
5. Luckenwalde 1878	251,737	.. 3,545
Do. 1879	272,150	.. 3,756

Increase 20,413 Inc. 211

The increase is to be accounted for by the improvement and extension of the cloth trade.

	Production. Cubic Metres.	Number of Burners.
6. Gladbach-Rheydt. 1878	2,645,700	.. 30,886
Do. do. 1879	2,534,925	.. 28,860

Decrease 110,775 Dec. 1,976

The production having considerably increased during the first half of the year, afterwards diminished during the second half, resulting in the above decrease. This is attributable to the economy practised at the railway stations and by private consumers, as well as the competition with petroleum, and the depression of several branches of the cotton industry. In the current year there is no perceptible improvement as yet. During the year 1879 the entire substitution of generator furnaces was accomplished in these large works.

	Production. Cubic Metres.	Number of Burners.
7. Hagen-Herdecke 1878	1,033,010	.. 11,794
Do. do. 1879	966,880	.. 11,680

Decrease 66,130 Dec. 114

A considerable decrease, growing towards the end of the year, has, therefore, followed the small increase noted in 1878.

	Production. Cubic Metres.	Number of Burners.
8. Warsaw-Praga 1878	6,859,991	.. 53,147
Do. do. 1879	7,419,374	.. 57,613

Increase 559,383 Inc. 4,466

This was the largest increase ever observed in Warsaw, the number of burners also increased more than in 1878. The recovery of enterprise and commerce following the war, and the progress of gas lighting in private houses, were chiefly the causes of this result. The rate of exchange was, however, not satisfactory, and the loss from this, therefore, remained very nearly as before. As already mentioned, the rate at which the value of the Warsaw bills had been calculated, rose from 205 in 1878 to 206 in 1879. At the commencement of the year it even fell to the lowest point reached during the war. As stated in the last report, the increased production has necessitated the erection of a third retort-house, to contain 24 settings of eight retorts to be provided with generator furnaces of the newest design. Six of these settings have already been built. This year the fourth gas-holder will be telescoped, whereby the available gasholder space will be increased by about 8500 cubic metres. It was also necessary to build another house for the employees, so that at least all the officers and foremen could reside on the works. Rents have risen so much in Warsaw that the building was rendered necessary for reasons of economy alone, even if it had not been otherwise required for the proper service of the works.

	Production. Cubic Metres.	Number of Burners.
9. Erfurt 1878	1,165,941	.. 12,671
Do. 1879	1,070,943	.. 13,204

Decrease 94,998 Inc. 533

Although, allowing for a decrease in the loss of gas of 16,990 cubic metres, the real consumption has fallen off 74,008 cubic metres only, yet the decrease is not much less than in 1878. The reasons for this are the same as stated in last year's report—viz., less consumption by the railway companies, general saving by the public, and the competition of petroleum. That this last circumstance is of greater influence in Erfurt than in any other German town is accounted for, in addition to the depression, by the great and extending lamp manufacturing trade of the town. On July 1, 1879, the price of gas was reduced, whereby a loss of 6900·70 marks was sustained; but the consumption has not been thereby increased. This year, however, there appears to be a slight increase.

		Production. Cubic Metres.	Number of Burners.
10. Krakau-Podgorze	1878	674,879	6,548
Do. do.	1879	663,199	6,607

Decrease 11,680 Inc. 59

The three previous years having been marked by an increase in the gas consumption of Krakau, there was a decrease in 1879, which appeared to grow gradually throughout the year. The state of trade is no better at this place than in Germany. The exchange slightly improved from 171½ to 174.

		Production. Cubic Metres.	Number of Burners.
11. Nordhausen	1878	602,164	8,376
Do.	1879	583,315	8,564

Decrease 18,849 Inc. 188

This decrease was almost entirely balanced by reduction of waste. The trade of the town has not yet recovered from the depression of 1878. No visible effect followed the reduction in price which was made on July 1, and which cost the Company 3606·97 marks. It is hoped, however, that the current year will show a better result.

		Production. Cubic Metres.	Number of Burners.
12. Lemberg	1878	984,806	10,480
Do.	1879	943,107	11,265

Decrease 41,699 Inc. 785

At Lemberg, as at Krakau, and for the same reasons, there was a falling off instead of the usual regular increase. The exchange was the same as with Krakau. Customs were considerably increased.

		Production. Cubic Metres.	Number of Burners.
13. Gotha	1878	605,107	8,457
Do.	1879	603,061	8,778

Decrease 2,046 Inc. 321

By diminution of waste, this decrease was converted into an actual increase of 6422 cubic metres. The reduction of price which was made on July 1 caused a loss of 4423·79 marks, which it is hoped will be covered by increased consumption. The superfluous portion of the ground bought in 1873 for extension of works here was sold, and realized such an advanced price that the part retained did not cost anything. The building charges of the establishment were in consequence 11,325·13 marks less than the previous year.

		Production. Cubic Metres.	Number of Burners.
14. Ruhrort	1878	461,687	4,327
Do.	1879	434,171	4,298

Decrease 27,516 Dec. 29

There was thus again a decrease here. The improvement in the iron and coal trade at the end of last year will, it is hoped, eventually extend to the business of the Company. The Ruhrort contract was similar to the other old contracts, enacting that after 30 years the town should have the right of purchasing the gas-works, and that after 50 years the works should become the sole property of the Municipality. As before mentioned, the Company succeeded in Jan. 22, 1879, in altering the contract in a manner satisfactory to both parties. Accordingly, the works are to remain in perpetuity the property of the Company, who have covenanted to gradually reduce the price of gas to 18 pfennige per cubic metre (1·258 thaler per 1000 cubic feet Prussian), and of gas for public use to 2 pfennige per hour. The Company had also to pay 60,000 marks in cash, which amount was almost covered by the redemption-fund. The contract for lighting the harbour has already been referred to.

		Production. Cubic Metres.	Number of Burners.
15. Eupen	1878	246,080	4,107
Do.	1879	275,475	4,002

Increase 29,395 Dec. 105

By this increase, attributable to the improvement in the cloth trade, the production nearly reached the point attained in 1874, and a further increase may be expected.

		Production. Cubic Metres.	Number of Burners.
16. Herbesthal	1878	94,921	246
Do.	1879	89,168	246

Decrease 5,753

The diminished consumption by the railways was in this case, as in so many others, the reason of the decrease.

The total results of the year are as follows:—

		Production. Cubic Metres.	Number of Burners.
1. Frankfort-on-the-Oder.		1,276,397	15,124
2. Mülheim-on-the-Rohr.		815,870	11,517
3. Potsdam-Neuendorf		1,545,004	17,824
4. Dessau		656,715	10,943
5. Luckenwalde		272,150	3,756
6. Gladbach-Rheydt		2,534,925	28,860
7. Hagen-Herdecke		966,880	11,680
8. Warsaw-Praga		7,419,374	57,613
9. Erfurt		1,070,943	13,204
10. Krakau-Podgorze		663,199	6,607
11. Nordhausen		583,315	8,564
12. Lemberg		943,107	11,265
13. Gotha		603,061	8,778
14. Ruhrort		434,171	4,298
15. Eupen		275,475	4,002
16. Herbesthal		89,168	246

Total. 1879 20,149,754 . . 214,281

Total. 1878 20,034,793 . . 208,911

Increase 114,961 Inc. 5,370
= 0·57 p. ct. = 2·57 p. ct.

Besides the increase in production, there is a diminution in waste to be taken into consideration, so that the real increase in consumption was 313,957 cubic metres, or 1·67 per cent. This is not only relatively, but absolutely the smallest increase recorded in any year since the formation of the Company.

In 1878 the lost and unaccounted-for gas had been reduced as low as 5·92 per cent. During the past year it was reduced to 4·9 per cent., owing to the search for, and stoppage of leaks having been energetically continued. This is a result never before attained by any gas management, and is the more remarkable as all the street burners are provided with rheometers, which admit only the quantity of gas contracted for, thus rendering over-statements as to the street-light consumption quite impossible. The loss of gas cannot well be so small this year, as a lasting intense frost has seriously affected the pipes.

The small increase in the number of burners, four-fifths of which is due to Warsaw, is a very good indication of the bad state of things. The decrease of 2224 burners at four stations does not, however, entirely fall on the past year. A special and careful enumeration has shown that in many cases the decrease should be spread over the preceding years. In the past year, as well as in the three preceding years, the percentage of increase in the number of burners is higher than that of consumption. The average yearly consumption per burner was, therefore, again reduced. For street-lamps it was 318·8 cubic metres, and for private burners 80·2 cubic metres, or respectively 5·1 more and 2·1 less per cent. than in 1878. The total average was 89·6 cubic metres, or 2·0 cubic metres less per cent. than the previous year.

The following quantities of coal were used during last year:—

	Hectolitres.	Per Cent.
Westphalian	348,096	or 40·52
Oberschlesische	313,943	" 36·74
English	70,344	" 8·23
Moravian	69,833	" 8·17
Niederschlesische	52,321	" 6·12
Platten Kohl, &c.	50	" 0·01

Total 854,587 or 100·00

So that the proportion of "ober-" and "nieder-schlesische" coals has increased, and that of English and Moravian coal has decreased. The total increase, as against 1878, was 2003 hectolitres. The average quantity of gas made per hectolitre was 23·6 cubic metres (1832 cubic feet English per old Prussian ton), or 0·1 cubic metre more than in 1878.

The average price of coal delivered at the works was 1·40 marks per hectolitre, or 3d. less than in 1878. This is the lowest price at which coal has been bought for eleven years. At six stations the price was a trifle higher, at all the rest it was lower than in 1878. The greatest difference in price (22d. per hectolitre) was at Frankfurt, the next was at Dessau (13d.), Krakau (11d.), and Potsdam (10d.). The considerable rise in the price of coal which took place at the end of 1879 will not affect the Company, who had previously purchased the whole of their requirements for 1880 at the same, and partly even at lower prices. Only for the small quantities of English and Niederschlesische coal were the Companies compelled to pay a slightly higher price.

The fall in the value of coke in 1878 was entirely balanced last year. The average price was 75d. per hectolitre, or 4d. more than in 1878. The rise only took place in the second period of the year, and particularly in the last month of the winter. Prospects are this year better for the coke market.

In the tar business there was a slight improvement of 9340·80 marks. The profits earned by the manufacture of salts of ammonia from the ammoniacal liquor were also very considerable, amounting to 92,572·46 marks, or 776·13 marks less than in 1878. The decrease is to be ascribed partly to an allowance having been made to the Managers, and partly to less ammoniacal liquor having been bought. Relatively there was an increase. At several stations the profits derived from the ammonia was greater than from the tar. For 1880 the prospects are still more favourable.

The greatest improvement in gas technique—the generator firing—caused a decrease last year also of the percentage of fuel used for the retorts—viz., from 19·79 to 19·56 kilos. of coke per 100 kilos. of coal carbonized, fuel used in getting up and letting down heats being always included. Only 36 per cent. of the total gas production came from the old settings with simple furnaces, and these are all being altered for generator firing. The change will be completed by the end of 1881. In Frankfurt the generator working was most favourable, with 17·08 kilos. used for fuel, or only 27·95 per cent. of the coke made; and at Gladbach only 27·44 per cent., the Westphalian coal giving more and better coke than the Schleswig coal. In some months the consumption of fuel in Frankfurt and Dessau was only 16 to 16·25 kilos.—results which have scarcely yet been equalled, and promise a further considerable decrease in the average percentage of fuel. There are also good prospects in the future of great economy in retorts, 213 being replaced last year. Detailed statistical reports of the average production of the retorts will only be possible when all the furnaces are constructed for generator firing. Although the system of generator firing, which was introduced into Germany from France, was not adopted by the Company until its technical and economical advantages had been clearly established, yet alterations had to be made and tried for several years, and many difficulties had to be removed. The system may now be considered fairly established, and the Company thank their Engineers, Officers, and Managers for their assistance in carrying this great reform into practice.

The construction accounts of the various works amount to the following sums:—

	Marks.
1. Frankfort-on-the-Oder	3,889·96
2. Mülheim-on-the-Rohr	2,035·13
3. Potsdam-Neuendorf	4,650·43
4. Dessau	2,508·88
5. Luckenwalde	1,098·32
6. Gladbach-Rheydt	73,080·69
7. Hagen-Herdecke	5,060·60
8. Warsaw-Praga	190,930·77
9. Erfurt	1,458·15
10. Krakau-Podgorze	5,104·19
11. Nordhausen	188·63
12. Lemberg	3,280·83
13. Ruhrort	1,419·10
14. Eupen	1,445·21

296,050·88

Gotha 11,325·13

Total 284,725·75

The increase of construction capital amounted to 123,637 marks against the corresponding sum for 1878. This year extensive building operations will only be required at Warsaw; and the total cost of buildings will be but moderate.

The length of street-mains at the close of 1879 was 521,613 mètres.

During the past year the Company had fresh cause of complaint respecting taxation by the State and by local bodies. The total amount paid on this account was 113,069·04 marks, or 8455·81 marks more than in 1878. The taxation amounts to half the Company's general expenditure. Although the Galician towns are first in this respect, yet there are some in the Rhine country and in Westphalia where taxation is not much lower.

The gross profits of the works amounted to 74,169·67 marks, and a dividend of 18 per cent. was again declared, leaving a balance to be carried forward of 58,184·48 marks, which is greater than that of the previous year. In consideration of the unusually small increase in consumption this year, and the fact that the holders of the 1,500,000 marks worth of stock issued in 1878 participated for the first time in the dividend, the results must be considered highly favourable by the Proprietors.

To the premium profit on the last subscription of 123,455·77 marks must be added the premium on shares disposed of later, which was 22,284·00 marks—total, 145,739·77 marks. In accordance with the bye-laws of the Company this amount has been thus disposed of:—

	Marks.
Redemption-fund	63,618·04
Reserve-fund	75,000·00
Building	5,871·73
Costs of the allotment	1,250·00

Total 145,739·77

By the addition of the above amount, the reserve-fund has now reached 1,500,000 marks, which is the amount prescribed by the bye-laws. It is hoped that this fund will be still further increased in the future, without lowering the dividends, for the purpose of avoiding the issue of fresh loans for building purposes.

In January last the consumption of gas increased 26,951 cubic mètres. The increase would have been more favourable but for a considerable decrease at the Gladbach establishment, and the clear weather. Generally speaking, many branches of business seem to be improving, and the rise in the value of coke will be favourable in view of the cheap contracts for coal. Moreover, there is a likelihood of the exchange in Russia rising rather than falling. Prospects for 1880 are, therefore, decidedly good.

TWO MEN SUFFOCATED AT THE CHESTERFIELD GAS-WORKS.

As briefly mentioned in last week's JOURNAL, on Monday, the 22nd ult., an inquest was held at the Chesterfield Gas-Works, by Mr. C. S. B. BUSBY, the Coroner for the Hundred of Scarsdale, on the bodies of Patrick Kelly and William John Barton, labourers in the employ of the Chesterfield Water-Works and Gaslight Company. Mr. R. T. GRATTON, the Chairman of the Board of Directors of the Company, was present during the proceedings; while the examination of the witnesses was conducted by Mr. JOSEPH SHIPTON, the Solicitor to the Company.

The jury having viewed the bodies and the place where the accident occurred, formal evidence was given identifying the deceased. Barton, who was 47 years old, had been employed at the works for the last two years. Kelly was 52 years old, and had been at the Newcastle Gas-Works for 18 years, during which time he had been working at the manufacture of sulphate of ammonia, in which occupation he was employed at the time of his death.

Mr. Charles Taylor was then called and said: I am now Resident Engineer to the Derby Gaslight Company, with whom I have been for 15 years, previous to which I was for 10 years with the Nottingham Gas Company. I have looked at the place where the sulphate apparatus is fixed. It is the common one, and is similar to that used generally all over the country. The ventilation of the place where the apparatus is fixed seems to me to be amply sufficient, and the general arrangements are perfect.

The CORONER: Will you give us a rough account of the work in which the deceased men were employed?

Witness: The ammoniacal liquor—which is one of the bye-products of gas-making—is conducted into a boiler or still, to which heat is applied so as to promote the evolution of ammoniacal vapour. Together with carbonic acid and other gases, these fumes or vapours are conducted through a pipe or tube, and driven into a receptacle known as the saturator. This contains a solution of sulphuric acid—the “mother liquor,” which promotes the formation of sulphate. The ammoniacal vapour is brought into it, and sulphuric acid added as soon as the operation commences. The tube which conducts the ammoniacal vapour terminates in a coil at the bottom of the saturator, which coil has perforations for the emission of the ammonia vapours. These then mingle with, and are retained by the sulphuric acid; and the chemical action occurs, ending in the formation of sulphate of ammonia, which is precipitated, and falls to the bottom of the vessel.

Mr. SHIPTON: Can you tell us what is the effect of putting sulphuric acid into boiling liquor?

Witness: Yes. If added in a boiling state there would be an immediate decomposition of the contents of the saturator, with an evolution of carbonic acid gas—that which in coal mines is called after or black damp; but if the acid is added when the liquor is cold, and in proper quantities, there is no danger. A sufficient volume of carbonic acid gas would have the effect of destroying life.

Mr. Edward John Oliver, of the Attercliffe Chemical Works, Sheffield, said: I have minutely inspected the sulphate of ammonia apparatus on these works, and consider it perfect of its kind. We are makers of the same kind of salt ourselves, and I can quite corroborate the evidence of Mr. Taylor as to the process. The effect of adding sulphuric acid to the “mother liquor” in a boiling state is that carbonic acid gas is evolved in sufficient quantities to destroy animal life. There are other gases created, in the shape of sulphides, which are of a dangerous character; but the predominant deadly gas is the carbonic acid gas. There is not the least danger in carrying out this process to a workman accustomed to it, if he exercises ordinary care.

The CORONER: What is the effect of adding sulphuric acid when the “mother liquor” is in a cold state?

Witness: It is harmless. The acid should be added before the operation commences.

Is the process Mr. Taylor described the ordinary one used for brewing sulphate of ammonia?—Yes.

Mr. SHIPTON: Can you suggest any improvements?

Witness: I know of nothing better at present. We are experimenting with an improved apparatus at our own works, but it is not yet quite perfected.

In reply to Dr. WALKER, who was called in to attend the deceased, witness said: If the process were not carried on in a proper manner, there would be a large quantity of ammonia gas in the apartment where the men were working.

By the JURY: I consider the place sufficiently ventilated. The men at work cannot interfere with a large open ventilator I saw constructed in the roof, independent of a large doorway, which is always open. In the

event of an accumulation of this kind of gas, you can get it away from the vat. There is a flue erected for the purpose upon the top, so as to carry it away to the chimney or fire. Supposing the deceased had put the acid in when the “mother liquor” was cold, there would not have been an emission of gas. The vapour of ammonia would require to pass through sulphuric acid before gas could be formed.

Mr. Charles Edwin Jones, Resident Engineer to the Company, said: I have had 25 years experience in gas-making, and have been nearly seven years at Chesterfield. I am perfectly acquainted with the manufacture of sulphate of ammonia and sulphuric acid. The apparatus we use for the production of sulphate of ammonia is complete, and perfectly safe in its operation, with proper care on the part of the user. Patrick Kelly has been in the employ of the Company about seven months. I had an opportunity of testing his knowledge of the manufacture of sulphate of ammonia, and considered him perfectly competent to undertake it. From my own investigation and inspection of the scene and its surroundings, and according to my own judgment and examination of the men present at the accident, I am of opinion that Kelly forgot, for some reason or other, to put the sulphuric acid into the vessel at the proper time. What should have been done at half-past eight o'clock was done at a quarter to twelve in the evening, and if the liquor was by that time in a boiling state, it would be unwise and dangerous to add the acid. The fire would be lit in the ordinary course at eight in the evening, and in three hours it would have boiled. Then during the interval it would be the duty of Kelly to remove from the pans to the store the sulphate of the previous evening's manufacture. I found this had not been done. He did not empty his strainers in the ordinary course, and having neglected his work at the commencement of the evening, he endeavoured to make up for it when he found the “brewhouse” impregnated with ammonia gas, which would be, and doubtless was, passing through the “mother liquor.” It appears that then Kelly, instead of getting the foreman in charge to assist him, asked a man unaccustomed to work of this kind to do so.

The CORONER: We will put it this way. If the deceased (Kelly) had gone for the foreman, it would have been the foreman's duty to have stopped the operation forthwith, and allowed the liquor to cool before adding the acid?

Witness: Yes.

Then you are of opinion that something took place when the acid was added on the evening of Saturday, shortly before twelve o'clock?—There would very probably be given off carbonic acid gas in large quantities from the mass of liquor and acid he used. The quantity of carbonic acid gas given off would be considerable, and sufficient to account for death, besides which there would be in the liquor other gases dangerous to life. I cannot account for the absence of vitriol from the saturator on any other hypothesis than that of forgetfulness. Kelly was a very good servant, and understood his work, but on this occasion he evidently did not exercise sufficient or reasonable care. His duties were mechanical, and he was quite competent to perform them, and I cannot account for the absence of vitriol from the “saturator,” except by forgetfulness on his part.

By the JURY: The hotter the “mother liquor” the more gas would be produced. The operation of making sulphate of ammonia consists of neutralizing or saturating sulphuric acid with ammonia gas, which produces a salt called sulphate of ammonia. In the apparatus we use there are two divisions, one only being used for saturating, and when the liquor is prepared for the ammonia coming over from the boiler it is acid. After the brewing, the residue is transferred to the other division, that is what is called the “mother liquor,” and it is used over again. The salt which falls to the bottom of the “saturator” is sulphate of ammonia, which is then removed with an iron shovel, and put into the strainers to dry.

A JURYMAN asked: Would it not be better to employ something else than men to put the acid in?

Witness: There is a feed-tank attached to the saturator, but the men do not seem to have used it. It is placed a little higher than the saturator, and they have to lift the acid about 3 ft. 6 in. to put it in. On this evening they put it in the easiest way.

The CORONER: You say they did not, it appears, use the feeding-tank erected for supplying sulphuric acid, but instead they poured the contents of the carboys over the side of the saturator?

Witness: Yes; exactly so.

John Higginbottom, engine-tender and foreman of stokers at the works, said he had been in the employ of the Company for 35 years next Whitsuntide. He was in charge of the works on the Saturday night the accident happened. The manufacture of sulphate of ammonia had been carried on at the works in the same way as at present for the last 30 years at least, and during that time he had not heard of a single accident happening. He saw Kelly in the yard on the Saturday night. He first came in about a quarter to six, and at eight o'clock he took a shovelful of fire to light his fire in the “brewhouse.” Witness saw him again a little before ten, and at half-past eleven in the stoker's lobby, and he went from that place to the sulphate house. Soon after he had left, witness heard some one crying for help; but being Saturday night, and a great many people passing, he thought at first it was in the lane. The timekeeper afterwards fetched him to the brewhouse, and he went in, but could not stay there on account of the smell. He saw the liquor in the saturator. It was boiling, and foam was on the top of it. Three carboys of acid should have been used that evening; but he found only two empty ones, the other full. Kelly should have put the acid in at eight o'clock—as soon as he lit the fire. He was in the habit of putting it in at that hour. In regard to the sulphate in the strainers, when it was made into “salt” it was his duty to get it out, but this was not done. Supposing Kelly wanted some assistance, he should have come to witness, but he did not. The effect of putting acid into the hot liquor would be to cause a foam to come on the top of the liquor, and gas would rise which would be strong enough to knock any one down. If Kelly had come to witness, he should not have allowed the acid to have been put in. The other deceased, Barton, was employed regularly on the works as a stoker, and had no business to go into the “brewhouse.”

William Hawley, timekeeper at the works, said that about half-past ten o'clock on the night of the accident he saw Kelly in the stoker's room having his supper. He again saw him about 25 minutes to 12, going in the direction of the sulphate house. A few minutes after, on entering the sulphate house, he saw Barton lying on his face, all his length, and Kelly sitting down with his head leaning on the side of the vat. All the sliding doors were open. He tried to examine the deceased; but there was ammonia gas about, which prevented his staying to see who they were. He went to the doors and called for help, and then went inside, took hold of Barton, and tried to carry him out, but could only get him near the doorway, when, being overpowered, he had to drop him. When he dropped, witness fell over his body, on his face, with his head outside the door. He did not know how long he was there, but he was sensible, and cried for help, though he could not move his limbs. When he did regain the use of his limbs, he got up and fetched two stokers named Ellis and Higginbottom. He returned, and Ellis and he went in together. They got hold of Barton, and brought him out. Higginbottom then ran inside to fetch Kelly, and almost directly afterwards came reeling out, and fell

down in the yard. Ellis and witness afterwards went in again, found Kelly against the vat, pulled him outside, and tore his clothes open and felt whether his heart was beating, but could detect no pulsation whatever.

Mr. SHIPTON: Did you notice in what state the liquor was in the saturator?

Witness said he could hear it boiling violently. There were two empty carboys and one full, or partly full of acid. The full one was at the side of the men. Not near the empty ones. They were near the door.

By the JURY: The deceased men were quite sober when witness saw them, and had not been out for beer.

Mr. JONES said he would now call a man to prove that Kelly was warned of the danger of the work, and that he had full instructions with regard to putting in the acid.

Walter Bates, a lamplighter in the service of the Company, said he was at one time employed in making sulphate of ammonia at the works, and was doing so when Kelly came. He showed deceased the work, and gave him instructions as to how to proceed. He told him first to fill the boiler, and to see that his taps were open. Then make a fire under the boiler and put the lime in. Next to open the tap belonging to the steam-pipe, and put his acid in, and he said, "Well, I can go forward with it." He said he had been used to lighting the fire, and witness told him he must put the acid in before he had any heat up at all. Also that if he did not have it in before the steam was up, it would knock him down, and he would not be able to get out. He replied that he had been used to that kind of work, and it would not hurt him; he would see to it.

By the JURY: Witness thought the apparatus was perfect if the acid was put in at the proper time.

Dr. William Abraham Walker said: I was called at midnight on Saturday, March 20, to the gas-works, and found the two men, Barton and Kelly, in a side room in the works yard, where they had been removed after having been found. I examined Kelly carefully, and found him to be quite dead. There was some sign of life in Barton, and by the aid of artificial respiration and other attentions, his breathing became fairly re-established; but tetanic spasms and convulsions supervened, and he sank in twelve hours after being found. I consider that he died from poisoning by ammonia gas.

The CORONER: Not carbonic acid gas?

Witness: No. The smell of ammonia was in the breath, and the symptoms were those of poisoning by ammonia.

Can you form any opinion as to Kelly's death?—I consider he died from suffocation, probably by carbonic acid gas.

The CORONER, in summing up the evidence to the jury, said: The material point to be considered is that Kelly, knowing his duties, part of which, we have been told, was at eight o'clock each night to pour sulphuric acid into the vat, it appears that from some reason or other he did not do so until twelve o'clock; at all events, when he put the two carboys full of sulphuric acid into the vat it was boiling. We also learn that he neglected some other of his duties, part of which was to carry away the sulphate which had been made the previous night or day. He was about the place from the time he came on until the accident happened. The other man, Barton, went with him, and when they had been in the "brew-house" a few minutes this accident took place. Shouts were heard, and some one, on going to the house, immediately found the two deceased, who were suffering from the effects of the gas they had inhaled. Two of the carboys of acid were found empty, and one full, and the suggestion is, that having poured in the two carboys full when the liquor was boiling, they were affected, and had not strength to pour in the third. This seems to be the whole state of affairs. Kelly neglected his duty. He ought to have put the acid in when he lighted the fire, and in consequence of his neglect this accident has happened, and he has, unfortunately, died through his own neglect. Really, the work in which he was engaged was, with care, not dangerous. He had been employed in a like occupation for many years, and was warned of its nature on entering the employ of the Company. It does not appear that he was incompetent for his work, but rather, it seems to me, his death was caused by his own neglect, that no one was culpable, and that he suffered from want of caution in his office. As to Barton, he had no right at all in the place where he was found, and was ignorant of the danger he ran in being there. The death of these two men were, I consider, caused by an accident, but sufficient caution was not, it seems, exercised by Kelly.

The jury, having considered the evidence and the summing up, returned a verdict "That the accident happened through deceased's own neglect," and exonerated all the officials of the Company from any blame whatever.

BURNLEY CORPORATION WATER SUPPLY.

THE PROPOSED EXTENSION OF THE WATER-WORKS.

It may be remembered that at the meeting of the Burnley Town Council on the 3rd of December last [see JOURNAL, Vol. XXXIV., p. 939] the minutes of the Water Committee contained a recommendation for extending the Corporation water-works in Swinden Valley, and connecting them with those in Thurston Valley, at an estimated cost of not exceeding £80,000. The details of the proposed extension were explained by the Chairman of the Water Committee (Mr. Keighley), and after a short discussion the recommendation was agreed to, the General Purposes Committee being instructed to apply to the Local Government Board for their sanction to the Corporation raising the necessary funds for carrying out the proposed works.

Application having been forwarded to the Board for permission to borrow £74,000 for the above purpose, Mr. C. NEALE DALTON, one of their Inspectors, held an inquiry into the subject at Burnley, on Tuesday, the 23rd ult.

The TOWN CLERK (Mr. A. B. Creeke), in support of the application, stated that the water-works had belonged to the town since 1846, under three Acts of Parliament—those of 1846, 1854, and 1871. By the last-named Act they had power to extend the works, and with this object to borrow and expend the sum of not exceeding £30,000. They had already borrowed and laid out £24,000, leaving £6,000 unexpended, which, taken from the estimated cost of the proposed works (£80,000), left the sum applied for—£74,000. As showing the rate at which the town had increased, he mentioned that 750 new houses were built in 1878, 400 in 1879, and about 150 this year; but the Inspector would remember that the two years just referred to were very indifferent ones, on account of the depression in trade. Now, however, there were signs of greatly increased activity, inasmuch as already 150 new houses were in course of erection. The supply of water was sufficient at present, by the exercise of great economy, and with a fair quantity of wet weather; but in the event of a long-continued dry season the supply would be very inadequate. Already notices had been given prohibiting the use of water for cleaning windows and washing flagstones. It would take eight or ten years to complete the proposed works, and it would be three or four years from the time of commencing the works before there could be any increase whatever in the supply.

Mr. J. Hitchon, Surveyor to the Corporation, having put in the plans he had prepared,

Mr. J. Emmett, the Manager of the water-works, explained the details of the scheme. He estimated the cost would be covered by an outlay of £71,089, and this included 10 per cent. for contingencies. The Committee had, however, asked for more than this, as they thought the work could not be done for the money. Difficulties certainly might arise which would render necessary the expenditure of the £80,000 set down in the application. He thought, supposing the increase of new buildings went on as before, £200 or £300 a year would cover the cost of extension of the water-mains, and, so far as he was aware, nothing else would have to be paid out of capital during the next few years. There were now in use 1090 acres in the Swinden Valley and 1000 in the Thurston Valley, to which the extension was being made. There were, on the 30th of June last, 12,098 houses, and taking the average population to be 5½ per house, it would be 63,515, though it must be borne in mind that the Corporation supplied with water others besides those in the borough. At present they only had, in dry weather, a supply of 789,891 gallons per day. When the work was completed there would be an ample supply, for the amount of water flowing into the town would be doubled, although the gathering-ground would not be increased by one-half. This was explained by the fact that there would be no extra compensation to give.

Mr. J. Green, C.E., of Portsmouth, stated that he had inspected the plans, ground, and details of the proposed extension, and considered that it was not only a good one, but that it was the only one which could be relied upon at the present time. The estimate presented by Mr. Emmett was also a fair one, though the item for contingencies might not prove sufficient, and he thought it would be prudent to ask for £80,000. At the same time, however, he did not anticipate that the estimate made by Mr. Emmett, of £71,000, would be exceeded.

The INSPECTOR intimated that he had all the information he required, and the inquiry terminated.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Trade in this district has not yet settled down to its usual course, the excitement consequent upon the elections being a disturbing element which interferes very considerably with business. Very little, therefore, has been transacted during the past week, and in what has been doing the tendency of the market has generally been towards weakness, with the exception that engine fuel is firmer. This, as I pointed out in previous reports, is the natural result of the diminished production of slack, and colliery proprietors who have very little of this description of fuel to offer are in most cases asking an advance of about 5d. per ton upon last month's rates. With regard to all classes of round coal, however, prices are very weak and irregular, and where sales are pressed low figures have to be taken. The average quoted prices at the pit mouth may be given about as under:—Best Lancashire round coal, such as Arley Mine coal, 8s. to 8s. 6d.; second qualities, such as inferior Arley and Pemberton four-feet, 6s. to 6s. 6d.; common Lancashire round coal, 5s. to 5s. 6d.; burgy, 4s. to 4s. 6d.; good slack, 3s. 6d. to 4s.; and common, 2s. 9d. to 3s. 3d. per ton.

For good cokes there is a steady demand, and some makers have advanced their prices 5d. per ton.

In the iron trade the tendency of the market is also towards more weakness, and local makers of pig iron are not holding so firmly for their full list rates as they were. They are, however, still so much undersold by iron in second hands that they are securing very few new orders, and the iron at present going away is almost entirely on account of old orders. Nominally, the quotations for Lancashire pig iron delivered into the Manchester district remain at about 70s. per ton, less 2½ per cent. Second-hand lots of bar iron can still be bought at about £8 per ton delivered into the Manchester district, but very few of the makers as yet are quoting under £8 10s. to £9 per ton.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

Commercial men have been very much taken up with electioneering. There has been great excitement in Northumberland and Durham, as every division of the counties and all the boroughs except Morpeth have been or will be contested. Durham county is being fought out by representative men connected with the coal trade. Colonel Joicey is a partner in extensive gas collieries. Sir George Elliot has also a large capital embarked in pits, the Hon. Mr. Lambton is brother to the Earl of Durham, who has extensive possessions in collieries, and Mr. J. W. Pease is by far the largest holder of colliery property in South Durham. Under these circumstances the energies of most persons concerned in the coal trade in the county of Durham are absorbed in politics, and a very small measure of attention is given to trade.

As the days extend, the demand for gas coals, as is usual at this season of the year, begins to weaken. The steam coal trade of Northumberland is in what may be described as a small crisis. Merchants made contracts with owners for the delivery in April of best steam coals at 10s. per ton; but now the time for delivery has arrived they cannot find a market at the advanced price. Merchants upon the Continent continue to hang back, and there is just a possibility that the buyers for forward delivery may "make" a considerable loss by the speculation. Nothing is doing in steam except at the old rates, and it is very likely that affairs may hang on in this condition for a week or ten days, when the buyer or the seller will have to yield to the circumstances of the hour. They seem rather to favour the notion that the buyers will, to some extent at least, remain masters of the situation. Household coals continue in a depressed state. The market for manufacturing coals and coke is unchanged from last week.

More business has been transacted in chartering vessels for the Baltic, but trade to that sea is hardly up to the April form. The supply of tonnage is pretty abundant, not only for the Baltic, but for all parts of the world. The coasting trade continues quiet. What there is doing is with craft of from eight to ten keels. The figure offering for vessels of this description is from 6s. 9d. to 7s. for the bye-ports.

Steamers are taking coals to London at 4s. per ton; Hamburg, 5s.; Copenhagen and Swinemunde, 6s., which are low quotations.

The somewhat large shipments of fire-bricks to the Continent continue. They are being sent out to the North of France, Holland, Germany, Denmark, and Spain. The quotation for small vessels to load fire-bricks for London above the bridges is 8s. per ton, but only a special sort of craft can take up orders of that description. The iron trade of the Cleveland district is quiet, if not a little dull; but very little new can be said about business until the elections are through.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The arrangements for the next half-yearly meeting of the West of Scotland Association of Gas Managers, which is to be held at Hamilton on the last Thursday in the present month, are in a forward state. Besides the presidential address of Mr. Mitchell, Coatbridge, there will be papers

treating of the construction of gasholders, the valuation or rating of gas-works, scrubbers and scrubbing, and on Painter's hydrostatic joint for gas and water mains. I understand that Mr. Levi Monk is to describe some peculiar arrangement which he has in operation at the Lanark Gas-Works, in which there are embodied some of the principles of the Aitken-Young system of condensation and Young's system of scrubbing. Amongst the other authors of papers to be read, I may mention Mr. Brodie, Gas Engineer, of Paisley, and Mr. Niven, of the Dunoon Gas-Works.

There was a large gathering of people more or less interested in gas affairs at the Partick station of the Glasgow Corporation Gas-Works last Friday, the occasion being the public auction of the plant connected with the station, as it has been found desirable to depend upon the Dawsholm station for supplying the district which for the better part of 40 years has obtained its supply of gas from the Partick works. Amongst the persons present there were the gas managers from Greenock, Dumbarton, Maryhill, Coatbridge, Milngavie, Grangemouth; Messrs. William Young (Clippens Oil-Works), Robert Laidlaw, D. M. Nelson; James Donald (Hanna, Donald, and Wilson, of Paisley); Provost Kennedy, contractor, Partick; Mr. W. Foulis, Mr. Granger, and others. There were three gasholders sold, one of which measures 100 feet in diameter, rises 40 feet in two lifts, and has a capacity of 350,000 cubic feet. The smallest of the three is 40 feet in diameter, rises 20 feet, and is capable of holding 26,000 cubic feet. When it was put up in the year 1842 by Mr. J. B. Neilson, the inventor of the hot-blast, it was considered to be the largest gasholder in Scotland. It consists chiefly of plates having a thickness equal to No. 16 Birmingham wire gauge. In all, there were 142 lots, for some of which there was rather brisk competition. It is understood that a good deal of the plant was purchased for the Glasgow Corporation Gas Commissioners. Mr. Archibald H. McCulloch (Morrison, Dick, and McCulloch, of Glasgow) was the Auctioneer on the occasion. There is some talk of the Partick Burgh Commissioners tendering for the purchase of the large expanse of ground which the works and adjoining properties at present occupy. The site is almost in the centre of a large suburban town, and when cleared and opened up it will be well suited for use as an open recreation space, and partly for new streets of dwelling-houses, shops, &c.

The subject of casting gas-pipes vertically in 12-foot lengths bids fair to become one of considerable importance in the estimation alike of pipe-founders, gas managers, gas companies, &c. It seems that vertically-cast pipes of that length down to 4 inches in diameter are extensively produced in the United States, whereas in Glasgow, which is the largest seat of the pipe-founding industry in the world, it is seldom that such pipes are made of less than 15 inches in diameter. Two or three Glasgow firms are said to have tried to produce pipes of the kind referred to down to 8 inches in diameter; but owing to the great difficulties connected with their foundry plant, the waste, the trouble with the workmen, &c., the results have been anything but satisfactory, and the attempts to meet the inquiries and demands had to be departed from. On that account a number of orders have been put past the Scotch foundries, one of them a Canadian order, quite lately, which was eventually placed in the United States. It is urged that Scotch pipe-founders ought not to stick at a trifle in order to meet successfully this new element in competition, and that they should not hesitate to spend some effort in learning what improvements have been made in pipe-founding in America, so that 12-foot lengths of piping have become a regular article of trade. Doubtless gas managers would welcome the advent of such pipes in this country, as their use would effect a great amount of economy in jointing, and therefore a large saving in the leakage which has so widely and so frequently to be deplored.

Notwithstanding the extraordinary degree to which the public mind is absorbed with the elections which are now in progress, the leading Scotch newspaper has found space within the past few days to devote to an interesting and comprehensive article on "Gas-Engines," a subject which is exciting a large amount of attention in Scotland. The article makes special reference to the gas-engines which have been put up at the extensive new works at Parkside, Edinburgh, belonging to the eminent printing and publishing firm of Messrs. Thomas Nelson and Sons, one of them being about the most powerful of the kind yet constructed. I believe it is nominally an engine of 16-horse power.

On Friday, the 26th ult., the Shareholders of the Denny Gas Consumers Company, Limited, held their annual business meeting—Mr. John Cousland, merchant, Chairman of the Company, presiding. The Directors submitted their report, which announced that the works of the Company

were in a satisfactory state of efficiency and order. The financial statement and balance showed that the Directors had been able to conduct the affairs of the Company with profit; and they recommended that, besides the 6 per cent. interest which fell to be paid on £1000 of preference shares, a dividend of 10 per cent. be declared on the ordinary shares of the Company. The Directors had to acknowledge the care and attention bestowed on the affairs of the Company by the Working Committee, and by Mr. John Potter Scott, the Manager, on whom so much depended for the successful and profitable carrying on of the works. The report was unanimously adopted, and a dividend of 10 per cent. on the ordinary shares was agreed to, as recommended. Messrs. Shanks, Cousland, Bulloch, and Campbell, the retiring Directors, were re-elected; and Mr. J. Cousland was re-appointed Chairman of the Company.

When speaking of the Prestonpans Gaslight Company, a couple of weeks ago, I omitted to mention that the Directors had resolved to reduce the price of their gas to 5s. 10d. per 1000 cubic feet over all their services.

Last week's Glasgow warrant market was very steady, and the amount of business done was much curtailed. The bulk of the buying was done to cover "bear" sales made at the higher prices. Iron for forward delivery is in very limited request, and shipping iron is exceedingly flat; indeed, the demand has almost disappeared. Makers have reduced their quotations, but all brands are pressed for sale at much below the official list prices. Large parcels bought on American account are being re-sold in Glasgow instead of being shipped. As low as 54s. 9d. cash was accepted on Friday forenoon, but at the close in the afternoon 55s. 3d. was the price for sellers, and buyers offered 1½d. per ton less.

The coal market remains quiet, with no new feature, and prices rule low.

CARLETON WATER-WORKS COMPANY, LIMITED.—A Company under this title was registered on the 22nd ult., with a capital of £2000, in 1000 shares of £2 each, the object being to supply the village of Carleton, near Shipton, with water.

BRITON FERRY LOCAL BOARD GAS SUPPLY.—The monthly meeting of the Briton Ferry Local Board was held on Thursday last, when the Gas Manager (Mr. W. Cheyne) reported that the coal he had been using during the past month produced an average of 10,870 feet of gas per ton. Also that the sales of gas for the quarter ending March 31 exceeded those of the corresponding quarter of last year by about £30, notwithstanding the reduction recently made in the price of gas; and that the accounted-for gas for the half year was over 9550 cubic feet per ton of coal carbonized. In answer to a question from a member of the Board, the Chairman stated that the unaccounted-for gas was 8½ per cent., which was very good, and for which Mr. Cheyne deserved great credit, seeing that it was 33½ per cent. when he took charge of the works.

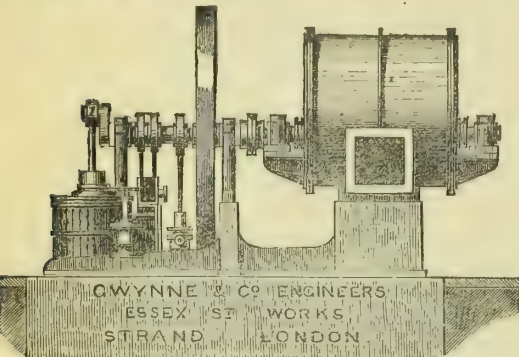
TECHNOLOGICAL EXAMINATIONS.—The arrangements for the technological examinations of the City and Guilds Institute are now complete, and notice has been issued to all secretaries of science classes throughout Great Britain and Ireland of the system to be adopted. These examinations, as has been already mentioned in the JOURNAL, are worked concurrently with, and on the same system as those of the Science and Art Department. They will be held on the 12th of May, on which day also part of the science examination is held. By thus availing itself of the existing organization of the Government, the City Institute is enabled to hold its examinations all over the kingdom, as there are now no places of importance at or near which there is not a centre for the Government system. There are 32 subjects of examination, covering all the chief industries of the country—all, at least, in which the application of science is such as to enable theoretical knowledge to be tested by examination. Any workman, or any person connected with any manufacture included in the scheme, wishing to obtain a certificate testifying to his knowledge of that manufacture, has merely to apply to any one of the numerous Local Secretaries of the Science and Art Department, and ask him to return his name, as a candidate, to the office of the Institute, at Gresham College. When the day for examination arrives, the candidate will have to present himself at the centre where he has sent in his name, and he will find a paper of questions ready for him. If he succeeds in answering these, he will in due course receive a certificate. There are now over 50 classes in different parts of the kingdom, in which students are being prepared for these examinations, but the examinations are also open to any person who likes to try for a certificate or for one of the prizes to be given by the Institute. Further information can be obtained on application at the Halls of the Companies of Mercers, Drapers, and Clothworkers, London.

Share List of Gas and Water Companies.

Number of Shares issued.	Amount paid up per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount paid up per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount paid up per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.
589892	£ 10	GAS COMPANIES.	£ s. d.	£ s. d.	£	6200	5	GAS COMPANIES.	£ s. d.	£ s. d.	£	12500	5	GAS COMPANIES.	£ s. d.	£ s. d.	£
10000	20	Alliance and Dublin	0 10 0	0 10 0	15½-16	300000	100	Georgetown, Guiana	5 0 0	7 0 0	4½-4¾	2000	5	Singapore (Lim.)	5 0 0	7 10 0	5½-6
5000	20	Anglo-Romano	0 10 0	0 10 0	21-23	115000	100	Glasgow Corporation Gas	100 0 0	9 0 0	205-210	500000	Sk.	Do., preference.	5 0 0	7 10 0	5½-6
1500	20	Bahia (Limited)	0 10 0	0 10 0	14-15	7000	100	Do., do.	100 0 0	6 15 0	155-160	..	..	South Metropolitan	100 0 0	11 10 0	200-205
40000	5	Do., 2nd pref.	0 10 0	7 10 0	20-22	5000	100	Grimsby Gas, A.	100 0 0	..	186-190	..	..	Do., "B"	100 0 0	10 0 0	180-185
10000	5	Bombay (Limited)	0 10 0	7 10 0	5½-6½	2000000	100	Hampton Court	10 0 10 0	0 10 0	15-16	1500	10	Tottenham & Ed-	5 0 0	10 0 0	81-83
10000	5	Do., fourth issue.	0 10 0	7 10 0	1-3 pm.	7000	100	Hong Kong (Lim.)	10 0 10 0	0 10 0	15-16	1500	10	Wandsw. & Putney	10 0 10 0	0 10 0	142-15
22970	10	Bournemouth	0 10 0	8 0 0	13½-14½	5000	100	Hornsey	10 0 10 0	0 10 0	15-16	4000	10	Do.	10 0 10 0	7 0 0	113-12
..	..	Brentford	0 10 0	9 0 0	14½-14½	..	..	Imperi. Continental	100 0 0	10p.c. & 182-184	..	25000	5	West Ham	5 0 0	10 0 0	83-92
..	..	Do., 5 per ct. pref.	0 10 0	5 0 0	95-100	..	..	..	..	2 p.c. bonus	..	..	..	West Kent	10 0 10 0	0 0 0	14-16
..	..	Do., C shares	0 10 0	9 0 0	6-8 pm.	..	..	Kingston	..	..	..	2400	5	Woolwich, Plumstead, and Charlton	5 0 0	16 0 0	9-10
5100	20	Brighton	0 10 0	10 0 0	33-35	..	..	Lea Bridge	..	7 0 0	11½-12½	..	..	..	..	..	..
5000	20	Brighton and Hove	0 10 0	10 0 0	33-35	561000	100	Liverpool United	100 0 0	10 0 0	180-185	..	..	..	..	..	..
14000	20	British (Limited)	0 10 0	10 0 0	34-35	1691000	100	Do., B	100 0 0	7 0 0	125-135	..	..	..	..	..	..
7223	20	Cagliari (Limited)	0 10 0	6 10 0	16½-17½	3865000	Sk.	London	100 0 0	10 0 0	175-180	..	..	..	..	..	..
1500	10	Colney Hatch	0 10 0	5 0 0	9-11	1500000	Sk.	Do., 1st pref.	100 0 0	6 0 0	123-126	..	..	..	..	..	..
550000	Sk.	Commercial	0 10 0	11 0 0	188-193	7622	25	Do., A shares	25 0 0	6 0 0	29-31	..	..	..	..	..	..
700000	Sk.	Do., 7 per cent.	0 10 0	8 0 0	135-140	266927	Sk.	Do., Debent. stk.	100 0 0	5½ & 6½	..	..	..	..	..	..	..
20000	20	Continental Union	0 10 0	6 10 0	19½-20½	15000	5	Malta and Mediter-	5 0 0	2 10 0	2-23	..	..	..	..	..	..
20000	20	Do., new	0 10 0	6 10 0	11½-12½	..	..	anean (Limited)	5 0 0	7 10 0	5-5½	615600	100	Chelsea	100 0 0	6 10 0	197-202
10000	20	Do., preference	0 10 0	7 0 0	23½-24½	..	..	Mauritius (Limited)	2 5 0	1 0 0	12½-13½	1624700	100	East London	100 0 0	6 10 0	197-202
750000	Sk.	Crystal Palace Dis-	0 10 0	10 0 0	172-177	25000	20	Monte Video (Lim.)	20 0 0	6 0 0	13-14	10798	50	Grand Junction	50 0 0	5 0 0	109-112
1250000	Sk.	Do., 7 per cent.	0 10 0	7 0 0	122-127	8000	10	Nietheroy, Brazil	10 0 0	5 0 0	33-43	5840	25	Do., 4 shares	25 0 0	5 0 0	54-56
500000	Sk.	Do., preference	0 10 0	6 0 0	118-122	..	..	Oriental (Calcutta)	5 0 0	9 0 0	7-7½	6160	25	Do., new ditto;	25 0 0	5 0 0	40-45
25000	6	Do., ordinary	1 4 0	7 0 0	3-1 pm.	30000	5	Do., new shares.	3 10 0	9 0 0	14-14½ pm	5551800	100	Kent	100 0 0	8 0 0	280-285
7100	25	Edinburgh	25 0 10	10 0 0	46-48	30000	5	Ottoman (Limited)	5 0 0	3 0 0	2-23	7818000	100	Lambeth	100 0 0	6 10 0	203-206
23400	10	European (Limited)	10 0 10	10 0 0	18½-19½	10000	10	Para (Limited)	20 0 0	4 10 0	57-61	3261500	100	Do., max. 7½ p.c.	100 0 0	6 10 0	170-175
12000	10	Do., new shares.	7 10 0	10 0 0	5-6	27000	20	Phœnix	20 0 10	0 10 0	35-37	442	100	New River	100 0 10	3 8360-370	..
35400	10	Do., new shares	5 0 10	10 0 0	3½-4½	3600000	100	Do., new max. 7½	90 0 0	7 10 0	115-20	4475	100	Do.	85 0 10	3 8280-300	..
4096300	Sk.	Gaslight & Coke A.	0 10 0	10 10 0	177-179	1440000	Sk.	Do., capitalized	100 0 0	5 0 0	87-92	6000000	100	Do., deb. sk., 4p.c.	100 0 0	4 0 0	101-103
1000000	Sk.	Do. B	0 10 0	4 0 0	73-75	20	20	Do., new, 1876.	16 0 10	0 10 0	15-17	4475	100	Southwark & Vauxh.	100 0 0	6 0 0	205-210
50000	10	Do. do., 5th do.	0 10 0	5 0 0	16-17	37500	20	Richmond (Surrey)	10 0 10	0 10 0	16-17	6668000	100	Do., pref. stock.	100 0 0	5 0 0	120-125
2000000	Sk.	Do. C 10 p.c. pref.	0 10 0	10 0 0	205-210	..	..	Rio de Janeiro	20 0 0	10 0 0	25-27	700000	100	Do., D shares.	100 0 0	6 0 0	170-175
3000000	..	Do. D do. do.	0 10 0	10 0 0	205-210	..	..	(Limited)	..	..	..	..	..	Do., new ordinary.	..	4 10 0	..
1650000	..	Do. E do. do.	0 10 0	10 0 0	205-210	1500	32½	Shanghai	32 10 0	12 0 0	.. [pm]	1600	100	Do., nw. ord. No. 1	40 0 0	4 10 0	..
300000	..	Do. F 5 do. do.	0 10 0	5 0 0	101-104	135000	100	Sheffield, A.	100 0 0	10 0 0	197-198	15073	61	West Middlesex	61 0 0	6½ p.sh.	168-173
600000	..	Do. G 7½ do. do.	0 10 0	7 10 0	150-156	99700	100	Do., C	100 0 0	10 0 0	193-197
1300000	..	Do. H	0 10 0	7 0 0	128-132

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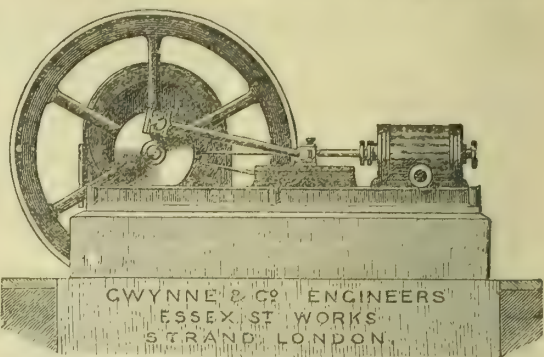
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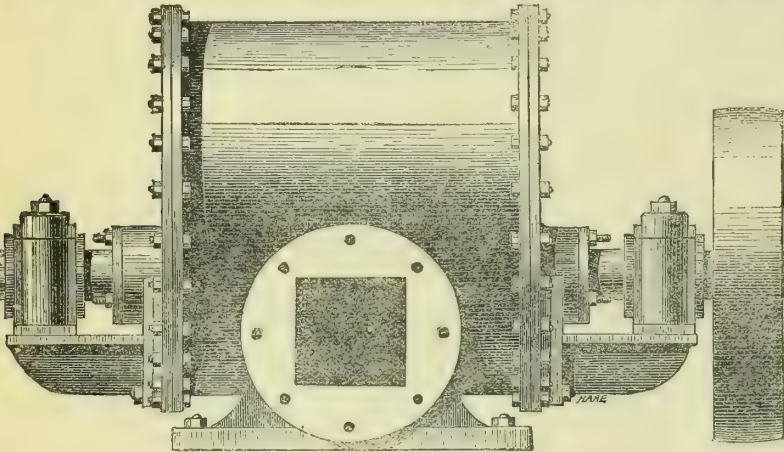
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TO GAS ENGINEERS.

THE appointment of Engineer to the above Company will be vacant on the 1st of July next. The Directors are therefore open to receive applications for the same not later than May 4, to be addressed to the CHAIRMAN of the Company, stating qualifications, age, salary required, references, &c. A residence is provided. Offices, Upper Bristol Road, Bath, April 2, 1880.

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Six-inch Connections with Lifting Screw and Traveller complete.
Three 6-in. Cathels's patent Four-way Valves.
Station-Meter to pass 1500 feet per hour, 4-in. Connections.
Five-inch Condenser, nine Pipes, and Tar Box with Overflow Pipe.
Six 6-in. Dunkin's Valves.
For particulars and price apply to **Mr. JOHN SMITH, Manager, Gas-Works, Sunbury-on-Thames, MIDDLESEX.**

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THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 13, 1880.

Circular to Gas Companies.

WITHIN the last few days three important meetings of Metropolitan Gas Companies have been held. Although at the present time many questions of the utmost consequence press themselves on the attention of the Companies, there is one which does not in the least trouble them. Their dividends are safe, and with this result the Shareholders are, of course, perfectly content. But questions remain which will presently have to be answered. There can be no doubt that the circumstances in South London fully justify the action taken by the South Metropolitan Company, and it may be considered as certain that all the favourable results expected will be fully realized from the recent combinations. Nothing, indeed, can so much conduce to the interests of Gas Companies as amalgamation. This is a fact which the JOURNAL has endeavoured to press upon the minds of its readers for many years. We believe we are right in asserting that the inventor of the idea of amalgamations was the late Mr. T. G. Barlow, who unfortunately did not live to see so nearly accomplished as we have the work that he originally cut out. It is not yet ended. The combination in South London is almost complete, but something still remains to be done. The southern portion of the London Gaslight Company must be brought into the union, and then the whole of the gas interests south of the Thames will be combined—a consummation devoutly to be wished.

The winding-up meeting of the Phoenix Gaslight and Coke Company was held last Wednesday. The fabulous bird has flapped her wings, set fire to her nest, and gone to glory; which, put prosaically, means that the Company have amalgamated, as our readers already know, with the South Metropolitan Company. At the meeting we refer to, the maximum dividends which could be declared under the Act of 1860 were, of course, decided upon; and here we may remark upon a curious sentence in the speech of the Chairman, who confidently prophesies that a dividend of eleven per cent. will in the course of twelve months be realized with the price of gas at 3s. per thousand feet. It is singular that the Directors of the late Phoenix Company, whose eyes are now so wide open, did not see their way some years ago to such a reduction in

the price of gas as would have secured to them popularity, and would have brought to them a greatly increased trade. A change has now come over the spirit of the dream. Visions of a dividend of eleven per cent., with the price at 3s. per thousand, float before their astonished eyes. These visions will in time turn into realities, and it may be that some who never saw it before will recognize the benefit of cheap gas. But let us not do the now extinct Company an injustice. They had, in fact, no inducement to lower the price of gas beyond the point that would have paid them ten per cent. and have added to their reserve. This fund was practically full, and is, of course, handed over to the South Metropolitan combination. At a no distant future the Shareholders in the late Phoenix Company may participate in the advantages which are obtained by selling cheap gas; as, when they have reduced the price to 3s. per thousand feet, a larger dividend will be distributed than has ever yet been received by the Shareholders. So far, then, both the Shareholders and consumers may be heartily congratulated on the change now consummated.

Nothing can be more satisfactory to public and private interests than the union between these two great Companies. To both it will bring enormous benefits, the Shareholders receiving higher dividends, and the consumers being charged lower rates. We must leave it for the future to settle the relative advantages of the amalgamation scheme as compared with the old régime. We can, of course, express a confident opinion that the amalgamation will prove eminently successful to all parties concerned. But precautions, which it is not our business to indicate, must be taken to avoid certain rocks which seem to lie ahead. There can be no doubt that the business which the United Company can command is perfectly adequate to provide profits for the dividends which the South Metropolitan Company, standing alone, could very easily pay. We look with no apprehension on the future of the United Company, and will conclude these remarks by wishing them all the success the efforts which are certain to be made will bring.

The meeting of the South Metropolitan Company, held shortly after that of the Phoenix, on the same day, passed off very pleasantly. The Shareholders of the Phoenix Company joined in the general chorus of praise which even the damp ardour of a few present could not repress. It might be a melancholy occasion for some, but they should have been cheerful, and most of them were so. Nothing can be more satisfactory than the profits which the South Metropolitan Company make and apply to their respective Shareholders as the law directs. In future these profits will be gathered over a wider area, and will be distributed among a largely increased number of Shareholders; but the result will remain the same—general prosperity, unimpeded by what we have called mediæval legislation.

The half-yearly meeting of the London Gaslight Company, which also took place last Wednesday, was naturally a very happy one. The Company are still working under the Act of 1860, and with the price of gas at 3s. 3d. per thousand feet pay maximum dividends. The circumstances of the Company indicate that such a dividend may continue to be maintained. But why should the Shareholders not have more? We notice that at the meeting the question of amalgamation was brought prominently forward. It is clear that among some of the leading Shareholders a desire exists to see the Company united with others, in order to conform with modern gas legislation. We have upon previous occasions expressed an opinion that the London Company would be benefited by amalgamation; the difficulty being to settle with whom they shall be amalgamated. We have always advocated a division of the undertaking into two parts—that lying north of the Thames to be allocated to the Chartered Company, and that south of the river to the South Metropolitan; and we confess that we see little difficulty in carrying out such an arrangement. Mr. G. Livesey may be perfectly right in saying that a combination of the whole of the undertaking with a Company north of the Thames is out of the question. We think it would be found that complete amalgamation with the Southern Company would be equally difficult to effect. The only plan, then, which appears feasible to us is the division we have suggested. How the apportionment of capital accounts shall be made we confess to being at a loss to indicate; but we think one or two eminent engineers and a financier would settle this part of the business in a short time. We here allude to the question of amalgamation because it is, as we have said, evidently uppermost in the minds of some of the leading Shareholders in the London Company; but as we have so recently referred to this subject, it need not be pursued further than to express a hope

that the Directors of the Company will presently see their way to join in some general union. Before concluding our remarks upon the meeting, we should take the opportunity of congratulating the Secretary on the addition made to his salary. He has worked hard in the service of the Company, and deserves all the rewards which the Directors can shower upon him.

The Town Council of Birmingham take an immense interest in the success of their gas undertaking, and are never tired of discussing everything appertaining to it. At the last meeting of the Council the Gas Committee presented a report, in which it was shown that new storage works are required to replace worn-out holders at the Windsor Street works. The Council have authorized the Committee to spend £100,000. Some of this will, of course, come out of revenue; but the bulk will have to be raised by the issue of new capital. There is no disputing the success of the Birmingham gas undertaking in the hands of the Corporation, but then it must be acknowledged that no little of this success has resulted from the maintenance of somewhat high charges for gas. Allowing for probable exaggerations on the part of the opponents of the Gas Committee, we think it must be admitted the charges of the Corporation are higher than those made by the old Companies, even reckoning the slightly superior quality of the gas supplied. The Committee, however, are bound to show a good profit. The Council want and expect it, and there is nothing for it but to make such charges as will allow the Committee to hand over to the Council a considerable balance for the improvement-fund. There is very little objection made to this course in Birmingham. The gas consumers do not appear to complain of it, and no one outside has any right to object.

We are happy to see that the Birmingham Gas Committee have resolved to abstain from any further litigation in the case of the West Bromwich award, and now we hope that soon matters will be satisfactorily settled with the other Local Authorities who have been in dispute with the Corporation. To say the truth, we feel somewhat sorry for these Authorities, as we fear they will find in the long run that working the shreds of a gas undertaking will not pay. They had better have remained under the Corporation, and made some agreement as to a proportional division of the profits. That the whole of these should have been devoted to the borough of Birmingham could not be borne, but there could have been little difficulty in making an arrangement by which a proportion of the gas profits made in the district of each Authority might have been assigned to that body. Mr. Chamberlain's contention has always been that since Birmingham is responsible for the purchase, and must bear the brunt if any failure happen, it should be very properly entitled to all the profits which could be made in or outside the borough. We do not think the argument is worth much, though we have never contended that the outside districts should be entitled to the whole of the profits made within their areas. The case may now be said to be finally settled. The outside Local Authorities and the Corporation will part company on or before July 1, 1882, and from that time pursue their separate courses, with results which may be guessed but not foretold.

The ordinary meeting of the Swansea Gaslight Company was held on the 2nd inst., when the gratifying announcement was made that, after paying full dividends out of the profits of the half year, a disposable balance of £2739 remained. The reserve-fund of the Company is happily full, and, therefore, it was necessary to find some other way of applying any excess of profits. A contingency-fund has, accordingly, been started, and £2500 was allocated to it, leaving £239 to be carried forward to the next half year's account. We are assured by the Directors that the quality of the gas has been well maintained during the half year. If it had not been, we are certain that the present Mayor of Swansea, the most uncompromising of the opponents of the Company, would have had a good deal to say on the matter. The position of the Swansea Gas Company is somewhat peculiar. They supply a wide area, much of which is very sparsely populated. Better days, however, would appear to be in store for them. The new docks in course of construction will require a large amount of illumination, which must be supplied by the Company. The foundation stone of these important works was laid on the 31st ult., and the Mayor gave a ball on the occasion, when an attempt was made to illuminate the interior and exterior of the ball-room by means of the electric light. The experiment appears to have been a signal failure, gas being triumphant. We make no special comment on this, for casual experiments of the kind will and must come to grief. We simply notice the fact that gas can always be relied upon for illumination, while the electric light cannot.

The quarterly report of the Chief Gas Examiner for the Metropolis—Professor Williamson, F.R.S.—has just been issued. It shows that the quality of the gas supplied by the Companies under the Examiner's supervision was, during the past three months, well maintained. The illuminating power of the gas is said to have been in all cases in excess of that required by Act of Parliament. As regards purity, we find that the conditions imposed by the Referees have been more than complied with, there having been in all instances a marked diminution in the quantity of sulphur. In some cases it was very noticeable. For example, at the Ladbroke Grove testing-station, supplied by the Chartered Company—presumably from their Kensal Green station—the amount of sulphur fell as low as 9.7 grains per hundred feet. At Friendly Place, Mile End, supplied by the same Company, but at the opposite side of London, probably from Bow Common station, the sulphur was down as low as 7.1 grains per hundred feet. These results, considering that the regulations of the Referees would allow of larger amounts being present than those we have mentioned, reflect the greatest credit on the Companies, and show that their Officers are extremely attentive to the interests of their customers. Ammonia, as a matter of course, has been well kept down. It is too precious to be wasted, and admirable appliances are in use for taking it out of the gas. We are reminded here to refer to an invention, which may have some interest for Gas Companies. It has long been a dream with chemists that ammonia might be very cheaply produced by combining the nitrogen of the atmosphere with hydrogen obtained from decomposed water. Small successes can be said to have been made in this direction, and until now no important results have been obtained. It is, however, reported that an invention has been made, by means of which chloride of ammonium can be obtained at the small expense of one penny per pound. The details of this invention have not yet been fully published, but we believe the results alleged to have been obtained by its use are correct. It will not very much matter to Gas Companies if they have to compete with the new process; they will simply have to look out for some cheaper means of getting ammonia out of gas.

A proposal was made by a Shareholder, at the Phoenix Company's meeting already referred to, that special thanks should be given to the Directors for the action they took in initiating experiments in improved street lighting. The fright of a year ago having passed away, no one seemed to think the proposal necessary, and it consequently dropped. It is, however, a matter for congratulation that those experiments were put in hand, and so judiciously followed up. Throughout South London, and in many places north of the river, as well as in most of the chief towns of the country, the Local Authorities have quietly improved the lighting of important thoroughfares and centres of traffic, thereby at the same time conferring benefit on the passengers, improving the revenue of the Gas Companies, and illustrating practically what gas is capable of doing. The Companies will ill deserve success if they allow efforts in such directions to cool down until another scare wakes up another spasm of activity.

In our last "Circular" we anticipated the regret which would be felt at the retirement of Mr. Edward Horner from the Chairmanship of the Phoenix Gas Company. We are glad to see that he is to carry with him an enduring expression of the respect and gratitude of the Company's Shareholders. The proposal made at the meeting last week was a very graceful one, and will, doubtless—judging by the manner in which it was received—be generally adopted by the Shareholders.

Among the other retirements consequent on the last completed amalgamation in South London is that of a younger man, but one who has seen the Phoenix Company through many difficulties, to the highly satisfactory position in which they were when their absorption took place into the South Metropolitan Company. Mr. Corbet Woodall, under whose presidency the last London meeting of the British Association of Gas Managers proved such a success, and who is respected wherever he is known, has vacated his appointment, and is about to add his name to the at present very limited list of professional advisers of Gas Companies. We feel sure our readers will with us wish him every success in his new sphere, which is one that his very varied experience eminently qualifies him to occupy.

We seldom allude to political matters in this column, but cannot help here congratulating Mr. William Woodall on his election as member of Parliament for Stoke-upon-Trent. This gentleman, who is brother of Mr. Corbet Woodall, has been for a considerable time connected with the borough, but what makes his election interesting to the gas world is that

he was one of the founders of the British Association of Gas Managers, and for some years took great interest in their proceedings. Mr. Woodall's knowledge of gas matters will be of much value in the new Parliament, in which, so far as we have seen, practical gas men are not strong.

We publish in another column an account of some experiments made by Mr. Lewis T. Wright on the formation of nitrogen acids in the combustion of coal gas, from which it appears that the nitrate and nitrite of ammonia found in the condensed liquid from the products of the combustion of coal gas have their origin in salts of ammonia floating in the atmosphere. Mr. Wright also finds that the sulphur in coal gas can be accurately estimated by passing the products of combustion through a standard solution of iodine—a proof that the sulphur in coal gas only yields directly sulphurous acid when burnt. We have heard a rumour that one of the London Gas Companies intends to have the composition of unburnt and burnt coal gas thoroughly investigated by competent chemists. We sincerely hope that this rumour is well founded.

At the last meeting of the Manchester City Council, it was announced by Mr. Harwood, the Vice-Chairman of the Gas Committee, that, for the first time in the history of the Corporation gas undertaking, the Committee had been able to make arrangements by which they could entirely dispense with Sunday labour on the works.

The Crystal Palace District Gas Company are already, in the sale of coke, availing themselves of the "four-bushel measure" recently legalized by the Board of Trade as a standard under the Weights and Measures Act of 1878. From a notice issued and signed by the Secretary of the Company (Mr. Magnus Ohren) we learn that they now quote the prices of coke at "per dozen sacks of the four-bushel measure—under the new Weights and Measures Act—equal to the old chaldron;" with the request to purchasers: "When ordering coke, please say so many dozen sacks."

The Manchester Corporation Gas Committee have at length decided on the appointment of an Engineer-in-Chief over their various works of manufacture and distribution; and from an advertisement in another column it will be seen that they invite applications for the post to be sent in on or before the 6th prox. The salary fixed is £1000 per annum. We doubt not that the opportunity thus offered will bring forth a host of aspirants, and that the selection which will be made will be looked forward to by the gas world with much interest.

The question of the appropriation of gas profits has again cropped up at Manchester. At last Wednesday's meeting of the City Council the following motion, of which Alderman Curtis had given notice, was agreed to—"That the Town Clerk be requested to examine the various Acts of Parliament which regulate the purposes to which the surplus gas profits may or are to be applied, and to prepare and submit a report to the Council showing the legal position both of the Gas Committee and the Council in relation thereto."

Yesterday there was opened at the Agricultural Hall, Islington, an exhibition having a somewhat novel character. Its object is to show the progress of building and decorative art, and it consists of a large collection of materials and appliances employed in the construction, furnishing, decoration, lighting, warming, ventilating, and sanitation of houses. About three hundred firms, whose businesses are nearly or remotely connected with the object of the exhibition, have contributed to its completeness by sending articles in the several departments with which they are specially identified, and these, under the direction of the Manager (Mr. John Black) and his assistants, have been skilfully grouped into eight classes, which are so arranged that the visitor may trace the subject of building construction literally from its foundation. In the brief period during which the exhibition has been open it has not been possible to notice particularly any exhibits which may have special interest to the readers of the JOURNAL—such as those relating to the lighting, water supply, and sanitary arrangements of dwellings—but should a closer inspection reveal anything novel in these important branches of house building it will receive attention. The exhibition will remain open until the 17th inst.

We are pleased to notice that His Royal Highness the M. W. Grand Master has appointed Bro. Magnus Ohren, of Lower Sydenham, to the office of "Assistant Grand Director of Ceremonies" of the Grand Lodge of England for the year 1880-81. It will also interest many of our readers, even those who are not Freemasons, to hear that last Saturday one of the daughters of the late Mr. John Johnson, of the Chartered Gas Company, was elected into the Royal Masonic Institution for Girls, being second at the poll out of a list of forty-five approved candidates.

Water and Sanitary Notes.

WHAT is now to be done with the Metropolis Water-Works Purchase Bill? This is what Mr. Watherston has summoned the Vestry delegates to decide—that is, so far as they can. Up to this time we have had no distinct expression of opinion on the matter from the Metropolitan Local Authorities collectively. Some opposition has been made in remote quarters to the proposed price; but, as a matter of fact, nothing like an authoritative opinion has been expressed by any important local governing body. Nor is there likely to be until the new Parliament meets, and an attempt is made to proceed with the Bill. Everything, it may be said, depends upon the action which the Local Authorities may take. Mr. Cross was impelled to his proceedings by a *vis a tergo* applied by the Metropolitan Authorities. He adopted, perhaps, the only means he could of obtaining an estimate of what was the value of the Metropolitan Water Companies, and then seems to have retired frightened, so to speak, at the results of his own proceedings. There was no occasion for it; he had simply to send on the Bill—that is, if he had had the opportunity—and awaited the decision of the Hybrid Committee which would have had the matter under consideration. But this has to be said: The terms of purchase in Mr. Cross's Bill express the deliberate determinations of the Companies. They say in effect, take us at this price, or leave us. "Rinsed out by water," however, as the present has been, the matter will have to be taken in hand by some future Home Secretary, who will certainly have a much larger majority, but may not have so strong a character. Much will depend on the individual proclivities of the new Secretary. If he entertain firm opinions on the matter, and is well supported by Mr. Fawcett and others, the measure proposed by the present Administration will probably be carried in spite of the opposition which we fear will be raised by the Local Authorities, to whom the scheme holds out no hope of a diminution of charges or a change of supply.

In our last number we published extracts from the very valuable report by Lieut.-Col. Bolton on the present condition of the works of the several Metropolitan Water Companies. He shows to demonstration how great are the efforts now being made by the Companies to furnish pure and wholesome water, and, further, to develop to the utmost the constant supply system, which every one is so anxious to see applied. Except in one case, all the Companies are working in this direction, and their exertions we are certain will be freely acknowledged by the public. The single thing, however, which the Companies cannot give, is the thing which the public most want, and that is, reduced charges. These will never be obtained until the Companies, if they continue to exist, have worked up to their maximum dividends. Then water-rates will be immediately lowered. It is pleasing to see that Lieut.-Col. Bolton is well satisfied with the filtering arrangements. These have been provided at enormous expense, and ought to assure the Metropolitan ratepayer that every effort is being made to satisfy his wants so far as the purity of his supply can be ensured by these means. Thames and Lea waters, we all know, are not perfection, nor is there any water supply in the kingdom which is; but much can be done by engineering skill, and this we believe is being provided by the Metropolitan Water Companies. Let us hear the results of their efforts as described by Dr. Tidy in his report for March on the Metropolis Water Supply:—"The water was found to be clear and nearly colourless in all cases but the following, when it was slightly turbid—namely, 'Lambeth Water Company.' This is a very small matter. Slight turbidity simply means a little suspended clay, which will not hurt anybody. We need not quote Dr. Tidy's analytical results, for they necessarily resemble each other so much month by month that repetition is needless."

THE DISPOSAL OF THE SEWAGE OF COVENTRY.—The Coventry Town Council have agreed to renew the lease of the city sewage works to the Rivers Purification Association, Limited, for a further term of four years, at an annual subsidy of £2200.

INSTITUTION OF CIVIL ENGINEERS.—At the ordinary meeting of this Institution, last Tuesday, the monthly ballot resulted in the election, as Associate Members, of (among others) Mr. William Belton, Engineer and Manager of the Shrewsbury Gas-Works; Mr. John Allsopp, Engineer to the Local Board of Walsall; and Mr. John Thomas Earnshaw, the Borough Surveyor of Ashton-under-Lyne.

ROCHDALE CORPORATION WATER SUPPLY.—The minutes of the Water-Works Committee, presented at the last meeting of the Rochdale Town Council, stated that the deficiency in the water-works accounts for this year would, it was estimated, amount to £9500, and the Committee had passed a resolution requesting the Finance Committee to include this amount in their estimates for the next borough rate. The deficiency last year was about £7000, the greater amount this year being due to the increase of expenditure on capital account.

PROSPECTS OF THE METROPOLITAN WATER QUESTION.

THE impending change of Government by no means removes the Metropolitan Water-Works Purchase Bill from the programme of possibilities. The discussion which has been going forward on the merits of the measure, has probably removed a little of the prejudice previously excited against it, and further consideration may convince the public that the efforts of Mr. Cross have been unduly disparaged. Arguments held to show that the price proposed to be paid is extravagantly high are of no practical value, if the Companies are determined not to abate their terms. The buyer may prove to a demonstration that the seller is asking too much; but if the seller will take no less, the demonstration is only so much talk. If the buyer threatens by force of law to impose his own terms on the seller, the aspect of affairs is altered, but by no means *pro bono publico*. Mr. Cross has proceeded on the principle of agreement. If the principle of compulsion is introduced, a blow is struck at the value of all property based on statutory concession. When those parties who quarrel with Mr. Cross's provisional bargain propose a compulsory process, they, of course, intend that the compulsion shall be of such a sort that the Companies shall not obtain the price for which they are willing to sell. That is to say, Parliament having created a vested interest, is afterwards to step in and destroy or damage what it has first created. Powers were granted by Parliament, and conditions were exacted from the parties to whom the powers were given. A compact was thus set up, and this having been fairly observed by the one side, is afterwards to be broken by the other, simply because the stronger side changes its mind. This is not the way in which the British Parliament has hitherto acted, nor is it the way in which we may expect it to act. Such a procedure, occurring in any instance, and especially in one of such magnitude as that of the London Water Companies, would at once depreciate all property based on statutory right. We may, therefore, consider that Mr. Cross was fully warranted in his evident conclusion that the compulsory purchase of the Metropolitan water-works was not a measure which Parliament would be likely to entertain.

An attempt may be made to draw a parallel between the purchase of land by compulsion for the construction of a railway, and a compulsory purchase of the interests of the London Water Companies. If land, which in many cases has belonged to a family for generations, may be taken by power of an Act of Parliament, and paid for according to a price settled by arbitration, why may not the same process be applied to water-works belonging to a number of Shareholders who cannot be supposed to care very much whether they get their income from water-works or from something else? But it will be seen that the parallel is not perfect. The land is absolutely essential for the construction of the railway. If the land be not obtained, the railway cannot be made, and the public interest absolutely requires that the land should be bought for this specific purpose. There is no such necessity in regard to the purchase of the London water-works. It was necessary, in the first instance, that the land on which the works exist—that is to say, the area requisite for the reservoirs, filter-beds, and other appliances—should be purchased by means of compulsory powers. But these works being called into existence, London receives its supply of water, and the avowed object is gained. It is not essential that the water-works should be transferred to a new body, for, whether such transfer takes place or not, London will be supplied with water.

The contention that the terms embodied in Mr. Cross's Bill are too liberal towards the Companies, takes the shape of an argument that the additional security has not been duly taken into account. Granting that the Shareholders will receive no larger income from their water stock under the new Trust than they did from their shares under the Boards of Directors, it is argued that the security given is so much better that a less rate of dividend ought to be accepted. The purchaser may hold this view, but the seller may think differently. Shares in the London Water Companies have not generally been held by a speculative class. Families have drawn their incomes from this source over long periods of time, and have not cared to transfer their money to other undertakings. They are content with the position and prospects of the Companies, and if the security is not absolute, it is sufficiently substantial. A man receiving £500 a year from his water shares, if asked to accept as an equivalent £400 a year from water stock having the local rates as a guarantee, may prefer his £500 a year, being satisfied with the security which he already possesses. An outsider, who perhaps never before bought a share in a Water Company, thinks the new security a very desirable thing, and prefers it to the

former basis. The public at large can appreciate the absolute security thus offered, and they make a rush for the shares. The non-speculative holders have no particular desire to sell, and hold their stock rather tightly. The desire to purchase on the one hand, and the absence of any particular desire to sell on the other, will serve to send up the price of the shares in the market, and the quotations are brought forward as evidence that the equivalent in water stock is an extravagant bargain.

In the midst of the controversy that is now going forward, there are proposals for compulsion under the guise of competition. It will be remembered that the Metropolitan Board came forward with a double-barrelled gun of this description. The Board had a Purchase Bill and a Competing Supply Bill. But the latter was a hopeless affair from the beginning, and the former met with no very substantial encouragement. The effort thus made altogether broke down, despite a large expense incurred in perfecting the plans and preparing evidence. Perhaps it was rather a pity that the scheme was so summarily disposed of. It might have been interesting to have known what evidence the Board had to bring against the Companies, and possibly a few popular bugbears would have been laid to rest. In one respect the incident was instructive, and so also is the career of the present Purchase Bill. The Metropolitan Board entered on what appeared to be a popular course in their attempt to deal with the Water Question. But no sooner did the scheme come before the world than the tide of public opinion turned dead against the Board, and the Water Companies had the satisfaction of seeing the two Bills utterly swamped. When Mr. Cross took up the subject, there was a general chorus of delight; but when his scheme came out, there at once ensued a perfect hubbub of discontent. The history of the Metropolitan Water Question amounts to this—that, although the public have been led to believe they have a grievance against the Companies, yet, after all, they have not been satisfied with the prospect of any change that has been proposed. Certainly, there is no proof forthcoming that the Companies have failed in their statutory obligations, and such being the case, it is not likely that Parliament will authorize any competing scheme of supply. A transfer of the present undertakings is another matter; and if both parties agree upon a price, the affair is so far settled. If they fail to agree, it is no use to indulge in hard language or elaborate arguments. If Parliament will not agree to the terms on which the Companies are willing to sell, the latter must be supposed to understand their own business, and we think it must be allowed that they have a right to fix their own price. If the Water Companies have not this right, neither have any other statutory Companies, and it must be understood that in future all Railway Companies, Gas Companies, Tramway Companies, and the like, may at any time be called upon to surrender their property at a price which it may please the public for them to receive, the public being represented by speakers and writers who may not be so intimately acquainted with the facts of the case as to render their judgment at all trustworthy.

The only case on record in which the property of a Water Company has been acquired by the exercise of compulsory powers on the part of the Local Authorities is that of the famous Stockton and Middlesbrough transaction. In that instance the Local Authorities pleaded their anxious desire to get something better than the polluted water of the Tees, with which the Company were supplying the inhabitants. Having acquired the property of the Company, the Corporations of Stockton and Middlesbrough are now applying to the Local Government Board for a Provisional Order to rescind the clause which limits the quantity of water to be taken from the Tees, so that the Corporations may furnish a larger supply of water from this source for the use of the inhabitants. As the Act by which the Corporations acquired the property of the Company was only passed in the session of 1876, we cannot suppose that the Tees has greatly improved in its quality in the interval. Thus, having obtained the water-works, the Local Authorities are content to let things remain substantially as they were; although, so long as the works were in the hands of the Company, the Authorities were always complaining of the character of the supply. Birmingham affords an instance which is often cited as one of compulsory purchase. In reality, the water-works were purchased by a voluntary agreement, although it is true that an Act was obtained for purchase by arbitration. The passing of this Act took place under peculiar circumstances, such as do not arise in reference to the London Companies. But the Birmingham case is worthy of notice, as affording proof, like that of Middlesbrough, how the Local Authorities can content themselves, under their own

régime, with a state of affairs which they condemn in a Company. The Birmingham Corporation came before Parliament with an intimation that if they obtained possession of the water supply they would reduce the rates. They have now had possession of the works for at least four years, and it has just been stated that the prices charged have not exhibited any reduction, but in many instances there has been an increase. Neither is the prospect brightened by an approaching addition to the capital account.

The estimated value of the undertakings of the London Water Companies is affected by various considerations, which may be easily overlooked by critics who are not directly concerned in getting at the real state of the case. The power of the New River Company to pay up back dividends extending over the last 150 years may seem absurd, but it means something. The continual and enormous growth of the Metropolis is a very important element, as assuring the future prosperity of those Companies which extend into the suburbs. The "proximate and assured increment" is no mere figure of speech. Mr. Cross knew it to be a reality, and told the House it was "impossible to deal with the Water Companies unless that fact is recognized." If London were stationary, or growing only at a very slow rate, or if the Companies to be treated with had no relation to the outer circle, the prospects of the Shareholders would be different. So also the case would be different from what it is, if all the Companies were paying their maximum dividends, or charging their maximum rates. The fact that the Companies, on the whole, are not charging nearly their full parliamentary rates, affords them a species of guarantee for their future dividends. It is quite useless to ignore such considerations as these, since there can be no doubt that the Companies are conscious of the value which attaches to these several points. On the side of the public, it is possible that the value of what is to be obtained has not been duly estimated. At least we may say this in respect to journalists and others, who profess to speak in the public interest. While quarreling with the terms of Mr. Cross's Bill, these objectors fail to perceive that these are the pecuniary conditions on which the water supply is already based. The public simply have to choose whether they will pay the Shareholders through the medium of a Water Trust, or through the existing Boards of Directors. If they adopt the plan of the Trust, the public will acquire a highly valuable property, which can be made to yield important pecuniary benefits in the future. The mode of payment devised by Mr. Cross also has the advantage of making the purchase a mere matter of account. The case was far different when the Stockton and Middlesbrough Corporations made their purchase, and the difficulty they experienced in raising the requisite capital enhanced the burden they had to bear. This will be obviated if the scheme devised by Mr. Cross be adopted.

An attempt is made in some quarters to impugn the character of the present water supply. It was the expressed opinion of Mr. Cross that there was no actual need to change the sources from which the supply was taken. The Home Secretary's statement to the House on this subject was as follows:—"As to getting new sources of supply, I do not think that will be at all necessary, at any rate in the immediate future. I have no doubt that the water obtained from the present sources is to a great extent capable of being made pure at a very small cost." Common sense will settle this question in the long run; and we shall see that, whenever any scheme is propounded for introducing a new supply, the public will discover some fatal objection to the proposal. Possibly, if the Companies are "bought up" we shall hear no more of any fresh sources of supply. At present there is a gentleman who thinks he knows how to give London "a constant and ample supply of pure softened spring water, at high pressure," at an outlay of ten million pounds. Remembering the usual fate of estimates, we are not disposed to think this very low for a beginning. Rather oddly, the same gentleman calculates that it will cost six millions to substitute spring water for the proportion of river water now in use, and to make the new supply constant. Mr. E. J. Smith, the valuer for the Government in connection with Mr. Cross's Bill, replies that the Water Trust will be able to command the requisite quantity of spring water at a cost of a hundredth part of the aforesaid six millions. We do not know that the inhabitants of the Metropolis will find particular reason to rejoice when the Companies have been made to give place to a Public Authority. But if the change is to take place at all, the ratepayers had better have it carried out at once; and even though Mr. Cross's bargain may seem a costly one, delay will not be likely to produce a better. On the contrary, every year's postponement will be dearly bought.

ON THE PRODUCTS OF COMBUSTION OF COAL GAS.

Mr. Lewis T. Wright deserves the thanks of all those connected with the manufacture of gas for his endeavours to clear up some of the vexed questions relating to the products which are formed by the combustion of coal gas. In a paper published in the Transactions of the Chemical Society at the beginning of last year,* Mr. Wright brought forward some interesting experiments to show that the ammonium nitrate and nitrite found amongst the products of combustion of coal gas in air are derived from the ammonia, either free or combined, which seems to be a constituent of a normal atmosphere. The experiments were made by burning coal gas at a Bunsen burner, in an apparatus similar to that prescribed by the London Gas Referees for determining the quantity of sulphur in the coal gas supplied by the Metropolitan Companies.

In the first series of experiments the gas was purified from ammonia before reaching the burner; ordinary air was employed, but precautions were taken to ensure its freedom from accidental contamination with ammonia. Ammonium nitrate and nitrite were found in the condensed liquid. The following table gives the nitrate and nitrite found, in grams of nitrogen, for every thousand litres of coal gas consumed:—

Coal Gas free from Ammonia burned in a Normal Atmosphere with Bunsen Burner.

Nitrogen as HNO ₃ per 1000 Litres of Coal Gas consumed.		Nitrogen as HNO ₂ per 1000 Litres of Coal Gas consumed.
(1) 0.0009 gram	..	0.00096 gram
(2) 0.00062 "	..	0.0005 "
(3) 0.00056 "	..	0.00061 "
(4) 0.00046 "	..	0.00064 "
(5) 0.00035 "	..	0.0002 "

Average 0.00058 gram 0.00058 gram

In a second series of experiments the coal gas before reaching the burner was passed over a strong solution of ammonia. As a mean of five experiments, the quantity of nitrogen as nitrate in the condensed liquid was found to be 0.0107 gram per 1000 litres of gas consumed, and the quantity of nitrogen as nitrite was found to be 0.0017 gram per 1000 litres of gas consumed. Similar experiments were made with the air-holes of the Bunsen burner closed, but no appreciable difference was found in the amount of nitrogen acids formed.

In another set of experiments the coal gas was freed from ammonia, and the air charged with a large quantity of ammonia by placing lumps of ammonium sesqui-carbonate near the top of the burner. The results of these experiments are given in tabular form:—

Coal Gas free from Ammonia burned in an Atmosphere charged with Ammonia with Bunsen Burner.

Nitrogen as HNO ₃ per 1000 Litres of Coal Gas consumed.	Rate of Consumption per Hour.	Nitrogen as HNO ₂ per 1000 Litres of Coal Gas consumed.
(1) 0.04645 gram	16.1 litres	0.13154 gram
(2) 0.04165 "	16.4 "	0.11793 "
(3) 0.04485 "	18.6 "	0.12701 "
(4) 0.03684 "	19.5 "	0.10433 "
(5) 0.03363 "	20.3 "	0.09522 "
(6) 0.03283 "	22.1 "	0.09298 "

Average 0.03938 gram 18.8 litres 0.1115 gram

The amount of nitrogen found as nitrate and nitrite diminishes with increased consumption of coal gas. This is probably due, Mr. Wright tells us, to the ratio of air to coal gas diminishing with the increased supply of gas.

On burning hydrogen in the same apparatus with ordinary air, amounts of nitrogen were found in the condensed liquid varying from 0.009 gram to 0.018 gram for nitric acid, and not exceeding 0.0002 gram for nitrous acid per 1000 litres of hydrogen consumed. When the air was thoroughly purified by passing it through two wash-bottles charged with potassium permanganate solution and sulphuric acid, then through a column of freshly-slaked lime, and finally through pumice saturated with concentrated sulphuric acid, and when the hydrogen was bubbled through two wash-bottles charged with potassium permanganate solution and sulphuric acid, no traces of nitric or nitrous acid were found in the condensed liquid, which did not give the slightest tint with Griess's metaphenylene-diamine in 24 hours, and had no action upon potassium iodide and starch in presence of hydrochloric acid.

These experiments, Mr. Wright justly considers, lead to the belief that the origin of the nitrogen acids found in the condensed water procured by burning coal gas or hydrogen in air is ammonia, either free or combined. We may point out, however, that the conditions under which coal gas is burnt in the Referees sulphur apparatus are not the same as those which obtain in an Argand burner.

In his last paper† Mr. Wright deals with the product of the combustion of the sulphur in coal gas. Having unsuccessfully attempted to completely oxidize the sulphurous acid into sulphuric acid by burning the coal gas from a Bunsen burner in an atmosphere charged with nitrous fumes, Mr. Wright drew the products of combustion of coal gas, containing 17 grains of sulphur per 100 cubic feet, through several wash-bottles charged with distilled water. The sulphuric acid found in the water was only equal to 2 or 3 grains of sulphur per 100 cubic feet.

Mr. Wright next endeavoured to estimate the sulphur by drawing

* "On the Occurrence of Certain Nitrogenous Acids amongst the Products of Combustion of Coal Gas and Hydrogen Flames." By Lewis T. Wright. *Journal of the Chemical Society*, Jan., 1879.

† Note on the Products of Combustion of Coal Gas." By Lewis T. Wright. Read before the Chemical Society, April 1, 1880.

the products of combustion through a solution of iodine in potassium iodide of known strength. He says:—"My expectations were not at first realized, for results palpably too low were obtained. I should, perhaps, have attributed these low results to the formation of sulphuric acid before the products of combustion reached the iodine solution, had I not noticed a reappearance of iodine in some of the wash-bottles after the iodine solution had been completely bleached and the current of gases had been stopped." This reproduction of free iodine Mr. Wright attributes to the "disturbing influence of nitrous acid." Nitrous acid undoubtedly liberates iodine from hydrogen iodide, but the reaction takes place quickly. The gradual re-appearance of free iodine in a solution which has been reduced either by sulphurous acid or by a thiosulphate is a well-known phenomenon, and is probably due to the oxidation of the hydrogen iodide by the oxygen dissolved in the water employed. It can be prevented either by using freshly-boiled water, or by bubbling a stream of carbonic acid through the solution, which drives out the dissolved oxygen, and prevents air from coming in contact with the liquid. Mr. Wright discovered that the re-appearance of the iodine could be prevented by dissolving pure sodium bicarbonate in the iodine solution, and that "with this precaution the sulphur of coal gas could be accurately estimated by burning such a small quantity as half a cubic foot." In other words, Mr. Wright expels the dissolved air by carbonic acid.

The importance of these experiments lies in the fact that, if all the sulphur present in the gas can be estimated by the reduction of iodine, on passing the products of combustion through a standard iodine solution, the sulphur must yield no sulphuric acid, but only sulphurous acid, on burning under the conditions of the experiment.

TWO NEW INVENTIONS.

A recent invention of Mr. J. P. Rickman, for the manufacture of ammonia from the nitrogen of the atmosphere and the hydrogen of steam, may prove of some importance to the owners of gas-works, should it be shown to be successful in practice. The ammoniacal liquor produced in the manufacture of gas being now the chief source of ammonia, its value would considerably diminish should a cheaper source of that useful substance be discovered. Numerous endeavours have been made to convert into ammonia the nitrogen which forms the bulk of our atmosphere; but none have hitherto been a commercial success. We may mention Maxwell-Lyte's process of passing nitrogen and steam over an alloy of potassium and antimony, and Swindell's system of conducting a mixture of atmospheric air and steam through incandescent coke. Rickman's process is similar to that of Swindell. A series of inclined retorts are filled with coke and heated to 550° C. A mixture of 12 parts by volume of steam and 5 parts of atmospheric air is then introduced, and ammonia is formed and afterwards condensed in water. The most important point in working this apparatus is to maintain uniformity of temperature. Should the apparatus be too cool, no ammonia is formed; if the heat be too great, any ammonia which may have been produced is dissociated, and again resolved into the elements to which it owed its origin. This regulation of temperature was found to be so difficult to attain, that an improvement has been devised which promises to overcome the chief obstacle to the successful working of the process. It is well known that chloride of ammonium is less easily decomposed at a high temperature than ammonia alone. Mr. Rickman, therefore, converts the ammonia into chloride of ammonium at the moment it is generated, which is effected by mixing common salt with the coal or coke used. It is claimed that by these very simple means ammonia can be produced at less than 1d. per pound.

Another invention, which may prove of importance to gas producers, is that recently patented by Mr. W. F. Reid, for the utilization of tinned iron waste. At first sight this may appear to have little connection with gas; but when we mention that pure hydrogen can be obtained as a bye-product in this process, the connection will be more apparent. Mr. Reid separates the iron from the tin contained in tinned iron waste by first oxidizing the outer layer of tin and the alloy of tin and iron underlying it, and then by mechanical means separates the oxides thus formed from the iron which constitutes the bulk of tinned iron. This oxidation is performed either by means of atmospheric air or steam acting on the tinned waste at high temperature. When steam is employed, the oxides of tin and iron are formed, and hydrogen is liberated. As the value of the pure scrap iron obtained is sufficient to cover the cost of materials and working, the oxide of tin and the hydrogen are obtained as valuable bye-products, and many uses may be found for the latter if they can be produced cheaply.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE SLIDING SCALE.

SIR,—“There is nothing new under the sun,” and in this sense the sliding scale is not new; but the application of this principle in its entirety to gas companies was first suggested at the meeting of the British Association of Gas Managers in 1874, when the President, after denouncing the then existing system, said that “it ought to be possible to frame a scheme that should cause the interests of gas companies and their customers to run side by side—to make the consumers in a sense partners in the gas company—whereby both should participate in any improved or more economical working, giving the companies a slightly increased dividend for every reduction in price,” coupled with a reduction of dividend when the price of gas was increased. Up to this time no proposal had been made for increasing gas dividends beyond 10 per cent., although an incomplete and ineffi-

cient sliding scale had been adopted in two or three cases, of which West Ham may be taken as the type. That Company, in 1869, obtained an Act whereby they were empowered to raise additional capital on which the dividend was limited to 7 per cent., when the price charged for gas was 4s. 6d. per 1000 feet or more; at 4s. 3d., the dividend might be increased to 8 per cent.; at 4s., to 9 per cent.; and at 3s. 9d., to 10 per cent.; and there the increase of dividend stopped, and with it all further inducement to reduce the price of gas.

In the early part of the years 1873 and 1874 the Public Authorities of London became so dissatisfied with the revisions of price under the existing system, that in 1875 they introduced a Bill in which they adopted one half of the sliding scale principle above referred to. They proposed that, taking 3s. 9d. per 1000 feet as a standard price, the Gas Companies should lose 5s. per cent. of dividend for every 1d. added to the price beyond the standard rate. I agreed to support the Bill of the Metropolitan Board on condition that I should be perfectly free to contend before the Committee for an up and down sliding scale of dividend, in opposition to the one-sided arrangement in their Bill, which acted in reference to dividend in a downward direction only. The Board accepted my services, the late Mr. Newton saying that they could not propose that any Gas Company should be empowered to pay a larger dividend than 10 per cent. On the Bill coming before the Right Hon. W. E. Forster's Committee, the Board of Trade sent a letter to the Chairman, stating that, in their opinion, the sliding scale ought to operate in both directions; the Committee took the same view, and the Metropolitan Board acquiesced.

None of the London Companies, except the Commercial, had the good sense to accept the principle. The Commercial, however, were rewarded by obtaining their new capital without the auction clauses, which were introduced in the following year, when those Companies who had strenuously opposed the sliding scale were glad to take it, though coupled with the auction clauses. As a gas shareholder, I do not like these clauses, and had nothing to do with their introduction; but I cannot argue against them, because I believe them to be a fair arrangement as between the gas companies and the public, and, moreover, they are working well.

I trouble you with this *résumé* because in 1880 many gas men are either ignorant of, or have forgotten the views current in 1875, and I am not willing to lose the credit, or, if you like, the discredit, of being the author of this sliding scale, whereby dividends may be increased beyond 10 per cent., coupled with a possibility of reduction. The stock argument of those who object to the sliding scale is, that under the old system the 10 per cent. was absolutely secure under almost any possible circumstances. To this I reply that such a system was essentially unfair to the consumers, and also most detrimental to the best interests of the gas companies, owing to the incentive it gave to the extravagant expenditure of capital, and to its failure to supply any motive or encouragement to economical working; its effect, in short, being to make it a positive disadvantage to a gas company to reduce the price of gas, whereas the sliding scale acts in precisely the opposite direction.

The sliding scale, coupled with the auction clauses, compels economy of capital. It also offers a very strong inducement to gas companies to improve and cheapen the manufacture of gas, and to make the most of all subsidiary sources of revenue; thus immensely strengthening the position of those companies under its influence, and securing for them conditions of prosperity that were altogether wanting under the old system—conditions which I unhesitatingly affirm are far more than an equivalent for the safe 10 per cent. dividend of the old plan, and conditions, moreover, that are a direct and positive advantage to the consumer also, because they not merely tend to reductions of price, but they act as a guarantee that, even in the worst of times, the price of gas will not be raised if it can by any possibility be avoided. Should such times as those of 1873 and 1874 return, the utmost energies of the gas companies under the sliding scale will be put forth to avoid an increase of price and a reduction of dividend, and I have very little doubt that those efforts will be completely successful under the stimulus of that necessity which is the mother of invention. As I write I am almost tempted to wish that the circumstances of 1873 and 1874 would return, in order to show what the sliding scale can accomplish.

I heard the remark made by a Director of a London Company last week that a safe 10 per cent. is better than 11½ coupled with the possibility of a drop to 7 per cent.; and so undoubtedly it is, if the chances were even, and they could make sure of holding it always; but a drop from 11½ per cent. to 7 per cent. means an increase in the price of gas of 1s. 6d. per 1000 feet. Now 3d. per 1000 feet was sufficient to cover the extra cost of gas during the coal panic years, as evidenced by the Commercial Company, who, with an additional 3d., came through without any loss; while the Ratcliff, the Crystal Palace District, and the South Metropolitan Companies made no increase in price—the last named, in fact, reducing 2d., but taking from reserve the sum necessary to keep up the dividends.

589, Old Kent Road, S.E., April 10, 1880.

GEORGE LIVESLEY.

THE MANUFACTURE OF SULPHATE OF AMMONIA.

SIR,—The accident in the sulphate of ammonia factory which recently occurred at the Chesterfield gas-works, and also that which took place a year ago at the Ipswich works, show very clearly not only the danger that may ensue if the workman in charge does not perform each of the duties devolving upon him at the stated and proper time, but they also point to the fact that the system of using open saturators and concentrated charges of sulphuric acid is a source of danger which should, if it can, be avoided. Each of the witnesses questioned at the Coroner's inquest at Chesterfield, in regard to the efficiency of the apparatus, gave it as his opinion that there was no fault to be found with the system employed. Doubtless the apparatus in use at these works is complete and perfect of its kind, but I desire to point out that any arrangement by which the noxious fumes can make their exit from the saturator into the building containing the apparatus is defective, and does not sufficiently provide against possible neglect or mistake on the part of the manipulator.

Wherever the system of mixing the sulphuric acid in a concentrated form with the ammoniacal liquor or the vapour of ammoniacal gas is

adhered to, the saturator must be open, or, at any rate, the cover of it must be removable, and not sealed down; because, in the concentrated method of working, the sulphate is deposited as salt in the bottom of the saturator, and must be removed therefrom at the termination of each charge.

A far better and safer system is that of using the acid in a diluted form—usually in the proportion of one part of acid to two parts of water—and conducting the operation in a closed saturator, the fumes from which are carried away by a pipe to a safe distance from the scene of operations. In his case the sulphate remains in solution in the saturator, and must be run off from it by an outlet-pipe at the bottom into a separate vessel or pan, and evaporated to a sufficiently concentrated degree until the salt deposits itself.

It is true that this process entails more time than the other and cruder method, and requires a greater expenditure of fuel, on account of the after-evaporation of the "mother liquor." For this reason it is important to use a distilling apparatus which can be worked continuously, and in which the operation of saturating a second charge of acid may go on simultaneously with the evaporation of the charge previously neutralized.

Such an apparatus exists in its most perfect state at the Redheugh works of the Newcastle and Gateshead Gas Company, and may also be seen at the Crystal Palace District Gas Company's works, where it was introduced by the late Mr. Henry Hathaway.

At the Peterborough gas-works I have adopted a similar apparatus, in which the distillation of the liquor is effected by passing it through a Coffey still, and introducing a jet of steam into the bottom of the still. This converts the ammonia into vapour, the ammoniacal gas being then conducted by a pipe from the top of the still into the saturator.

Experience in working shows that there is a complete absence of danger to the workman in charge from poisoning by carbonic acid or cyanogen gas, it being impossible for any deleterious products to escape into the air. In addition to this advantage, the continuous Coffey still process permits of a much larger quantity of salt being turned out in a given time with the same sized apparatus, and with a less expenditure of labour than by any other process, so that although there is a slight drawback in the larger quantity of steam, and, consequently, fuel required, this is more than compensated for by the above advantages, even in a pecuniary sense.

I consider, Sir, that it is the duty of every Engineer to provide for the safety of the workmen under his control, and it is incumbent upon him to adopt such apparatus and methods of working as will best combine this requirement with practical efficiency and financial economy.

G. ERNEST STEVENSON, Engineer and Manager.

Gas-Works, Peterborough, April 10, 1880.

THE RECENT GAS-LAMP TESTS AT BIRMINGHAM.

SIR,—May I trouble you to correct a typographical error which appears in my letter in last week's JOURNAL? The Bray medium lighting power 80-candle cluster burner is there shown to yield 3.01 candles per foot of gas. It should have been 3.21 candles per foot, as in Mr. Hunt's table.

Blackman Lane, Leeds, April 10, 1880.

GEO. BRAY.

SIR,—I am sure that your readers will soon weary of correspondence on this subject, if it only degenerates into a personal controversy between two rival makers, each of whom is anxious to prove that his own manufacture is better than that of his opponent; while the public are desirous of learning how to illuminate public places, &c., in the best way, both as respects the light given, and the cost of producing that light.

Now, without again going into details, I claim that my burners and lanterns solve the problem, and give more light at a less cost than any others yield, by at least 30 per cent.; and I take my stand upon experiments carried out for me by eminent scientists, corroborated by a public trial made without previous communication to me, or without my interference in any way, and published by the experimenters themselves in your issue of the 20th of March last.

I do not understand Mr. Bray to claim the same result for his burners and lanterns as I do, but only to assert that my superiority is not so great as I maintain. Whatever his claim is, he takes his stand, not on a public trial, but on private experiments made before and after such trial, and under conditions with which we are not acquainted.

I can hardly see the use of proposing further public trials if the results are not to be accepted as final when they do not happen to suit some of the parties who compete; but as the question of itself, apart from trade squabbles, is very interesting to your readers, I am ready to send again my lanterns and burners of both kinds, Argand and flat-flame, in competition with Mr. Bray—both English and Scotch gas to be burned—if Mr. Bray and I can come to arrangements as to the places of testing and who is to do it.

I have no fear of any just comparisons of my processes with those of other makers, and therefore I will ask you kindly to publish the results in your JOURNAL.

With respect to Mr. Bray's allegation against me relative to copying his burners and infringing his patent for lanterns, I beg to say that the flat-flame combination burner exhibited by me at Birmingham was composed of five of my hollow-top circular-slit steatite burners, patented in 1874 (No. 4277), and therefore they cannot, by any means, be a copy of Mr. Bray's adamas burner of nearly the same shape, because the specification of Mr. Bray's patent (No. 4112) bears date three years later—viz., Nov. 5, 1877—and with it is a drawing exactly resembling my original hollow-top steatite burner invented in 1872. This burner was not, however, patented; but has been extensively used all over the world. This, I think, will be considered conclusive evidence.

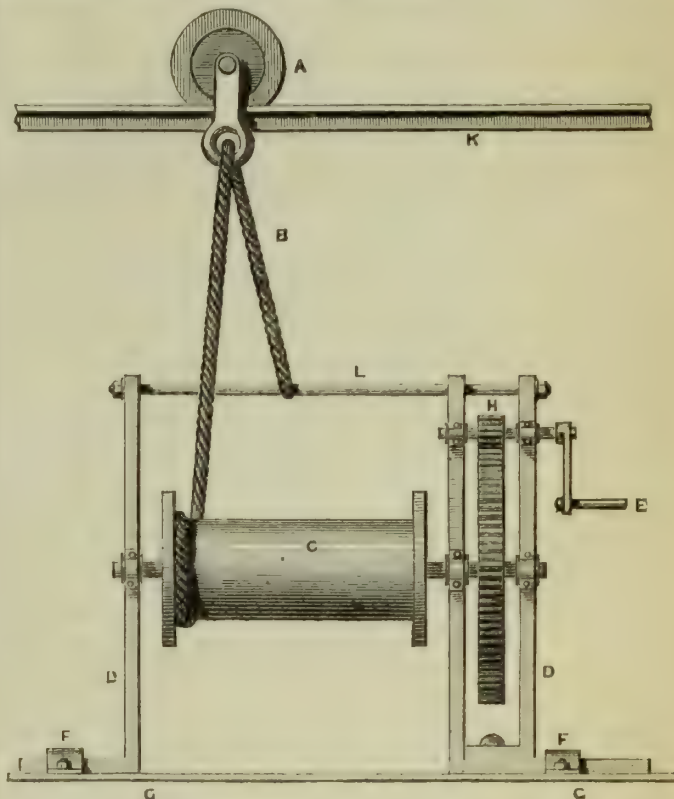
As to the second allegation, that the lantern I exhibited at Birmingham is an infringement of his patent, I beg to say that this charge against me is as baseless as the former. If Mr. Bray's specification drawing resembles my lantern, then I have only to say, that if he will search in the records of the Patent Office, under date Jan. 27, 1879, he will find his invention anticipated by me.

Vincent Street, Westminster, April 10, 1880.

WILLIAM SUGG.

THE RAISING OF PURIFIER COVERS IN SMALL GAS-WORKS.

SIR,—Having lately visited some gas-works in Belgium, I enclose a rough sketch of a simple contrivance for raising the covers of purifiers in small gas-works. It can be shifted from one lid to the other by simply slipping the whole frame from the staples and fastening it to similar staples, in the other lid. Of course one end of the rope is fastened to the drum, C, the other to the rod, L.



The drum is about 6 inches in diameter. The frames are of wrought iron, $\frac{1}{2}$ -inch and $1\frac{1}{2}$ inches wide; the spindle, $\frac{1}{2}$ -inch. The reference letters on the block are as follows:—A, wheel, with flanges running on same; B, winding-up rope; C, winding drum; D, frame for drum and gearing; E, handle for turning small spur-wheel; F, staples on purifier cover; G, purifier cover; H, small spur-wheel working into spur-wheel on drum spindle; K, T-iron girder; L, rod for fastening frames.

Thinking it may prove useful to country Gas Managers, I have sent it to you for publication.

Palace Chambers, Westminster, April 8, 1880.

A. A. LISTER, M.E.

Legal Intelligence.

HIGHGATE PETTY SESSIONS.—MONDAY, APRIL 5. (Before Messrs. HILL and BICKERSTAFF.)

ALLEGED DEFICIENT SUPPLY OF GAS BY A STATUTORY COMPANY.

The North Middlesex Gas Company were summoned, at the instance of Mr. Richard Goodwin Breeze, of East Finchley, for that on the 27th of February, and on the 5th and 6th of March they did unlawfully neglect to give him a supply of gas, he being the occupier of premises within the limits of the special Act of the Company, whereby they are authorized to supply gas under certain pressure, as is prescribed under and by the said special Act and statute in that case made and provided.

Mr. E. UPTON appeared for the complainant.

Mr. R. G. Breeze said he was a surgeon, residing at East Finchley. He had been for some time past supplied with gas by the North Middlesex Gas Company, and was charged for the supply by them. On Friday, Feb. 27, there was no continuous supply at his premises. The gas when lighted burned for about three or four seconds, and then went out, and it was impossible to obtain a continuous supply. On the 5th and 6th of March he had a great many medicines to prepare, but in consequence of the deficiency in the gas supply he could not see to prepare them, and therefore had to keep seven patients without their medicine until the next day. He was obliged to obtain some oil-lamps, which he had continued to use until the issue of the present summons, since which time the gas supply had been much better. He had made application in writing to the Company, through Mr. Porteous, the Manager, complaining of the supply, and had also complained verbally to him and to Mr. Johnson, the Inspector. On the first Saturday in December he (complainant) wrote to the Company, fully detailing the circumstances in which he was placed, but received no reply whatever. His complaints had extended over a year. For his own convenience it was his custom to keep the gas burning at night in three or four different places in his house. Before he retired to bed he turned the gas off at the meter until there was only a small blue jet left; but he had awoke and found it flaring, and had been obliged to get up and turn the gas down to the lowest point as often as three times during the night. From six until nine, and sometimes until ten o'clock, he found, upon examination, that the pressure had been usually 5-10ths of an inch, which was half the pressure it ought to have been; but at one o'clock in the morning the pressure had stood at 6 inches. On one occasion, when he had an interview with Mr. Porteous, it was promised that the matter should be attended to, and he should have a proper supply of gas within a month; but this promise had not been carried out. When he complained to Mr. Johnson he admitted that the supply was extremely bad, but intimated that he could do nothing in the matter.

Jonathan Oram, a bootmaker and the postman at East Finchley, said he burned the Company's gas in his shop, and the supply had been very bad at various times since Christmas.

Mr. HILL said the witness must confine himself to the dates mentioned in the summons.

Witness said he could not recollect the exact dates. He had been employed at the post-office in sorting letters, and within the last two months, on account of the insufficient supply of gas, the postmaster had been obliged to use oil-lamps.

William J. Jones, a baker at East Finchley, said that the gas had gone out while the bread was being put into the oven, and he had been obliged to use lamps and candles. He complained to Mr. Porteous on one occasion, and he promised to come and see about it, but did not do so.

John Stanley, in the employ of Dr. Breeze, gave some corroborative evidence with respect to the irregular supply of gas at his master's house. The gas, he said, had been much better since the summons was issued.

Mr. W. F. Johnson, the Company's Inspector, was called by Mr. Upton, and gave evidence with reference to the pressure at which the gas was supplied. He also stated that he had examined the fittings at Dr. Breeze's house, and found that they were in a very bad state indeed, some of them being corroded. He believed that the Secretary wrote to Dr. Breeze, pointing out to him that his gas-fittings were in an imperfect condition.

Mr. PORTEOUS, who represented the Company, said his defence was that there was a sufficient pressure of gas at Dr. Breeze's house, and the irregularities were due to imperfect fittings. There was no neglect on the part of the Company to supply him with gas.

John Creighton, foreman at the gas-works, said that on the three days mentioned in the summons he superintended the making and distribution of the gas, and it was sent out at the ordinary pressure of 35-10ths. A complaint was made on one of these days that water had found its way into one of the traps on the main, but on the 28th of February the pipe was repaired. It had been broken, and this would cause the oscillation of the lights in Dr. Breeze's house.

Mr. Johnson was now called as a witness for the defence. He said that on the 5th ult. complaints were received of the gaslights in the Market Place "jumping up and down." On making an examination the next day, he found that a syphon which was connected with the main that furnished the gas supply to Dr. Breeze's house had been damaged, apparently by a cart-wheel, and the water had got in. This would cause an irregularity in the supply of gas. The damage was repaired on the 7th ult. On the 27th of February there was also a defect in one of the pipes.

Dr. Breeze said that when the inspector and the foreman at the works came to his house, they professed ignorance of the cause of the irregular supply on Feb. 27 and March 6.

After a private consultation, Mr. HILL said the Bench considered that the accidents which had been mentioned were the cause of the irregular supply of gas; and, as these defects had been remedied, they had decided to dismiss the summons, but without costs.

[There was another summons taken out against the Company by Dr. Breeze, but it was decided that the hearing of this case should be adjourned for a fortnight.]

ILKESTON LOCAL BOARD GAS SUPPLY.—At the usual monthly meeting of the above-named Board, on the 6th inst., the minutes of the Gas and Water Committee were presented. They stated that the Clerk had prepared and laid before the Committee a statement of the quantity of gas made, consumed, and unaccounted for during the three quarters ending Christmas, 1879, the totals of which were as follows:—Gas manufactured, over 15 million feet; gas consumed, over 10 million feet; gas unaccounted for, over 4 million feet, or 32.5 per cent. of the quantity manufactured. During the first three months the loss was 39 per cent.; during the second three months, 52 per cent.; and during the third three months, after a number of mains had been repaired, the loss was reduced to 14.5 per cent. The total expenditure on the gas-works for the past year, including purchase-money paid to the late Company, was £29,982.

THE PROPOSED ACQUISITION OF THE LUTON WATER-WORKS BY THE TOWN COUNCIL.—At last week's meeting of the Luton Town Council an inquiry was made as to whether anything further had been done in reference to the proceedings initiated for acquiring the water-works. To it the Mayor replied that a legal question had arisen as to whether the twenty persons who must make request to the Local Board to require the transfer of the works, and the subsequent two-thirds of the persons rated who must assent, were burgesses or local board ratepayers in 1876. The Town Clerk had, therefore, written to the Local Government Board on the subject; and their answer was—"The case is one of some difficulty, but we are disposed to think that as the expenses of the Town Council as an Urban Sanitary Authority are defrayed out of a general district rate in like manner as if the Local Board continued the Sanitary Authority, the requisition should be by twenty or more persons for the time being rated to the general district rate. The poll should, we think, be of the persons rated to that rate, the poll being taken, as far as practicable, in the same manner as the votes in the election of a local board under the Public Health Act, 1875. It may, however, be a question for consideration whether an application should not be made to the Local Government Board with the view of ascertaining whether they would be prepared to issue an Order, under section 304 of the Public Health Act, settling the doubt, as the doubt arises out of, or is incidental to the transfer of the powers of the Local Board to the Corporation as the Urban Sanitary Authority." The Town Clerk was instructed to, first of all, write to the Local Government Board, and ascertain whether they would issue such an Order as they mentioned, settling the mode of procedure to obtain the consent of the burgesses to the proposed purchase.

EXHIBITION OF GAS APPARATUS AT IPSWICH.—On Tuesday, the 30th ult., as noted in last week's "Circular to Gas Companies," an exceedingly interesting exhibition of gas-burners, gas cooking and heating appliances, &c., was opened in the Public Hall, Ipswich, and continued open during the week. It was promoted by the Ipswich Gaslight Company with the object of affording the townspeople an opportunity of seeing the various ways in which gas may be used; and the admission was therefore free by ticket obtainable at the gas office. There was a large and varied collection of gas-burners, supplied by most of the well-known makers; while the principal manufacturers of gas cooking and heating apparatus throughout the kingdom were represented either directly or by the agency of some local firm. The cooking capabilities of gas-stoves were the great feature which the exhibition demonstrated, and their economy and adaptability were abundantly proved. The value of gas as a motive power was exemplified by means of the several gas-engines exhibited, which were inspected with considerable interest. Among the miscellaneous exhibits, the Birmingham Corporation sent a complete model of gas-works; while a number of working models of wet and dry gas-meters were shown. A collection of the products obtained from the distillation of 100 lbs. of coal was exhibited by Mr. D. Ford Goddard, the sub-Engineer of the Gas Company, upon whom devolved the responsibility of making nearly the whole of the arrangements in connection with the exhibition; and if its success may be estimated by the expressed satisfaction of both exhibitors and visitors, the latter of whom attended in very large numbers, he may fairly congratulate himself on the happy result of his efforts. The exhibition has, we learn, not only given great impetus to the trade in gas-cookers, but has been the means of demonstrating to the public the vast difference that exists between good and bad gas-burners.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

The Chief Gas Examiner for the Metropolitan Board of Works (Dr. Williamson, F.R.S.) has just presented his report on the examinations of the gas supplied in the Metropolis by The Gaslight and Coke, Commercial, and South Metropolitan Gas Companies, during the quarter ending the 31st of March, 1880:—

I. With respect to Illuminating Power.

	Average for Quarter.
The Gaslight and Coke Company—	
Beckton (common gas)	17.3
Friendly Place "	16.6
Millbank Street (cannel gas)	21.1
Ladbroke Grove (common gas)	17.0
Devon's Road "	17.0
Carlyle Square "	16.7
Camden Street "	16.8
Graham Road "	17.3
Commercial Gas Company—	
Parnell Road (common gas)	17.1
Wellclose Square "	16.9
South Metropolitan Gas Company—	
Hill Street, Peckham (common gas)	16.7

It will be seen from these results that the average illuminating power of the gas supplied by the three Companies has been above the requirements of the Acts of Parliament, especially at the Beckton, Ladbroke Grove, Millbank Street, Devon's Road, Graham Road, and Parnell Road stations.

II. As regards Purity.—Sulphuretted hydrogen has not been present in the gas. The average proportions of sulphur in other forms than this were as follows:—

Grains of Sulphur per 100 Cubic Feet of Gas.

	Average for Quarter.
The Gaslight and Coke Company—	
Beckton (common gas)	7.1
Friendly Place "	10.3
Millbank Street (cannel gas)	9.7
Ladbroke Grove (common gas)	12.8
Devon's Road "	16.7
Carlyle Square "	12.7
Camden Street "	15.0
Graham Road "	
Commercial Gas Company—	
Parnell Road (common gas)	11.5
Wellclose Square "	12.2
South Metropolitan Gas Company—	
Hill Street, Peckham (common gas)	15.5

It appears, therefore, that with regard to sulphur the maximum at all the stations of the three Gas Companies has been within the limits of the Acts of Parliament, and the average in all cases considerably better than required by the Acts, more especially at the Ladbroke Grove station of The Gaslight and Coke Company, where it has only amounted to 9.7 grains.

Ammonia has been present, in slight quantities, in the gas at all the stations of the three Companies, with the exception of the Beckton station of The Gaslight and Coke Company. In no instance was the parliamentary limit reached.

THE PROPOSED EXTENSIONS AT THE YORK UNITED GAS COMPANY'S WORKS.

At the Monthly Meeting of the York City Council last Wednesday, the Town Clerk read a letter which he had received from Mr. C. Sellers, the Secretary of the Gas Company, asking for permission to construct an iron bridge over the River Foss and the roadway adjoining the works, and also permission to cross the footpath running from Malton Road to Layerthorpe, on the east side of the Company's new site, to accommodate a proposed railway siding into both the existing gas-works and the works which the Company are about to erect. The whole of the traffic on the siding crossing the footpath will be worked by a small engine, which the Company intend to procure, so that the traffic will always be moved at very slow speed. The object of the proposed siding is to enable the Company to receive all their coal, lime, and other materials direct from the railway. This, the Directors believe, will not only be an advantage to the Company, but a great saving to the Corporation. At present the quantity of material which the Company have to cart from and to the railway amounts to nearly 28,000 tons a year, and this quantity is constantly increasing. The removal, therefore, of this large amount of heavy cartage from the streets cannot fail to effect a considerable saving in the wear and tear of the roads, and to give general satisfaction to the public.

The letter had been referred to the City Surveyor (Mr. Styan) to report to the Urban Sanitary Committee upon, and on his report the Committee had resolved that the Council be recommended to grant permission to the Company to construct the bridge, upon condition that the headway be made at least 14 feet above the present ground-line, and of such additional height as may be obtainable by lowering the level of the roadway, and further, that if the Committee should hereafter deem it necessary that a foot-bridge or subway should be constructed for the protection and convenience of foot-passengers, the Company will construct it; plans and elevations of the principal bridge to be submitted to, and approved of by the Committee, as also the proposed foot-bridge or subway, if the Council should require it to be made.

Discussion took place upon the letter, the general tone of which was one of satisfaction at the proposition, which was looked upon as being very likely to effect considerable saving both to the Company and the citizens generally. The only point at issue was as to the level crossing. Some of the members of the Council thought that such an idea should not be entertained; but (as it was explained) as the traffic would never travel at more than the rate of three or four miles an hour from the North-Eastern line to the gas-works, there is no possibility of danger. However, the matter was left in the hands of the Committee.

AITKEN AND YOUNG'S PATENT ANALYZER AND CONDENSER.—At the meeting of the Salford Town Council last Wednesday the Gas Committee were authorized to arrange for the erection of one of Aitken and Young's patent combined analyzers and condensers, at a cost, including royalty, of not more than £7000. The Chairman of the Gas Committee (Alderman Sharp) stated, in reply to a question, that the amount of the royalty was £1000, which would not be paid if the apparatus did not answer.

THE GAS-LIGHTED BUOY ON THE ROSENEATH PATCH.—The buoy at Rosneath Shoal, opposite Greenock, having been tampered with on Sunday, the 4th inst., and the gas turned off, the Clyde Lighthouses Trust have issued a notice intimating that any persons making fast to the buoy, or in any way injuring or tampering with the gas apparatus, will be punished according to the statute.

PHOENIX GASLIGHT AND COKE COMPANY.

The Half-Yearly General Meeting of this Company was held on Wednesday last, at the Bridge House Hotel, Southwark—EDWARD HORNER, Esq., in the chair.

The SECRETARY (Mr. I. A. Crookenden) read the advertisement convening the meeting, and the minutes of the meetings held on Oct. 1, Nov. 5, Dec. 17, and Jan. 14, which were all approved as having been correctly entered.

The following report of the Directors was then taken as read:—

The Directors submit herewith accounts and balance-sheet to Dec. 31 last. The various extensions referred to in the last report have been satisfactorily proceeded with, and the whole of the Company's plant is in good and efficient condition.

The scheme of amalgamation with the South Metropolitan Company has been

approved by the Board of Trade, and confirmed by the Queen in Council, and comes into operation as from the 1st of January last. Your Directors feel that the settlement thus arrived at will be for the mutual benefit of shareholders and consumers.

This will be the last meeting of the Phoenix Gaslight and Coke Company, and the declaration of the Dividends, as now recommended, will comprise the business to be done.

The balance of revenue for the half year is £62,989 10s. 9d.

Your Directors now recommend dividends be declared as follows, viz.:—

On the £20 shares, paid in full, at 10 per cent. per annum	£35,666 13 4
On the capitalized stock, paid in full, at 5 per cent. per annum	3,600 0 0
On the new stock, 90 per cent. paid, at 7½ per cent. per annum	11,025 0 0

£50,291 13 4

Less income-tax, leaving a balance of £12,697 17s. 5d.

No. 1.—STATEMENT OF STOCK AND SHARE CAPITAL, on Dec. 31, 1879.

Acts of Parliament relating to the Raising of Capital.	Description of Capital.	Maximum Dividend Authorized.	Number of Shares Issued.	Nominal Amount of Shares.	Called up per Share.	Total paid up.	Remaining to be Called up.	Total Amount Authorized.
5 Geo. IV., cap. 78	Shares.	10 per cent.	27,000	£20	All.	£540,000	..	£540,000
27 & 28 Vict., cap. 169	Stock.	5 ditto.	..	..	All.	144,000	..	144,000
Ditto ditto	Ditto	7½ ditto.	..	..	..	324,000	£36,000	360,000
Ditto ditto	Shares.	10 ditto.	10,000	20	All.	200,000	..	200,000
						£1,208,000		£1,244,000

No. 2.—STATEMENT OF LOAN CAPITAL.

Act of Parliament authorizing the Loan Capital.	Description of Loan.	Rate per Cent. of Interest.	Total Amount Borrowed.
27 & 28 Vict., cap. 159	Bonds.	..	Nil.

No. 3.—CAPITAL ACCOUNT.

Dr.	Description of Capital.	Certified Receipts to June 30, 1879.	Paid off since that Date.	Received since that Date.	Total Receipts to Dec. 31, 1879.
To Expenditure to June 30, 1879.					
Ditto during half year to Dec. 31, 1879, viz.—					
New buildings and machinery in extension of works	£27,359 17 7				
New and additional mains and services	2,828 2 2				
New and additional meters	613 4 0				
	30,901 3 9				
Total expenditure	£1,155,462 0 11				
Balance	52,537 19 1				
	£1,208,000 0 0				
		£1,158,400 0 0	£26,400 0 0	£26,000 0 0	£1,208,000 0 0

No. 4.—REVENUE ACCOUNT, for the Half Year ending Dec. 31, 1879.

To Manufacture of gas—		By Sale of gas—	
Coals, including dues, carriage, unloading, and trimming (see Account No. 7)	£67,136 16 8	Common gas, per meter, at 3s. 4d. per 1000 cubic feet	£137,621 6 9
Salaries of Engineers, Superintendents, and other Officers at works	1,969 4 2	Public lighting (common gas)	13,087 14 6
Wages (carbonizing)	12,808 1 4		£150,709 1 3
Sundries used in carbonizing	195 12 7	Rental of meters	3,077 14 2
Purification, including £1132 8s. 5d. for labour	2,120 19 1	Residual products—	
Repairs and maintenance of works and plant, materials, and labour, less £837 19s. 2d. received for old materials, &c.	19,992 13 8	Coke	£20,995 19 10
	£104,223 7 6	Breeze	221 14 10
Distribution of gas—		Tar	6,915 8 9
Salaries and wages of Officers (including Rental Clerks)	£2,008 4 7	Ammoniacal liquor	8,894 15 10
Repairs, maintenance, and renewals of mains and service-pipes, including labour	5,672 7 7		
Repairs and renewals of meters	2,706 15 3	Rents	37,027 19 3
	10,387 7 5		1,209 19 4
Public lamps—			
Lighting and repairing	3,044 0 10		
Rents, rates, and taxes—			
Rents payable	£577 10 9		
Rates and taxes	5,055 9 5		
	5,633 0 2		
Management—			
Directors allowance	£1,500 0 0		
Company's Auditors	100 0 0		
Salaries of Secretary, Accountant, and Clerks	1,238 13 8		
Collectors commissions	2,490 4 0		
Sundry expenses relating to collection	76 4 5		
Stationery and printing	661 15 9		
General charges	475 11 3		
	6,542 9 1		
Gas Examiner	39 7 6		
Law	1,052 8 2		
Bad debts	815 8 2		
Superannuation allowances	568 14 2		
Insurance	208 15 10		
Total expenditure	£132,514 18 10		
Balance, carried to net revenue account (No. 5)	59,509 15 2		
	£192,024 14 0		

£192,024 14 0

No. 5.—PROFIT AND LOSS (NET REVENUE) ACCOUNT.

Interest on bonds to Dec. 31, 1879.	£466 12 2	Balance from last account	£51,116 5 9
Interest on loans and consumers deposits	291 17 9	Amount from revenue account, No. 4	59,509 15 2
Dividends for half year to June 30, 1879	49,400 0 0	Interest on investment of reserve-fund	2,504 3 2
Balance applicable to dividends	62,989 10 9	Interest received	17 16 7
	£113,148 0 8		£113,148 0 8

No. 6.—RESERVE-FUND.

Balance on Dec. 31, 1879	£123,675 19 5	Balance on June 30, 1879	£123,675 19 5
	£123,675 19 5		£123,675 19 5

No. 7.—STATEMENT OF COALS.

Description of Coal.	In Store on June 30, 1879.	Received during the Half Year ending Dec. 31, 1879.	Carbonized and Used during Half Year ending Dec. 31, 1879.	In Store on Dec. 31, 1879.
	Tons.	Tons.	Tons.	Tons.
Newcastle	10,723	95,634	92,494	13,863
Cannel	512	2,694	2,802	404
	11,235	98,328	95,296	14,267

No. 8.—STATEMENT OF RESIDUAL PRODUCTS.

	In Store on June 30, 1879.	Made during the Half Year ended Dec. 31, 1879 (estimated).	Used during the Half Year (estimated).	Sold during the Half Year.	In Store on Dec. 31, 1879.
Coke, chaldrons of 36 bush.	576	95,296	22,484	69,966	3,482
Breeze, ditto	560	5,538	..	5,298	800
Tar, gallons	64,580	937,482	..	904,419	97,643
Am. liqr., butts of 108 gals.	866	25,631	..	25,051	1,446

No. 9.—STATEMENT OF GAS MADE, SOLD, &c., IN CUBIC FEET.

Description of Gas.	Quantity Made.	Public Lights and under Contracts (estimated).	Private Lights (per Meter).	Total Quantity sold.	Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lamps.
Common	Thousands. 959,822	Thousands. 65,299	Thousands. 830,124	Thousands. 895,423	Thousands. 9,042	Thousands. 904,465	Thousands. 55,357	6,219

No. 10.—BALANCE-SHEET.

To Capital—	
For balance, per Account No. 3	£52,537 19 1
Net revenue—	
For balance, per Account No. 5	62,989 10 9
Reserve-fund—	
For balance, per Account No. 6	123,675 19 5
Unclaimed dividends	119 4 3
Sundry tradesmen and others for amounts due for coals, stores, and sundries	31,704 15 0
	<hr/>
	£271,027 8 6

By Cash at Bankers	£10,592 7 8
Amount invested—	
Reserve-fund	123,675 19 5
Stores on hand, viz.—	
Coals	£9,926 11 9
Coke and breeze	1,269 0 0
Tar and ammoniacal liquor	1,233 11 5
Sundry stores	1,445 10 0
Accounts due to the Company—	
Gas and meter rental, for quarter ended Dec. 31, 1879	£101,230 17 0
Gas and meter rental—arrears outstanding	434 4 6
	<hr/>
Coke and other residual products	101,665 1 6
Sundries	17,731 8 6
	<hr/>
	£271,027 8 6

The CHAIRMAN: It now only remains for me to move—"That the report and accounts be received and entered on the minutes." On this, the last occasion I shall have to address you here, I think it is scarcely necessary for me to enter into that analysis of the accounts which I have done on many occasions. I will, however, say that, upon the whole, they are eminently satisfactory. The Company have made the largest profit they have ever made in any previous half year, and hand over their affairs to the amalgamated Company with a large sum on deposit, a good cash balance, and a very respectable reserve-fund. I think, therefore, the position of the Company is exceedingly good. Well, in carrying out this arrangement as we have, I think it will be found immensely to the advantage of the Proprietors as well as of the public. It ensures to the public a reduction in the price of gas, and at the same time the Proprietors get some remuneration, through that reduction, by an increase in their dividend. I think there is no question that the next time the Proprietors meet for the declaration of a dividend in the joint Company, they will receive a greater dividend than they do at the present time; and therefore I think, looking at it in this way—and we have acted solely and only in the interests of the Proprietors in the arrangements we have made—they will be well satisfied. I may say that, for myself, it is a considerable wrench to give up the whole concern, in which I have now completed rather more than my thirtieth year as a Director; but, of course, the name, and so on, is but an idea. The interest of every one connected with the concern must be, and has been, as it always has been, the first consideration of the Board. I am perfectly certain of this, that the step we have taken would never have been taken if we did not think we were doing that which served their interests to the very utmost. I believe that great savings will be effected by the amalgamations. We had three Boards with 26 Directors; now there will be only 10 Directors altogether; we had three Secretaries, now there will be only one; and many other things will tell eventually for the increase of the prosperity of the concern. There are other considerations, too. By this arrangement there is no limit to the reserve-fund of the Company. So long as we supply the public at a certain price, we can make as large a reserve as we like, and secure our property to any extent. Under our former Act we were limited to 10 per cent.; now there is no limit. We have also the power to form an insurance-fund, which is another security. Looking at all these things, I think that the Proprietors may congratulate themselves on the step we have taken. I have told you before that I shall not go into the figures of the concern, but altogether they were exceedingly satisfactory, and cannot be complained of by those to whom we hand them over. I conclude by moving—"That the report and accounts be received, and entered on the minutes."

Mr. JACOB BENJAMIN seconded the motion.

Mr. HOBSON said as this was the winding-up meeting of the Phoenix Company, he supposed that they ought to wind up in good spirits, and the feeling that they were going forward with 11 per cent.; but he was not quite clear whether they were entitled to 11 per cent. now or twelve months hence. He thought there was a sort of deferred time at which the price might be altered; but this was a matter on which the Directors could inform them. Another matter he wished to mention was that last December they took a general vote of the Shareholders present at a special meeting, and consolidated the 7½ and 5 per cent. stocks of the Company into 10 per cent. ordinary stock. He was a Shareholder in a good many railway and gas companies, and he thought it would have been better to have had a special meeting of the 7½ and 5 per cent. Shareholders, and taken a vote of those Shareholders on the question of the conversion of their stock. He, however, might state that he went into the general 10 or 11 per cent. ordinary stock with confidence, and might mention that since the amalgamation he had bought some more of the stock, to prove his faith in the Company. He supported the motion for the adoption of the report with great pleasure, and trusted that the new Company would be as successful as the old.

Mr. CYRUS LEGG observed that amalgamation with the South Metropolitan Company might be a very good thing, but he could not account for the 7½ and the 5 per cent. converted stocks of the Phoenix Company having recently decreased so materially in value. If they looked at the quotations of these stocks on the Stock Exchange, they would find that they were considerably higher before the resolution the last speaker had mentioned was passed. Although the original Shareholders had been well taken care of in the amalgamation, he did not think that the interests of the holders of the 7½ and the 5 per cent. stocks had been as well looked after, and this opinion was endorsed by the public. The public would otherwise have continued to give the same amount for these stocks as before, but as it was they had gone down 10 per cent. Their price would have been maintained had the conversion been referred to the holders. He was not disposed to find fault with the Board, but he thought that the 7½ and the 5 per cent. stocks had been rather sacrificed in the amalgamation, and that their property was not worth so much now as it was before the amalgamation took place.

The CHAIRMAN: Gentlemen, in reply to the remarks made, our friend asks us when we shall be entitled to 11 per cent. Now, the standard price for gas of the amalgamated Company is 3s. 6d. per 1000 feet, and the price of this Company is 3s. 4d., and as we are entitled to ¼ per cent. for every 1d. we charge below 3s. 6d. per 1000 feet, we are clearly entitled to only ¼ per cent.; but one of the provisions of the scheme of amalgamation is that after twelve months the price is to be reduced to 3s. all round, and we shall then be entitled to 1¼ per cent. more if the profits will enable that amount to be paid. I believe you will get 11 per cent. twelve months hence, as certain as I am here. I myself shall think the Directors are bad managers—and I shall be obliged to tell them so—if we do not get 11 per cent. after the first year. The annuities, whatever they are, will be taken up by the amalgamated Company, but not out of the reserve-fund. The reserve-fund is handed over to the united Company, and forms the total with the reserve-fund of the other two Companies. This makes the amount so much the larger—the guarantee is improved—and in the amalgamation that has taken place, I know that the South Metropolitan Company have set great store on our reserve-fund. With regard to the

remarks respecting the 7½ and the 5 per cent. stocks, it must be recollected that in the scheme of amalgamation presented to the Board of Trade we could not put it before them that these two stocks were preference stocks. They never were raised as preference stock, and whatever people might think, they were only simple stocks of 7½ and 5 per cent. Well, the Board of Trade very naturally said, seeing they were not raised as preference stocks, "You have here about £500,000 of stock with a certain dividend—7½ and 5 per cent. If you are only going to take the sliding scale on half your capital, there is not the inducement to reduce the price of gas and get the increased dividend that there ought to be. We shall therefore refer the scheme back to you to see if you cannot bring these two stocks under the sliding scale." It became perfectly clear that if the scheme was to be carried these stocks must be amalgamated into 10 per cent. stock, as the others, and then they would get the same dividend as the others. We thought this an enormous advantage. We scarcely thought, indeed, when we went into the scheme, that we should get the 7½ and 5 per cent. stocks converted into 10 per cent. stock, and I think it is a matter we may well plume ourselves on in having put the stocks in such a position. You can see, therefore, that what we did was the best. Some of us were large holders of the 7½ and 5 per cent. stocks. I myself was a larger proprietor of those stocks than the other Directors, and, therefore, if self-interest actuated us, it might be assumed that I should, if I did not consider it a benefit, have opposed these stocks being converted. I saw, however, it was my interest to get the larger dividend. There was no guarantee with the other stocks.

The motion was put, and carried unanimously.

The CHAIRMAN then said: It has been usual on these occasions for the Deputy-Chairman to move the payment of the dividends; but I may say that as he has joined the other Company, he is a sort of "half and half kind of fellow" to-day, and I think it just as well that I should go through the form of moving the dividends. I have very little doubt that on the next occasion, whoever moves the dividend will be able to offer you more than we do to-day.

Mr. CHARLES HARRIS seconded the motion, and it also was carried unanimously.

The CHAIRMAN, in announcing that this closed the business of the meeting, said: We have not, of course, to go through the form of moving the election of Directors or Auditors. It is all over with us now.

Mr. HOBSON said before the meeting broke up he wished to make a few remarks. They were going to part with the Board, and their Chairman would not be a Director of the new, or rather amalgamated Company. He should therefore be glad to propose that the Shareholders empower the Directors to form themselves into a Committee, and send circulars out asking the Shareholders to subscribe any sum not exceeding two guineas each to present the Chairman with a piece of plate on his retirement from his duties in connection with the Company. He limited the sum to two guineas so that most of them might be able to join in the movement. He knew that the Chairman would appreciate such an acknowledgment.

Mr. HOBSON said that, as, perhaps, the oldest Proprietor in the room, he would have pleasure in seconding the motion.

Mr. LEGG observed that the way in which the Chairman had conducted the affairs of the Company for the last 30 years certainly eminently qualified him to receive such a testimonial from a grateful body of Shareholders.

The proposal having been heartily agreed to,

The CHAIRMAN said: I have to thank my friends for what they have done in this matter, and of course anything that is presented to me will be gratifying to myself and, I have no doubt, to my family also. I can only say that I did not anticipate anything of this kind, and that I have received sufficient reward in the way that I have been treated by the Proprietors on all occasions. It does not matter what they have been asked to do by the Board, they have always responded to our wishes, and supported us in every sense, and I myself consider that I have been sufficiently rewarded in the way in which I have always been received by you here. I will say no more, but I am very much obliged to you. It is, of course, a matter of regret to me that I am going to retire from an office I have held so long.

Mr. LEONARD SHUTER said before they departed he would like to move one other resolution. He had had much pleasure for many years in sitting at the Board, but he felt on this occasion that he was simply a Shareholder. Their duties were at an end, and therefore he might very fairly be allowed to propose a resolution, which was a vote of thanks to the Officers of the Company for their integrity and zeal in carrying on the affairs of the Company. It had never before been his fortune to move this resolution, which had hitherto come from the Shareholders, who always acknowledged the ability of these gentlemen. He should be sorry if on this occasion the meeting separated without passing a vote such as the one he had moved. The Officers had served them for many years, and now several were retiring, while some were going over to the amalgamated Company.

The CHAIRMAN: I should like to second this motion myself, for I do not suppose that any one at the Board can more completely testify to the assistance we have always received from the Officers. I can only say that, much as the Directors might do, they could not do much if they did not have the assistance of these gentlemen. I regret that some of them are going to leave the united Company. They understand the work exceedingly well, and perhaps it would have been more agreeable to us if they had gone on with their work; but it has already been determined otherwise.

The motion was carried unanimously, and

The SECRETARY returned thanks on behalf of himself and the other Officers for what would probably be, he said, the last act of kindness they would receive from the Board and the Shareholders. It was merely one of a series of similar resolutions, for since they had been the servants of the Company they had received nothing but a succession of acts of kindness in one form or other. Perhaps the most consolatory knowledge they had was that the Directors heartily wished them well in the future.

Mr. Legg then moved a vote of thanks to the Chairman and Directors, saying it was the last time they would have the opportunity of passing such a vote, and he therefore hoped that it would be cordially done.

A SHAREHOLDER seconded the motion, and it was carried unanimously.

The CHAIRMAN: On behalf of the Board, I beg to thank you for what our friend has said. We are not, like the gentlemen on the hustings just now,

called on to make any pledges for the future. We have done our work, we are some of us turned out, and some of us are on the amalgamated Company's Board, but none of us have to make any promises. We hope that those you meet in future will be able to make as good a front to the Proprietors as we have done on the present occasion.

The proceedings then terminated.

SOUTH METROPOLITAN GASLIGHT AND COKE COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held last Wednesday, at the Terminus Hotel, London Bridge—Captain Thomas B. HEATHORN, R.A., presiding.

The SECRETARY and ENGINEER (Mr. George Livesey) read the notice convening the meeting, and the minutes of the last meeting; after which the Chairman affixed the seal of the Company to the register of Shareholders, and the following report and accounts were taken as read:—

In the last report the announcement was made that the amalgamation of this Company with the Surrey Consumers Company, dating from the 1st of July last, had been satisfactorily arranged, and only wanted confirmation by an Order in Council to become law. This was effected on the 28th of October, and from that date all separate existence of the Surrey Company ceased.

In October last, negotiations were entered into with the Phoenix Company, with a view to amalgamation, resulting in a satisfactory arrangement with that Company, whereby, from the 1st of January, 1880, the two Companies became one. This scheme was confirmed on the 18th of March.

As a consequence of these amalgamations, the district of the South Metropolitan Company now extends over the whole of South London between the boundaries of Woolwich and Wandsworth, except small portions of Lambeth and Battersea supplied by the London Company.

Excepting the bonds and the debenture stock, the capital of the United Company consists only of two classes, A and B; the original South Metropolitan capital being classed A, whilst class B includes the whole of the share capital of the Surrey and Phoenix Companies. A and B share equally in dividend up to 11 per cent., but in the event of a larger dividend than 11 per cent. being payable, the B capital takes one-half of its share of such additional dividend beyond 11 per cent., and the other half is to be paid to the holders of the A capital in addition to their own share of such larger dividend.

The accounts now presented relate to the first half year of the amalgamated South Metropolitan and Surrey Companies. The profit on the united undertaking is sufficient

to warrant the recommendation of maximum dividends, which amount for the A capital to 11½ per cent., and for the B capital to 11 per cent.

The business continues to increase as rapidly as ever, and will require further extensions of works. The Directors, in November last, advertised for tenders for a gasholder to contain 5,400,000 cubic feet, and let it at a moderate price to Messrs. Ashmore and White, of Stockton-on-Tees, who are making good progress with the work. The tank referred to in the last report is approaching completion, and the retort-house begun a year ago was put into operation last winter.

As one of the conditions of amalgamation, the Board of Trade required a reduction in the number of the Directors. To the great regret of his colleagues, Mr. Jenkins, who, under ordinary circumstances, would have retired by rotation, and have received their support for re-election, has resigned. They cannot, however, part with him without recording their sense of his high personal qualities, and of the great services he has rendered to the Company.

By the scheme of amalgamation this meeting is required to elect three Auditors. The following gentlemen offer their services:—Mr. Footner, of the South Metropolitan; Mr. Westcott, of the Surrey Consumers; and Mr. Puckle, of the Phoenix Company. The other Auditors have resigned.

The meeting will also be called upon to fix the scale of remuneration of the Directors and the fees of the Auditors.

The capital of the Surrey Company having been converted into stock by the amalgamation, the Shareholders are requested to send their share certificates to the office that they may be exchanged for stock certificates. To the Phoenix Company's ordinary shares the same remark applies. The £144,000 Phoenix 5 per cent. capitalized stock has been converted into £72,000 of 10 per cent. sliding scale stock, class B; and the £300,000 of 7½ per cent., when fully paid, will be converted into £270,000 of 10 per cent. sliding scale B stock. The holders of ordinary shares and of the 5 per cent. stock only may send in their certificates for exchange, but the new certificates for the 7½ per cent. stock cannot be issued until after the last call is made. It will be more convenient if those who hold ordinary shares, or 5 per cent. stock in addition to the 7½ per cent. stock would retain all their certificates until the last named is paid up.

No. 1.—STATEMENT OF CAPITAL (STOCK) on Dec. 31, 1879.

Acts of Parliament authorizing the Raising of Capital.	Standard Dividend; the Standard Price being 3s. 6d. per 1000 feet.	Paid up.	Amount not paid up.	Total Amount Authorized.
5 Vict., cap. 79	10 per cent.	£200,000 0 0	..	£200,000 0 0
32 & 33 Vict., cap. 130	Do.	50,000 0 0	..	50,000 0 0
39 & 40 Vict., cap. 229	Do.	250,000 0 0	..	250,000 0 0
Surrey Consumers Act	Do.	249,970 0 0	£250,000 0 0 30 0 0	250,000 0 0 250,000 0 0
		£749,970 0 0	£250,030 0 0	£1,000,000 0 0

No. 2.—STATEMENT OF LOAN CAPITAL.

Acts of Parliament authorizing Loan Capital.	Description of Loan.	Rate per Cent. of Interest.	Total Amount Borrowed.	Remaining to be Borrowed.	Total Amount Authorized.
32 & 33 Vict., cap. 130	Debenture.	Not exceeding 5 per cent.	£16,718 0 0	£45,782 0 0	£62,500 0 0
39 & 40 Vict., cap. 229	Bonds.	Ditto 5 ditto.	Nil.	187,500 0 0	187,500 0 0
Surrey Consumers Act		Ditto 5 ditto.	60,000 0 0	..	60,000 0 0
			£76,718 0 0	£233,282 0 0	£310,000 0 0

Dr.

No. 3.—CAPITAL ACCOUNT.

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To	Description of Capital.	Certified to June 30, 1879.	Received since that Date.	Total to Dec. 31, 1879.
Expenditure to June 30, 1879				
Expenditure during half year to Dec. 31, 1879, viz:—				
New buildings and machinery in extension of works		£21,718 1 1	..	£21,718 1 1
New and additional mains and services		8,420 15 0	..	8,420 15 0
New and additional meters		794 17 6	..	794 17 6
Total expenditure		£30,933 13 7		£30,933 13 7
Balance		£814,916 3 11		£814,916 3 11
		11,771 16 1		11,771 16 1
		£826,688 0 0		£826,688 0 0
			£809,530 0 0	£809,530 0 0
			£17,153 0 0	£17,153 0 0
				£826,688 0 0

No. 4.—REVENUE ACCOUNT, for the Half Year ended Dec. 31, 1879.

To	By			
Manufacture of gas—	Sale of gas—			
Coals, including dues, carriage, unloading, and trimming. (See Account No. 9)	Common gas (per meter), at 3s. per 1000 cubic feet	£63,728 2 3	£114,761 4 6	
Purification, including £855 5s. 3d. for labour	Public lighting and under contracts (see Statement No. 11)	3,575 7 9	12,847 14 5	
Salaries of Engineer, Superintendent, and Officers at works	Rental of meters	2,455 12 0		£127,608 18 11
Wages (carbonizing)	Residual products—	14,753 14 8		2,679 14 6
Repairs and maintenance of works and plant, materials, and labour, less £117 19s. 3d. received for old materials	Coke, less £1510 0s. 10d. for labour and cartage	10,015 17 1	£26,159 0 5	
	Breeze, less £219 13s. 5d. for labour and cartage	£94,528 13 9	523 19 5	
Distribution of gas—	Tar		8,459 18 1	
Repair, maintenance, and renewal of mains and service-pipes, including labour	Ammoniacal liquor	£4,103 10 0	10,492 14 9	45,635 12 8
Salaries and wages of Officers (including Rental Clerks)	Rents receivable	3,862 2 9		215 10 10
Repairing and renewals of meters	Transfer fees	1,756 13 9		8 0 0
Public lamps—		9,722 6 6		
Lighting and repairing		2,594 1 7		
Rents, rates, and taxes—				
Rents payable		£378 15 6		
Rates and taxes		3,872 15 11		
		4,251 11 5		
Management—				
Directors allowance and compensations		£9,455 14 0		
Salaries of Secretary and Clerks		3,456 2 10		
Collectors commission		1,337 9 11		
Stationery and printing		397 9 11		
General charges		699 18 1		
Company's Auditors		155 0 0		
		15,591 14 9		
Law and parliamentary charges		504 2 10		
Bad debts		729 2 2		
Superannuation-fund		411 6 0		
Gas Referees and Official Auditor		143 16 10		
Total expenditure		£128,481 15 10		
Balance carried to net revenue account, No. 5		47,666 1 1		
		£176,147 16 11		
	Total receipts			£176,147 16 11

No. 5.—PROFIT AND LOSS (NET REVENUE ACCOUNT).			
Interest on temporary loan and deposits	£130 1 8	Balance from last account	£80,395 14 2
Amount carried to insurance-fund	7,500 0 0	Less dividend on ordinary capital for the half year ending June 30, 1879	40,161 4 8
Interest on bonds	1,163 4 1		£40,234 9 6
Balance applicable to dividend on ordinary share capital	79,169 4 7	Amount from revenue account, No. 4	47,666 1 1
		Interest on moneys on deposit	362 3 0
	£88,262 13 7		£88,262 13 7

No. 6.—RESERVE-FUND.			
Balance on Dec. 31, 1879	£53,087 0 2	Balance on June 30, 1879	£46,598 7 8
		Interest on amount invested	488 12 6
		Depreciation - fund transferred to this account	6,000 0 0
		£47,087 0 2 invested in Consols.	
		6,000 0 0 to be invstd.	
	£53,087 0 2		£53,087 0 2

No. 9.—STATEMENT OF COALS.					
Description of Coal.	In Store, June 30, 1879.	Received during the Half Year.	Carbonized during the Half Year.	Used during the Half Year.	In Store, Dec. 31, 1879.
Newcastle coal	Tons. 8,130	Tons. 101,210	Tons. 91,732	Tons. 89	Tons. 17,519
Cannel coal	1,493	2,897	2,437	..	1,935
	9,623	104,089	94,169	89	19,454

* Under Weights and Measures Act, 1878.

No. 11.—STATEMENT OF GAS MADE, SOLD, &c.				
Description of Gas.	Quantity made, partly measured in Gasholders.	QUANTITY SOLD.		
		Public Lights and under Contracts (estimated).	Private Lights (per Meter).	Total Quantity sold.
Common	Thousands. 909,074	Thousands. 69,363	Thousands. 763,755	Thousands. 833,118

No. 12.—BALANCE-SHEET.			
To Capital—			
For balance, per account No. 3	£11,771 16 1		
Reserve-fund—			
For balance, per account No. 6	53,087 0 2		
Renewal-fund—			
For balance, per account No. 7	10,900 0 4		
Insurance-fund—			
For balance, per account No. 8	20,739 17 1		
Net revenue account—			
For balance, per account No. 5	79,169 4 7		
Debiture interest for amount due to Dec. 31, 1879	1,463 4 4		
Sundry tradesmen, for amount due for coals, stores, and sundries	25,416 19 8		
Deposits by consumers	8,008 17 11		
Property-tax account	637 4 8		
Dividend account (outstanding)	137 14 3		
	£211,331 19 1		

No. 7.—RENEWAL-FUND (LEASEHOLD.)			
Balance on Dec. 31, 1879	£10,900 0 4	Balance on June 30, 1879	£10,730 15 2
		Interest on amount invested	169 5 2
	£10,900 0 4		£10,900 0 4

No. 8.—INSURANCE-FUND.			
Balance on Dec. 31, 1879	£20,739 17 1	Balance on June 30, 1879	£13,114 12 7
		Interest on amount invested	125 4 6
		Amount brought from net revenue account	7,500 0 0
		£13,239 17 1 invested in Consols.	
		7,500 0 0 to be invested.	
	£20,739 17 1		£26,739 17 1

No. 10.—STATEMENT OF RESIDUAL PRODUCTS.					
	In Store, June 30, 1879.	Made during Half Year (estimated).	Used in the Half Year (estimated).	Sold in the Half Year.	In Store, Dec. 31, 1879.
Coke	676	124,476	34,088	83,903	7,161
Breeze	777	6,323	1,050	5,222	828
Tar	7,268	977,656	1,600	946,652	36,672
Ammoniacal liquor—Butts of 108 gallons, 8-oz. strength	3,653	25,375	..	23,776	5,252

The CHAIRMAN: Ladies and gentlemen, this is the first half-yearly meeting of the amalgamated South Metropolitan and Surrey Companies. It is, therefore, a pleasure to me to state that the working of the two districts as one during the past winter has resulted, as was expected, in mutual advantage, which takes tangible shape in the increased dividends the Directors have the pleasure to recommend for your adoption this day. I have also to welcome the Shareholders of the late Phoenix Company who have joined us for the first time at this meeting, and in doing so I would say that the negotiations between the Directors of the Phoenix Company and the South Metropolitan Company have been conducted on both sides in a spirit of fairness that augurs well for the success of the united Company. It is our opinion—and I think I may say this in the name of every member of the united Board—that the advantages of the combination are such that all classes of Shareholders will be better off in the amalgamated Company than any of them could have been had they stood alone; and as under the sliding scale no benefit whatever can accrue to the Proprietors until the consumers have derived benefit in the shape of a reduction in price, it follows that the advantages obtained by the Proprietors in consequence of the amalgamation will not be at the cost of the public, but as a result of reductions in the price of gas—reductions which have already begun in the shape of a drop from 3s. 9d. to 3s. per 1000 feet in the district of the late Surrey Company, which will be followed at the end of this year by a reduction of 4d. per 1000 feet in the late Phoenix Company's district, thus giving the whole district of the united Company the benefit of gas at 3s. per 1000 feet, at which figure I hope it will not stay very long. I may, in fact, state that we see our way to make it still cheaper. The price in the late Phoenix Company's district being maintained at 3s. 4d. per 1000 cubic feet for the present year will, of course, cause the dividends on their portion of the capital to be restricted to 10½ per cent. during this year; but next year, with the price at 3s., the whole of the B capital will be entitled to a dividend of 11½ per cent. It was considered advisable to make this arrangement for this year, because to take off 4d. per 1000 feet from the price in their district might have embarrassed the united Company at its starting, and it was the desire of the whole of the Directors that a good start should be made. There is, I am glad to say, no sign of the constant increase of business falling off—on the contrary, the growth this year is as rapid as it was twelve months ago, which fully justifies the Directors in the great extensions of works they have undertaken. I shall be happy to furnish any further information the Shareholders may require. It is unnecessary for me, with such a complete statement of the position of the Company in the report in your hands, to go into details. I, therefore, conclude by moving—"That the report and accounts be received and adopted, and the report entered on the minutes."

Mr. SIMPSON ROSTRON, in seconding the motion, said it had fallen to his lot to do so on this occasion, owing to the resignation of their late Deputy-

Chairman, Mr. Richard Foster. All his colleagues lost him with very great regret, because he not only represented what might be called the backbone of the Company, being one of the largest Shareholders in the undertaking, but he was a most agreeable man to work with. So long as he had been a Director on their Board, Mr. Foster had lost no opportunity nor spared any trouble to arrive at what was for the best interest of the Company, and to carry it out. He (Mr. Roston) had prepared a few figures just to give the meeting an idea, in a very short space, of what the report—which was the first report of the enlarged Company—was, as compared with the two separate reports of the corresponding period of last year of the Surrey and of the old South Metropolitan Company. The broad result came to this—of course, he left all small items out of the question, and went to the sale of gas and the residuals, which were the two great things; and although they had sacrificed £9000 in the half year by reducing the price of gas in the Surrey Company's district 9d. per 1000 feet, they had sold gas to the extent of about £2200 or £2300 more than in the corresponding period of the previous year. Nothing could be more satisfactory than this; while in the sale of residuals they also had an increase of over £6000. It came out on the whole of the revenue that they had had an increase of about £8400, which, if added to the £9000 they had sacrificed in rental by reducing the price of gas, showed an increase of about £17,000 odd on the half year. This, he was sure, must be very satisfactory to them all. It was so to the Board, and so far as they were able to foresee, they had no reason to consider that the future progress of the united Company would go on on a less scale. It therefore gave him very great pleasure to second the resolution for the adoption of the report, because the dividend they would have proposed for their adoption had been fairly earned, and would be gratefully received.

Mr. A. Pocock said he observed, under the head of management in the revenue account, the item of "Directors allowance and compensations." He could understand the allowance, but not the compensations.

The SECRETARY said that the compensations were the compensations paid to the late Directors of the Surrey Company under the scheme of amalgamation, as sanctioned by the Board of Trade.

The resolution was then put, and carried unanimously.

Mr. HENRY BUTLER moved the declaration of the dividends as recommended on the "A" and "B" stocks.

Mr. HENRY FINLAY seconded the motion.

The CHAIRMAN, in putting it, said: I think you will not object to it, as it is one of those propositions which touches us all. You see that the dividend is increasing, and I trust that it will increase still more. Mr. Shand, our new Deputy-Chairman—for we elected him Deputy-Chairman about three-quarters of an hour ago, in the place of Mr. Foster—will propose the next resolution.

Mr. SHAND said they had heard from the Chairman of the increasing

prosperity of the Company, and that the consumption of gas was extending; and they all, of course, knew that gas could not be made without plant and material. For that purpose additional capital was required, and it had been found most convenient to call up the balance of the Phoenix Company's $\frac{7}{8}$ per cent. stock. He therefore moved a resolution authorizing the calling up of the balance of the £36,000 of this stock at such time as might seem most expedient to the Directors.

Mr. JOHN MEWS, J.P., seconded the motion, and it was carried unanimously.

Mr. JENKINS then observed that at this meeting it was customary to elect the Auditors of the Company, and under the last scheme of amalgamation it was provided that the Auditors of the two amalgamating Companies who were in office at the date of the commencement of the scheme should continue in office till the first general meeting at which the Auditors were appointed of the united Company. He read the 20th clause of the scheme, and in compliance therewith said he would move that Messrs. Footner, Westcott, and Puckle be elected Auditors of the united Company, at a salary of £75 each per annum.

Mr. HORNER expressed his pleasure in seconding the motion, especially as he knew that Mr. Puckle, a late Director of the Phoenix Company, perfectly understood the circumstances of that Company.

Mr. LAYTON, in supporting the motion, said he thought it was a most agreeable thing that the Companies should be so fairly represented on the audit as the resolution proposed. Mr. Puckle was a very able gentleman whom he had known for many years, and who would represent all their interests most efficiently. He was thoroughly well acquainted with gas matters, and knew what prices were and what they should be. Mr. Westcott was an old Auditor—they knew him well, and it was unnecessary to say anything about that gentleman. Mr. Footner he did not know, but nevertheless he had equal pleasure in his appointment.

The CHAIRMAN said: It so happens that this is a most fortunate selection. Mr. Puckle was a Director of the Phoenix Company, and each Company is thus represented on the audit by one of these gentlemen. Before I put the motion, I should like to say a few words as I have the opportunity, which I may not have afterwards. The gentleman who proposed this resolution was a Director for a long time of the old South Metropolitan Company, and it was with considerable regret that we found he was resolved to leave us. Mr. Jenkins was on the Board for a long time. He came in among us when we were in great want of strength, and he gave any amount of his energy to the work he chose to go through with; and a man of his singularly accurate mind was most useful in all the engagements we had to carry out. I cannot tell you how we feel his loss, and I only hope that he will from the other side of the table give as much of his assistance in the conduct of the affairs of the Company as he has done before. We cannot expect everything, but, in our selfishness, we trust we shall get it.

The resolution having been carried unanimously, Mr. JENKINS said he was not prepared to listen to the graceful tribute which the Chairman had been kind enough to pay to him in regard to his services to the late Board. All he knew was that the work in the past had been very considerable, and he thought that in future it would be still heavier. He had to move a resolution which he thought would commend itself to them all—namely, as to the remuneration of the Directors. The scheme of amalgamation which had been sanctioned by the Board of Trade required that the remuneration of the Directors should be a fixed sum under the Shareholders guidance, and, in point of fact, although the Shareholders had had on former occasions the opportunity of increasing the amount of the remuneration of the Board, for the future they would not have the power of doing so. The scheme, as sanctioned by the Board of Trade, involved the greatest possible economy in the direction of the Companies, and, therefore, they might rely that in fixing a maximum it was the very minimum which the Shareholders could be expected to do. He had had considerable experience in what was required from a director of a gas company. He was not like a director of an ordinary company—he was not an ordinary "guinea pig." When he left the Board his duties were not to be shuffled off with his hat and coat. He was probably revolving every day till the next board meeting some improvement as to this or that, or an extension of the works, or possibly amalgamation, and a variety of things of this kind, so that in point of fact gas was always on his mind, and his duties as a director were never ended. He (Mr. Jenkins) was therefore quite sure that any amount of remuneration which the Shareholders might fairly give to the Directors would be readily approved of by the meeting. The Board of Trade had not been very liberal, but they had done what they considered just. He then read clause 17 in the scheme of amalgamation, relating to the Directors remuneration. Formerly there was, he said, no limit to the remuneration, as the Shareholders could act as they pleased; but there was now a limit, and, as he said before, the maximum fixed by the Board of Trade was the very least which the Shareholders should wish to offer to the Directors. Therefore, in view not only of the past, but also of the future—and the Directors henceforth would not only have their own Company to manage, but the Surrey and the Phoenix Companies, the three Companies united making the South Metropolitan Gas Company—he moved, "That the remuneration of the Directors be fixed in accordance with the maximum scale set forth in clause 17 of the scheme of amalgamation, to take effect from the 25th of March last."

Mr. JONES expressed his pleasure in seconding the resolution. He was sure that the remuneration accorded to the Directors by the Board of Trade was none too large, considering the responsible duties they had to perform. As to the accounts, he believed there would be an advantage to the amalgamated Company in the sale of residuals. Taking the South Metropolitan and the Surrey Companies, it would be found that they realized from residuals over 70 per cent. of the cost of their coals—a very large sum—and the Phoenix realized 55 per cent. They might now hope, when competition ceased, that the Phoenix would be lifted up above 55 per cent., and that the 70 per cent. of the South Metropolitan would be still maintained.

The motion was carried unanimously.

The CHAIRMAN: Ladies and gentlemen, as the spokesman of your Board we have to thank you very much for the liberal way you have accorded to us the remuneration as laid down in clause 17 of the scheme for the amalgamation of the South Metropolitan and Phoenix Gas Companies. As regards this question of remuneration, I should like to tell you that all through the negotiations we have put ourselves entirely in the hands of the Board of Trade. We have said, whatever you choose to give us we will abide by and be contented with, so that it should not be said that a great undertaking—a very great undertaking—should be fettered by any such thought of personal gains by those who are the servants of the enterprise. I think, in saying this, you will thoroughly understand that we as your Directors, are influenced by no other motive than the proper conduct of your Company, and we shall continue to be guided by the same feeling.

Mr. Pocock next moved a vote of thanks to the Directors for their able management of the affairs of the Company. He said he knew full well what they had had to pass through with the amalgamations. He had only been connected with the Company for six months, but he must say that

the balance-sheet was very satisfactory indeed, and much more satisfactory as regarded the amount of money received by the Proprietors, the consumption of gas, and the price charged for gas. He was very glad to hear the Chairman say that the Board saw their way to reduce the price still further. The consumers were the main persons to be studied. Without them they could not get their 11 or 11½ per cent. The lower the price the greater the consumption, and the better for the Shareholders generally.

Mr. SIMPSON, who seconded the motion, said it was most satisfactory to hear that the more they gave up to the consumer, the better it was for the Shareholders.

The motion having been passed,

The CHAIRMAN said: I rise again to thank you for the very kind way in which you have appreciated our exertions, and beg to assure you that, as long as we are Directors here, our exertions will continue in the same unflinching way as they do at present. I should like to include in the remarks you have made about hard work the name of Mr. Livesey, our Secretary and Engineer. There is no doubt that to him our great prosperity is more due than perhaps to any other Officer of the Company. To him and his assistants, his brother—Mr. Frank Livesey—and the two or three other Engineers we have on the staff, our warmest thanks are due, and I am quite sure that as long as we can retain them in our service we shall continue as prosperous as we are at present. It is scarcely necessary to enlarge on this question, but you know how valuable Mr. Livesey's services have been, and what a good organizer he is, and how much that has tended to the flow of prosperity which has been such a characteristic of the South Metropolitan Gas Company. I hope it will also be a characteristic of the united Company. We have a very valuable staff, and we shall do all we can to keep up such an organization as will always ensure our prosperity.

Mr. HEARN moved a vote of thanks to Mr. Livesey and the Officers of the Company for the able way in which they do their duty.

Mr. Pocock seconded the motion, which was carried unanimously.

Mr. LIVESEY, in reply, said: Mr. Chairman and gentlemen, it is not the first time I have received a vote of thanks at your hands, and I am bound to say that these votes are always given in such a cordial spirit that they are very cheering indeed both to me and the other Officers of the Company. The South Metropolitan Company used to be considered, and was in my father's time, the smallest of the 18 Companies in London—that was before the Surrey Consumers Gas Company was started. It is now second in size, and I think the prosperity which has hitherto followed it may be expected to follow it in the future. It is a great satisfaction to me to see this united meeting, to see so large a meeting, and to see such an unanimity of feeling exhibited. It has been my desire, in what little I have been able to do in regard to the amalgamations, to deal with the utmost fairness to all parties—in fact, I have felt sometimes that I might be exposed to the remark that I was an advocate of the other Companies rather than of the old South Metropolitan Company; but the one principle I have laid down for myself has been this—that no amalgamation can be satisfactory unless it is mutually advantageous. If one section of the united Company had by a little bit of sharp practice obtained the better of the other sections, it would have been sure to have caused ill-feeling and want of unanimity on some future occasions. I believe now that the three divisions of which this Company is composed will find that the united Company will be better off—considerably better off—than any one of them would have been if they had stood alone. I think the old South Metropolitan, the Surrey Consumers, and the Phoenix Shareholders will all find that they will receive a higher dividend than they could have done had they stood alone. It will be my desire so to work that no one will say that any preference is shown to one section over another. It is described in the scheme as the united Company, and I only hope that it may never belie its name. I thank you very cordially for your vote of thanks, on my part as well as on the part of the other Officers. We have a staff earnestly devoted to the Company's interests.

The proceedings then terminated.

SWANSEA GASLIGHT COMPANY.

The Ordinary Meeting of this Company was held on Friday, the 2nd inst.—Mr. T. PHILLIPS in the chair.

The SECRETARY and MANAGER (Mr. Thornton Andrews) read the notice convening the meeting; and the following report of the Directors, upon the operations of the Company during the past half year, was presented:—

The Company's operations have steadily progressed, notwithstanding a slight decrease in the quantity of gas sent out.

The gross profits amount to £2675 19s. 5d., and after allowing £513 2s. for interest on debentures, and £3543 15s. for dividends for the half year ending Dec. 31 last, there remains a balance of £2739 2s. 5d., of which the Directors have transferred the sum of £2500 to the credit of a contingent-fund, carrying forward £239 2s. 5d. to next half year.

In view of the rise in the price of coal, your Directors have secured contracts at a slight advance, which will provide for the requirements of the Company to the 30th of June, 1881.

The increase in the trade and manufactures of this district has been of too recent a date, and of a class unlikely to benefit this Company immediately. The long depression having affected the producer and consumer alike, will require several months to restore the normal rate of increase in consumption, which for many years this Company enjoyed. The new districts opened up by the Sanitary Authority, and the completion of the New East Docks, must eventually largely increase the consumption of gas, provision for which the Directors will make as required.

The supply of gas during the past half year has been of uniform good quality and quantity, and in no instance has the illuminating power fallen below 14 sperm candles.

The manufacturing plant is in good condition, and with the exception of the annual repairs no addition is contemplated.

Your Directors have pleasure in recommending the declaration and payment of the customary dividends, as follows:—At the rate of 10 per cent. per annum on the original £6000 share capital, and at the rate of 7½ per cent. per annum on the £86,500 new share capital, which together make the present share capital of £92,500.

The Directors retiring are Messrs. Thomas Arnold Marten and John Glasbrook, and one Auditor, Mr. R. G. Gawkerall; of whom offer themselves for re-election.

The report, with the accounts accompanying it, having been adopted, the dividends recommended in it were declared, and the retiring Directors and Auditor were re-elected.

Votes of thanks were then passed to the Directors, for the satisfactory progress of the Company's affairs during the past half year; to the Auditors, for their services during the same time; to the Manager (Mr. Andrews), for the uniform zeal and ability with which he conducts the affairs of the Company; and to the Chairman, for presiding.

EXHIBITION OF GAS COOKING APPARATUS AT SLEAFORD.—A course of lessons in cooking having been commenced last week in the Temperance Hall, Sleaford, by the local School of Cookery, the Sleaford Gas Company availed themselves of the opportunity thus afforded of having an exhibition of gas cooking stoves and apparatus, which are to be seen in successful operation in the intervals between the lessons. The collection comprises new gas cookers, reflecting cookers, and broilers, Leeds gas cookers, artizans cookers, and reflecting cookers and boiling stoves. The necessary appurtenances of kettles, stew-pans, &c., are also exhibited. The adaptability of these stoves for cooking purposes is highly spoken of, and this exhibition affords a good opportunity for personal judgment in the matter. The exhibition will be open to-day and on Thursday, from 6 till 10 p.m., and the admission will, as before, be free.

LONDON GASLIGHT COMPANY.

The Ordinary Half-Yearly Meeting of this Company was held last Wednesday, at the Freemasons Tavern, Great Queen Street, Lincoln's Inn Fields—MAJOR RONDE HAWKINS, Esq., the Governor, presiding.

The SECRETARY (Mr. A. J. Dove) having read the notice convening the meeting, the corporate seal of the Company was affixed to the register of Proprietors. The following report of the Directors was taken as read:—

Annexed to this report are submitted the accounts showing the result of the manufacture and distribution of the Company's gas for the half year ending the 31st day of December, 1879.

The business of the Company is in a satisfactory state, and the works are efficiently maintained. The low price of coal has materially contributed to produce the favourable result shown by the revenue account.

After providing out of profits for interest and dividends on the preference capital, there remains £24,979 5s. 8d., out of which the Directors recommend that a dividend at the rate of 10 per cent. per annum be declared on the ordinary capital.

The Bill in Parliament, promoted by the Company for the purpose of increasing the consumption of gas by letting on hire stoves and engines for motive power, and approved by the Proprietors at an extraordinary special meeting held on the 18th day of February last, has passed the second reading. It will be proceeded with from this stage in the new Parliament.

Three Directors—viz., Robert Rawlinson, Esq., C.B., the Hon. Henry Noel, and William Irving Hare, Esq.—retire by rotation, and, being eligible, offer themselves for re-election.

One Auditor, George Pearson, Esq., also retires by rotation, and, being eligible, offers himself for re-election.

No. 1.—STATEMENT OF STOCK AND SHARE CAPITAL, on Dec. 31, 1879.

Acts of Parliament relating to the Raising of Capital.	Description of Capital.	Maximum Dividend Authorized.	Number of Shares Issued.	Nominal Amount of Shares.	Called up per Share.	Total paid up.	Arrears of Calls.	Remaining to be called up.	Total Amount Authorized.
15 Vict., cap. 82	Ordinary stock.	10 per cent.	Stock	Stock	Stock	£389,800	..	..	£389,800
	2nd pref. "	6 ditto.*	Do.	Do.	Do.	5,850	..	..	5,850
	3rd ditto "	6 ditto.*	Do.	Do.	Do.	1,500	..	..	1,500
	1st ditto "	6 ditto.	Do.	Do.	Do.	150,000	..	..	150,000
29 Vict., cap. 55.	A ditto shares	6 ditto.	12,000	£25 0 0	£20 and £1 5s.	187,047	..	£112,953	300,000
20 & 21 Vict., cap. 73	1 & 2 Deb. stks. 6 & 5 ditto.		Stock	Stock	Stock	26,613	..	..	26,613

* With option of conversion.

No. 2.—STATEMENT OF LOAN CAPITAL.

Acts of Parliament authorizing the Loan Capital.	Description of Loan.	RATES PER CENT. OF INTEREST.		Total Amount Borrowed.	Remaining to be Borrowed.	Total Amount Authorized.
		4½ per Cent.	5 per Cent.			
15 Vict., cap. 82	Bonds, 4½ per cent.	£91,862	£7,687	£99,549	£79,305	{ £91,667 100,000
29 Vict., cap. 55	Debenture stock, &c.					

Dr.		No. 3.—CAPITAL ACCOUNT.				Cr.	
—		—		Description of Capital.	Certified Receipts to June 30, 1879.	Received since that date.	Total Receipts to Dec. 31, 1879.
To Expenditure to June 30, 1879.		£831,535	3 10	By Ordinary stock	£387,800 0 0	£2,000*	£389,800 0 0
Balance		10,563	5 0	2nd Preference ditto.	7,350 0 0	+	5,850 0 0
				3rd ditto ditto.	2,000 0 0	+	1,500 0 0
Total expenditure.		£842,098	8 10	1st ditto ditto.	150,000 0 0	..	150,000 0 0
Balance		18,261	6 2	A ditto shares, £25 each, including amount received in anticipation of calls	186,942 10 0	105 0 0	187,047 10 0
				1st & 2nd Debenture stocks, under 20 & 21 Vict., cap. 73	26,655 12 6	?	26,613 5 0
				Bonds, &c.	68,987 0 0	..	68,987 0 0
				4½ per cent. debenture stock	30,562 0 0	..	30,562 0 0
		£860,359	15 0		£860,297 2 6	..	£860,359 15 0

Note.—+ £1500 converted into ordinary stock; ? £500 ditto; total, *£2000. ? £42 7s. 6d. redeemed.

No. 4.—REVENUE ACCOUNT, for the Half Year ended Dec. 31, 1879.

To Manufacture of gas—		By Sale of gas—	
Coals, including dues, carriage, unloading, and trimming (see statement No. 8)		Common gas, per meter, at 3s. 3d. per 1000 cubic feet	
Salaries of Engineers, Superintendents, and other Officers at works		Public lighting, and under contracts—	
Wages (carbonizing)		Common gas	
Purification, including £1148 8s. 11d. for labour		(See statement No. 10.)	
Repairs and maintenance of works and plant, materials, and labour, less £406 3s. 1d. for old materials		Rental of meters.	
		Residual products—	
Distribution of gas—		Coke, less £2239 8s. 3d. for labour and cartage	
Salaries and wages of Officers (including Rental Clerks)		Breeze, less £297 12s. 7d. do.	
Repairs, maintenance, and renewals of mains and service-pipes, including labour		Tar, less £16 2s. 8d. do.	
Repairs and renewals of meters		Ammoniacal liquor, less £25 2s. do.	
Public lamps—		Rents receivable	
Lighting and repairing		Transfer fees	
Rents, rates, and taxes—			
Rents payable			
Rates and taxes			
Management—			
Directors allowance.			
Company's Auditors			
Salaries of Secretary, Accountant, and Clerks			
Collectors commission			
Stationery and printing			
General charges			
Law charges			
Parliamentary charges (oppositions).			
Bad debts			
Depreciation-fund for works on leasehold land			
Superannuations, sick allowances, and gratuities			
Total expenditure			
Balance carried to net revenue account, No. 5			

No. 5.—PROFIT AND LOSS (NET REVENUE ACCOUNT).

Interest on bonds, 4½ per cent. debenture stock, &c., to Dec. 31, 1879.	£2,266 4 8	Balance from last account	£22,468 13 11
Dividends on preference capital	11,082 6 6	Less dividend on ordinary capital for the half year ending June 30, 1879	19,390 0 0
	£13,348 11 2		£3,078 13 11
Interest on temporary loans.	231 10 2	Amount from revenue account, No. 4	36,230 13 1
Redemption-fund, reserve per London Gaslight Act, 1857.	750 0 0		
Balance applicable to dividend on ordinary capital	24,979 5 8		
	£39,309 7 0		£39,309 7 0

No. 6.—RESERVE-FUND.

Balance on Dec. 31, 1879.	£70,200 10 9	Balance on June 30, 1879.	£69,260 11 4
		Interest on amount invested.	939 19 5
	£70,200 10 9		£70,200 10 9

No. 7.—DEPRECIATION-FUND (FOR WORKS ON LEASEHOLD LAND).

Balance on Dec. 31, 1879.	£2,277 7 10	Balance on June 30, 1879.	£2,145 4 0
		Interest on amount invested.	32 3 10
		Amount brought from revenue account for the half year ending Dec. 31, 1879	100 0 0
	£2,277 7 10		£2,277 7 10

No. 8.—STATEMENT OF COALS.

Description of Coal.	In Store, June 30, 1879.	Received during the Half Year.	Carbonized during the Half Year.	Used for Sundries during the Half Year.	In Store, Dec. 31, 1879.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common	11,991	69,733	74,276	20	7,341
Cannel	1,584	3,526	3,953	..	1,172

No. 9.—STATEMENT OF RESIDUAL PRODUCTS.

Description of Residual.	In Store, June 30, 1879.	Made during the Half Year (estimated).	Used during the Half Year (estimated).	Sold during the Half Year.	In Store, Dec. 31, 1879.
Coke, chaldrons of 36 bush.	1,820	76,182	20,265	53,579	4,158
Breeze " " " " "	923	8,796	..	9,030	689
Tar, gallons " " " " "	150,000	729,088	..	722,088	157,000
Am. liqr., butts of 108 gals.	204	19,359	..	17,600	1,963

No. 10.—STATEMENT OF GAS MADE, SOLD, &c.

Description of Gas.	Quantity made (measured by Station Meters).	QUANTITY SOLD.			Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lamps.
		Public Lights and under Contracts (estimated).	Private Lights (per Meter).	Total Quantity Sold.				
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	775,283	57,088	668,997	726,085	8,658	734,743	40,540	5,501

BALANCE-SHEET.

To Capital—	By Cash at Bankers, and in hand	£19,552 12 7
For balance, per account No. 3	Amount invested—	
Net revenue—	Reserve-fund	£69,260 11 4
For balance, per account No. 5	Redemption-fund	7,390 0 6
Reserve-fund—	Unclaimed dividends	4,871 2 7
For balance, per account No. 6	Depreciation-fund (for works on leasehold land)	2,045 4 0
Depreciation-fund (for works on leasehold land)—		83,566 18 5
For balance, per account No. 7	Stores on hand, viz.—	
Redemption-fund	Coals	£7,619 2 7
Bond, 4½ per cent. debenture stock, &c., interest for amount due to Dec. 31, 1879	Coke and breeze	1,527 13 10
Preference dividends, ditto	Tar and ammoniacal liquor	1,144 15 10
Unclaimed dividends	Sundry stores	4,335 16 8
Sundry tradesmen and others, for amount due for coals, stores, and sundries		11,627 8 11
	Accounts due to the Company—	
	Gas and meter rental, quarter ending Dec. 31, 1879	£69,866 8 1
	Ditto arrears outstanding	4,238 15 3
		£74,105 3 4
	For coke and other residual products	16,114 15 3
	Sundries	867 14 9
		91,087 13 4
£208,831 13 3		£208,831 13 3

The GOVERNOR: On this occasion I am happy to state that I have really scarcely anything to say to you. The report tells you that we have been doing our business in a very satisfactory way—in fact, I do not think any Company in London is doing it in a more satisfactory manner. It is also pointed out in the report that coal has been rather low in price, which has enabled us to carry on our work successfully; and more than that it has enabled us to put our works into, and keep them in a very efficient state. I do not believe there are any works in England in a more perfect state, and under a more convenient system of arrangement; and to a great measure we are indebted to our Engineer (Mr. Morton) for having re-arranged the works in their present most perfect manner. The only point I have to refer to is one on which we met a few weeks ago—the Bill in Parliament we have introduced to enable us to let on hire gas-stoves and engines. Owing to the dissolution and the elections, it has been rather delayed, but certain negotiations recently took place, and I believe that when the Bill comes before the new House of Commons it will be unopposed. I do not think there is any doubt about our being able to commence carrying out before next winter what the Bill proposes. With these few observations, I now move the adoption of the report and accounts.

Mr. HOBSON said that before the motion was passed, he should like to refer to the Company's Bill in Parliament for letting on hire stoves and engines. He supposed that they also included the power of selling stoves, engines, and fittings. He was not present at the special meeting of the Company, but if he remembered aright it was proposed to limit the capital to be expended in this branch of the business to £20,000.

The GOVERNOR: Yes.
Mr. HOBSON thought that to take powers to let on hire and sell to the extent of only £20,000 was rather a weak point in the Bill. At Sheffield the Gas Company had had the power for the last 26 years of selling stoves, fittings, and gas apparatus of every kind. They employed, he believed, in the fitting department, between 100 and 200 men, and kept a large stock of apparatus on hand. They had no limit to the capital they employed in this branch of their business, but they never dreamed of such a thing as letting gas cooking stoves and fittings on hire. They sold them out and out, and the only things they let on hire were the meters, which they liked to have the control of, and the right to inspect. There was no doubt the London Company might obtain power to let these things on hire, but after 24 or 25 years experience in the matter he considered it was by far the best course to sell gas apparatus and fittings generally. There was an immense deal of book-keeping in connection with the fitting department, and it would require a good deal of attention. Nevertheless they made a large profit at Sheffield out of this branch of their business. Then, referring to another matter, he said that on the south side of the Thames, now that the South Metropolitan, the Phoenix, and the Surrey Consumers Gas Companies were amalgamated, the territory was pretty well absorbed, except that portion which the London Company had the right to supply. When the Company went to Parliament they would have to deal as they thought best with the question of their position as to the other side of the river—whether they sold it to the Company on the other side, or dealt with the matter in any other way which would best protect their interests. While, however, they were not in Parliament, they had the power to do one or two things in which he was much interested—such as convert their debenture into share capital. The Phoenix Company had done this, and it was £1000 in his (Mr. Hobson's) pocket, nor had it injured the Phoenix Company in any way. The stock that was thus issued would now go into the South Metropolitan Company, and the holders would get 10 per cent. and participate in something more. Parliament would not again give the Company the power they now possessed in this direction. He thought on one occasion that the Accountant said that it would endanger their dividends, but he did not hold with this opinion, and while they had the power he thought they should not neglect to use it. The Phoenix Company did it two or three years ago, and now the stock was absorbed in the rest of the 10 per cent. stock.

The GOVERNOR: I see there was a little omission in the report, for the Act we are applying for will give us power to sell as well as to let on hire stoves and fittings. I apprehend that at Sheffield they really manufacture them.

Mr. HOBSON: No.
The GOVERNOR: They are purchased and sold right out. What about the attention required in the fitting department?

Mr. HOBSON said they did not only the fittings, but also a good deal of work in making connections. He believed they had about 3000 or 4000 connections to make every year. They had 35,000 customers.

The GOVERNOR: It is a tentative process with us, and we thought if we took powers to expend £20,000 of our existing capital—not new capital—it would be sufficient to start with. If the business should increase, we can either go to Parliament to get additional capital, or powers to enable us to employ a larger amount of our existing capital in this branch of the business. There are many reasons why we should be careful. A Company like this, if we went into the matter on a large scale, would excite jealousy

in the minds of the manufacturers of the apparatus in which we shall deal, and that is a thing we ought not to do. Mr. Hobson has touched on the subject of amalgamation. We have had no fresh negotiations, and nothing fresh has occurred with reference to it, and, therefore, I have not anything new to say on the subject. With regard to the conversion of the debenture stock into ordinary share capital, that is a matter which at present we should not like to contemplate. I do not know what some of the Shareholders would think about it, but I consider that the ordinary Shareholders would say something about it. At present, the ordinary stock is something under £400,000, and if we converted our debentures it would add something like £200,000 more to the ordinary stock, which would in some way increase the risk of the holders of that stock. It is a very nice compact little sum is the ordinary stock of this Company, and I do not wish to see it increased.

Mr. HOBSON, in reply to a Shareholder, said they made a profit on the sale of gas apparatus and fittings at Sheffield. It was, however, a very much easier thing to sell gas at 3s. 3d. per 1000 feet than sell fittings. Still, they considered that they gave more satisfaction to the consumers by doing a great deal of the fittings themselves. They obtained more control over the gas-pipes generally by having the fittings left in their hands. As to jealousy among traders, they left the manufacturers to be jealous.

Mr. W. FORD said he was very sorry when he heard the Governor state that nothing fresh had been done towards the amalgamation of the Company, because the more he saw of the course of events with respect to public companies, the more did he see that amalgamation—the consolidation of interests—was absolutely necessary to ensure security to the shareholders. He could not help feeling that with this Company, as with certain other companies, considerable saving would be effected by amalgamation, and it was upon the principle of considerable saving that he had brought the matter forward from time to time. In his opinion it was only by supplying the public with a cheaper and a better article than at present that they could maintain the position which Gas Companies had hitherto maintained in the Metropolis, and he earnestly trusted that the Board would seriously consider whether some steps might not be taken, before the autumn of this year, by which they might present to the Shareholders a statement with respect to their amalgamation with one or other of the neighbouring Companies. He did not indicate that they should approach in any particular manner; but if Shareholders, holding the opinion that the Directors should make an attempt to effect this object, were to wait, and be told, "Oh, they did not approach us, and therefore we did not think it prudent to approach them," the result would be that the Shareholders themselves would have to take steps—and he doubted not that they would do so in course of time. It was, however, far better, in the interests of the Companies, that the respective Boards should approach each other, as if they were to wait for one to approach the other they might wait to the end of time. He urged that the Boards might take, not a formal, but an informal step, in the way of approaching each other. It was very well in these matters to consider the interests of the Companies from the point of view in which the public regarded them. The public looked upon them as big monopolists, supplying a very bad article at a very high price. They had no friends outside the Directors, the Shareholders, and the employés of the Companies. The public were against them, and the more he saw of the erratic way in which the public dealt with the interests of quasi-corporations when they desired to take advantage of those corporations, the more did he see that it was the interest of the Metropolitan Gas Companies to secure themselves.

Mr. G. LIVESLEY: The remarks made by the gentleman who has just sat down call for a few observations from me. The last speaker has alluded to the statement of the Governor, that there has been no approach made to the London Company with respect to amalgamation—

The GOVERNOR: During the last six months.
Mr. LIVESLEY: I accept that qualification. The statement I may make is that in the early part of the summer of last year the South Metropolitan Company, after they had amalgamated with the Surrey Company, addressed a letter to the Phoenix and the London Companies, asking permission to inspect their respective works, and asking for certain information for the purpose of making a proposal for amalgamation. The Phoenix Company at once responded in the affirmative to that request, but the London Company responded in a contrary direction. I find no fault with the letter; but, as I said to my friend Mr. Morton, "The letter means shortly, Mind your own business." The reply, which was dated May 14 of last year, was something like this: "In the absence of any information on the subject, the Board do not feel they are in a position to take any steps in the way of the amalgamation of the two Companies." Therefore, any step the South Metropolitan Company might have been disposed to take was at once put an end to. I do not come here to advocate amalgamation. Therefore, I shall not presume to say what is in my opinion the interest of the London Company; but I may say that great benefits result to both the public and the Gas Com-

panies by amalgamation, and that I believe, in the amalgamations which have taken place in the South of London, each of the amalgamated Companies is in a better position, as regards the public and as regards its own Shareholders, than any of the Companies could have been had they stood alone. The Phoenix Company will be better for the amalgamation, the Surrey Consumers Company are better for the amalgamation, and the South Metropolitan Company are better for the amalgamation. The short experience one has had already has proved this; and with regard to the London Company, it is for them, of course, to make up their minds what is the best course to pursue. But amalgamation with the North is out of the question. At all events, those who are best acquainted with the subject say that there is no possibility of amalgamation with the Chartered Company. Therefore, there is nothing left, if amalgamation is to take place at all, but amalgamation with the Company on the south side of the Thames. The South Metropolitan Company are going to erect extensive works. The London Company are in a first-rate position—no Company better; but they cannot go on much longer without going to Parliament for more land. To attempt much more on the present site will very inconveniently crowd the works, and thus render them less valuable to the amalgamating Company.

Mr. FORD hoped the meeting would thoroughly understand that he had not the honour of knowing the last speaker, nor had he communicated to any person whatever, directly or indirectly, his intention to make the observations he had made on this occasion. He was not a Shareholder in any other gas company, and the London Gas Company, therefore, was the sole Company he was interested in. The only person he had ever had any conversation with on the subject was his deceased friend, Mr. Hugh Oxenham.

Mr. LIVESSEY: And I do not know the gentleman who has just spoken.

The GOVERNOR: I did not suppose for a moment that any one would think there was collusion in the matter. The real point at issue as to the question of amalgamation is this: There are two things, as a Gas Company, which we have to attend to—one (the primary one) is the interest of our Shareholders, and the other is, in the interest of our Shareholders, to conciliate the public as much as possible. That is the object the Directors have had in view from the beginning. It is the object we have pursued as carefully as we could. I do not say that the time will never come when amalgamation will not be an advantage to the Shareholders of the Company, and possibly to the public; but I am perfectly willing to go into the question with any one. I am quite convinced, first of all, that the interests of our Shareholders at present would not gain anything by amalgamation, unless very different terms were offered than those which have been put before us, and I am also quite certain that we as an independent Company are quite as well able to serve the public as the amalgamated Companies have done or will do. At present we are, and for the last two years we have been, less in price than the great amalgamated Company on the north side. I do not know what my friend, Mr. Livessey, is going to do in the South, but we shall be ready to meet him in a year or two in that matter, and, perhaps, beat him. Although, again, we are supposed to supply nominally 12-candle gas, we give 16 candles. At the present moment our price is rather lower than—at all events, equal to the average price in London; and our share capital is in a better position than any of them, for we have but a small amount of ordinary share capital, and, therefore, a very small amount of share capital that would be amenable in any way to the sliding scale. We have also a reserve-fund which is pretty nearly equal to 25 per cent. of our ordinary share capital.

A SHAREHOLDER: Then why not pay a better dividend?

The GOVERNOR: Because we are limited by Act of Parliament. We are not under the sliding scale.

A SHAREHOLDER: If you amalgamated you could pay more.

Mr. R. H. WYATT: Not necessarily.

The GOVERNOR: We might pay less for a time if dear coal came.

Mr. NORTHOVER said he was rather pleased that this discussion had taken place. The matter had been ventilated at several meetings, and Mr. Ford knew that he had opposed him on a former occasion, thinking he was a little too precipitate, while he (Mr. Northover) was always disposed to think that the Directors were in a better position to judge of the advantages of amalgamation than probably any outsiders. Therefore he had always on those occasions given his support to the Directors. If he thought he knew better than they, probably he should assert independence in any observations he might feel disposed to make. He had never been able to understand how they were going to profit by amalgamation to the extent that others had mentioned when they spoke on this subject. They were in a position easily to pay 10 per cent., and he thought that Mr. Rawlinson's remark, in the last number of the JOURNAL OF GAS LIGHTING, was worthy of notice—to the effect that a certain 10 per cent. was preferable to obtaining under the sliding scale $11\frac{1}{4}$ or $11\frac{1}{2}$ per cent. if they were able to pay it. He had no doubt that Mr. Rawlinson could give good reason for that remark. He was himself rather inclined to believe that an absolute 10 per cent. was more desirable than the other—at least, unless it could be proved to him to the contrary. To revert, however, to the amalgamation, which was the only point they had to discuss beyond what had already been discussed, the Company was in such a good position, its works were good, the capital employed was comparatively speaking small, and its earning powers seemed to be without any doubt; but still, amalgamation did in some sense seem desirable, although he could not go quite the length of the two previous speakers. He did not know the subject so well as the other speakers did—particularly Mr. Livessey; but he was quite sure that this gentleman would not have expressed the opinion he had that day unless he was thoroughly convinced of it. He trusted seriously, but without in any way being thought dictatorial, that the Board would give the matter, if possible, even more serious consideration than they had hitherto done. He should be sorry if, in a few years time, they were not in as good a position as they were at the present time, for in that case they would not stand so well with the other Companies as they did now. Therefore, their negotiations with them would not be conducted so much to the advantage of the Shareholders as they could be at the present time. This was a point which seemed to him perhaps as important as any other that had been mentioned. They were all of them perfectly satisfied with the Directors of the Company, and were always ready to accord them their thanks, and would be ready to do so on this occasion. He trusted, however, that they would seriously consider the question of amalgamation, and he hoped that on another occasion when they came before the Shareholders they would be able to say that there was a prospect of the matter being settled.

Mr. WYATT said that since he had had the honour of a seat at the Board he had felt the primary duty of the Directors was to look after the interests of the Shareholders, whose trustees they were, and it was their duty to do the best they could to promote the interests of the Shareholders. To his mind too much had been said about conciliating the public. Did they hope to conciliate the public as long as they paid 10 per cent.? It was the characteristic of people who did not participate in the advantages of such concerns as this Company to covet the advantages so enjoyed. He spoke entirely for himself, and without concert with his colleagues. He had never been opposed to the principle of amalgamation, and he might perhaps mention that he knew something about this matter, because it had been his

privilege to prepare four or five schemes for the amalgamation of Gas Companies that had been united in the Metropolis; but he confessed that his difficulty had been, with respect to the London Company, that they were in an entirely different position to that of the Companies which had been amalgamated. They were all very prosperous now. Coals were cheap, and other advantages had enabled them to pay a 10 per cent. dividend; but if bad times should come, the position of this Company would be infinitely better than that of any other Company in the Metropolis. He would tell them why. If coals went up and other expenses were enhanced, they would not, or might not, be able to pay 10 per cent. with their present standard price, and there had been a very considerable limit put on the amount to be charged by Companies under the sliding scale. He was sure that Mr. Ford would forgive him for reminding him that this was a very important difference. If they amalgamated with those Companies which were under this restriction, and they could not charge for gas more than 3s. 6d. or 3s. 9d. per 1000 feet, as the case might be, they would be placed in the same difficulty should bad times come. Did they think the public would then assist them in getting the restrictive standard price removed, and in enabling them to go back to a higher maximum price as of old? Not at all. As matters stood, however, the London Company did not want the assistance of the public. They were able to do this without the assistance of the public. If they should have bad times, they could raise their price so as to enable them to pay that which Parliament had declared only a fair and equitable dividend—10 per cent. The general law passed in 1847 enabled them to charge a much higher rate than the present legislation enabled them to do; and certainly this was a privilege worth a great deal to them. He ventured to think with the last speaker, that a safe 10 per cent.—and it was safe with the law as at present affecting the Company—was worth more than a doubtful $10\frac{1}{2}$ or 11 per cent. with a restriction on the price of gas in the event of bad times coming. He confessed it was a matter which rather embarrassed him. If they were under the same restrictions as the other Companies, he should hold up both hands for amalgamation, because he knew that it was attended with considerable advantage, in the reduction of expenses and so forth; but was that commensurate with the advantages they now enjoyed of being able to raise their price in bad times so as to equalize their dividend? He was quite sure it would be a very serious matter for some of the Shareholders if they should suddenly find they were receiving 7 instead of 10 per cent., and therefore his opinion was that a safe 10 per cent. was better than a questionable $11\frac{1}{2}$ per cent. Mr. Ford said they had no friends; but if they amalgamated would they, he asked, have any more? He had no doubt they would pay 11 per cent., and he had also no doubt that the South Metropolitan Company also, which was an admirably managed and an improving Company, would pay 11 per cent.—he hoped they would, for he was a Shareholder, and would be very glad to see it—but he did not think that amalgamation with them and the payment of a higher dividend than they (the London Company) paid at present was likely to conciliate the public, or make more friends for them than they had at the present moment. There was another observation of Mr. Ford's which he could not quite endorse. That gentleman said the Directors ought to approach each other. This was all very well if a couple of landowners had pieces of land by the exchange of which they would benefit their estates; but if people were in a contented position it was not usual to run about and offer their property for sale. He believed in the old proverb, that "no man is beyond his price." If others would come and offer the Directors such a price for their property as they could accept, he should say, "By all means let them have it," but it must be such a price as would satisfy them that it would put them in as safe a position as they were now in. They could at present raise their price at any moment, but they charged as low as any one, and he quite agreed with what the Governor said, that they were able to compete with any one. Why, then, should they run about and say, "We have a splendid property; buy us?"

Mr. FORD said it was not likely that such a proceeding would be adopted. It would be done in a business-like manner. He did not suggest that they should go about offering the property for sale.

Mr. WYATT continued by remarking that Mr. Ford had on many occasions suggested amalgamation; but he (Mr. Wyatt) ventured to say—his colleagues could speak for themselves, but he believed he was speaking for all of them when he said that they had no desire to part with their property. The Directors were the Shareholders' trustees. He believed they were in a safe position, though there was a limit to the dividend.

The Hon. H. NOEL said if what Mr. Ford suggested were done, they would, in his opinion, do what would be most fatal. Were they likely to get a good price by going and thrusting their property under people's noses, or by waiting until they came to the Company?

Mr. NORTHOVER observed that no one wished such a course to be taken.

Mr. FORD expressed an opinion that the Directors had misunderstood what the Shareholders had suggested.

The Hon. H. NOEL said they were in the same position as a voter used to be in the old times about five minutes before four o'clock, when the poll closed. They had better take advantage of their position, and not do anything that was rash. As the Governor had said, amalgamation was constantly before them, but they entirely declined to be led by the observations of Mr. Ford or of Mr. Livessey, as they had understood them. They would take their own time, and the time they selected would be best for the proceeding.

The GOVERNOR: I think this has been a very useful discussion. All I can say on behalf of the Board is that the question of amalgamation we have never lost sight of. Mr. Northover suggested that we should take the matter into more serious consideration. We cannot do so, because it is constantly before us. As Mr. Wyatt has told you, we consider that we have a very valuable property, and I think my friend Mr. Livessey and other people are desirous of getting possession of us.

Mr. LIVESSEY: No, no, Sir. We say it is a valuable property, but we do not specially want to get possession of it.

The GOVERNOR: We are in business, and are perfectly ready to sell at a proper price.

A SHAREHOLDER: Why not buy some one else.

The GOVERNOR: We are in the market, and can buy or sell as we like.

The motion was then put, and carried unanimously.

The GOVERNOR moved the dividend resolution.

Mr. NORTHOVER seconded the motion, and it was also carried unanimously.

The GOVERNOR: The next resolution is the one relating to the three retiring Directors. I venture to move that Mr. Rawlinson be re-elected a Director of the Company. Mr. Rawlinson's name is much before the public. He is so thoroughly known, and his reputation stands so high, that I think I need not say more about him than express my opinion that the Company are very fortunate in having Mr. Rawlinson as one of the Directors.

The Hon. H. NOEL seconded the motion, and it was agreed to.

The GOVERNOR: I now move the re-election of the Hon. H. Noel, who has been connected with this Company for some years, and with an analogous Company—the New River Company; and if he manages our affairs as I think the Water Companies have managed theirs lately we need not complain.

Mr. JULAND DANVERS seconded the motion, which was carried unanimously.

The GOVERNOR: The third Director who retires is Mr. W. I. Hare, and I beg to move his re-election, for Mr. Hare has been with us a considerable number of years, and those who act on the Board with him are very good judges as to the value of his services. I do not know that we could ever anywhere find a man who goes more thoroughly into the working of the Company than he has done, or who would serve it with more zeal.

Mr. WYATT seconded the motion, and it was also passed.

Mr. OXENHAM next moved, and Mr. NORTHOVER seconded the re-election of the retiring Auditor, Mr. George Pearson, who was re-appointed.

The GOVERNOR: The last motion is a matter which I am quite sure that you will be unanimous upon. I have to move—"That the salary of the Secretary be increased to £1200 per annum." Mr. Dove has been with us from about the commencement of the Company, and the Directors are fully aware—and so are the Shareholders—of the high services which he has rendered to the Company. The Directors are of opinion that his salary ought to be increased to £1200, which is not more—in fact, it is rather less—than the Secretaries of the other London Companies are receiving.

Mr. FORD said he had great pleasure in seconding the resolution. He was not aware that such a proposal was contemplated; but he had for some time been of opinion that the remuneration Mr. Dove received was not equal to that of the Secretaries of other Companies. He was very pleased that the motion had come from the Directors side of the table. He believed it was a power which the Board could themselves have exercised, but he was glad, notwithstanding, to find that they had submitted it to the Shareholders.

The GOVERNOR put the motion, adding that the increase would date from the 30th of September last; and it was carried unanimously.

The SECRETARY said he should be most ungrateful were he not to recognize, with very deep thankfulness, the way in which the Governor had so kindly spoken about him and his services. He had certainly been some time with the Company, but not quite so long as the Governor intimated, inasmuch as there was a time when the Company were not paying any dividend at all. He was happy to say that he was not in office at that time. The Shareholders had received the proposition very kindly, and he was much obliged to them, and to Mr. Ford for his kind remarks in seconding the motion.

Mr. FORD, in moving a vote of thanks to the Governor and Directors, observed that he thought it was right to state that he did not consider, as Mr. Wyatt seemed to suppose, that the Directors alone had a monopoly of the trusteeship of the Company. He himself felt himself individually a trustee for every Shareholder, because he had a large stake in the Company himself, and he would not think of making any proposal which he believed would be detrimental to his own or the other Shareholders' interests. He dissented entirely from the "bogus" fears that had been expressed of bad times. He thought the Company were in such a position that they could make proposals to other Companies with considerable advantage; but those proposals would be made by business men, in a business manner, at a business time, and not in a manner which should in any way sacrifice those interests which they all had a wish to promote. He also thought that when suggestions came from the Shareholders side of the table, which were recommendations to the serious attention of the Board, it was rather inconvenient for an individual Director to deal with the matter piecemeal. It was rather better that the observations of the Shareholders should be weighed by the Board subsequently, and then that at the next meeting they should give collectively their formal opinion of what would be best for the interests of the Company. Between the present time and October next he would wait on the Governor, and they might be able to formulate their views in a more direct and regular manner than they had that day done. He trusted these observations might not be thought to detract from the resolution he had proposed.

Mr. NORTHOVER seconded the motion, and said he thought they could not have had a more satisfactory discussion on the subject of amalgamation. He was quite sure that the Board deserved the thanks of the Shareholders, and he hoped they would always be as deserving of it as they were now.

The motion was carried unanimously.

The GOVERNOR: On behalf of myself and my brother Directors I beg to return you our best thanks for the compliment you have paid us. I have now the pleasure of moving a vote of thanks to the Secretary, Engineer, and the other Officers of the Company. Our work is very well done.

The Hon. H. NOEL seconded the motion, and said that being on the Committee of Works he was aware of what the exertions—and the successful exertions—of Mr. Morton were, and also those of Mr. Dove.

The resolution was passed unanimously, and the proceedings terminated.

BIRMINGHAM CORPORATION GAS SUPPLY.

PROPOSED EXTENSIONS AT THE WINDSOR STREET WORKS.

At the Meeting of the Birmingham Town Council last Tuesday—the Mayor (Mr. R. Chamberlain) presiding—the Gas Committee presented a report, in which it was stated that on the completion of the extensions at the Windsor Street works, which had been authorized by the Council, it would be necessary to provide additional storage accommodation, and that in the course of the next two or three years it would be desirable to abandon, as they wore out, several of the small gasholders at those works, and in respect of which a further provision of storage would be required. The plans for the extension of the works, which had been submitted to the Committee, include two gasholders to hold 6½ million cubic feet. It had been the intention of the Committee to postpone the execution of this work until the completion of the new retort-house; but as a favourable opportunity for the construction of the tanks had presented itself, whereby a considerable saving would be effected in the total cost of the work, they recommended that they should be empowered to obtain estimates and make contracts for the construction of the tanks for these holders during the present and two following years. They estimated the total cost of the tanks and holders at £100,000, a portion of which would be chargeable to revenue.

Alderman CHAMBERLAIN moved, and it was agreed, that the Committee be authorized to expend a sum not exceeding £100,000 for the purpose of carrying out the above-mentioned extensions.

The Committee further reported that the appeal against the judgment of the Queen's Bench Division was heard on the 4th and 5th of March, when the judgment was affirmed with costs. They had informed the West Bromwich Improvement Commissioners that the question would not be carried further, and that the Corporation would be prepared to transfer the West Bromwich supply to the Commissioners on the 1st of July next. They had been asked by the Local Boards of Oldbury, Smethwick, and Tipton to endeavour to arrange with them the terms for the transfer of the portions of the gas undertaking within their districts without incurring further costs in arbitration, and they had expressed their willingness to meet the Boards in the hope of making such an arrangement. The Local Board of Smethwick had preferred the further request that their portion of the undertaking might be transferred before the 1st of July, 1882, the

date now agreed on. The Committee recommended that they should be authorized to arrange terms of the transfer with each of the Boards, and that they should be also empowered to arrange terms for the transfer, before the date now agreed on, to any Boards who desired to take over their portion of the undertaking before that date.

Alderman CHAMBERLAIN proposed a resolution authorizing the Committee to act as they recommended. In doing so he explained that the Committee had, with the sanction of the Council, appealed against the Arbitrator's decision in the West Bromwich case, on the advice of the most eminent counsel and of their skilled witnesses, who were all of opinion that the award was based upon an incorrect view of the Act of Parliament. However, the appeal had gone against the Corporation, and he did not think that the Committee or the Council would be justified in going further. They might appeal to the House of Lords if they liked, but the Committee considered they had had enough of law.

Mr. COOK seconded the resolution.

Alderman CHAMBERLAIN, replying to the discussion which followed his motion, said there were two questions that arose in reference to the arbitration. The first was—Had the Corporation received as much as they hoped to get? No; they had not. The second question was—Had they been awarded as much as they offered to take? He thought he should be able to show that when they added to the sum which they would obtain under the arbitration the amount of profit which they had been making during all the period since they purchased the gas undertaking—for they had kept the works in their hands—they had had from the Local Boards, under any circumstances, more money than they would have had to pay if they had accepted his offer two or three years ago. As to the law expenses, he had not told the Council what they were, simply because he had not the least idea himself. Before the arbitration commenced he told the Council that it would probably cost £20,000. But whatever it might be it would undoubtedly be very heavy, both for the Corporation and the Local Boards, and from the first he had never ceased to regret that the money should be wasted, as he considered it had been, by the obstinacy of the Local Boards, and by their refusal to meet the Committee in an amicable way.

The motion was then adopted; as was also one for the approval of the whole report.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There has again been very little doing in either the coal or iron trades of this district during the past week, but with the close of the elections business may be expected to resume its usual course. So far as anything has been doing, the market is nominally in much the same position as last week. All classes of round coal continue plentiful, and there is a want of firmness in prices wherever sales have to be pressed. One or two contracts are now being advertised for gas coal, but in this branch of trade the season is yet too early to afford any very reliable indication as to how prices will actually rule. Judging, however, from the low prices at which all descriptions of round coal can now be bought, there is every probability of consumers being able to cover their requirements on very favourable terms indeed. Buyers who are prepared to take anything like quantities can readily obtain best Wigan Arley at about 8s. per ton at the pit, and inferior sorts range from about 6s. per ton upwards, with Pemberton four-feet much about the same in price. Common round coals for steam and forge purposes are very low in price, and can be bought at under 5s. per ton, with the average quotations ranging from 5s. to 5s. 6d. per ton. For the limited quantity of slack now being produced, sellers are able to obtain advanced prices without difficulty, and good slack is about 4s. per ton, with inferior sorts fetching about 3s. to 3s. 3d. per ton; burgy is also firmer, and for good qualities 4s. 3d. to 4s. 6d. per ton is being obtained at the pit mouth.

The shipping trade continues very dull, and those collieries which have been mainly dependent upon this branch of trade are now very badly off for orders.

In the iron trade there has been less firmness in prices. Local makers of pig iron, finding that they are undersold by other brands, and are so securing very few orders to replace those which are being worked off, are not holding out for their full rates, and although nominally the quotation for Lancashire pig iron delivered into the Manchester district is still about 70s. per ton, less 2½ per cent., fully 2s. 6d. per ton below this figure would in some cases be taken to secure orders. Finished iron has also been easier to buy, and Lancashire bars can now be bought from makers for delivery into the Manchester district at about £8 10s. per ton, with second-hand lots offering at about £3 per ton.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The shipments of gas coals from the Tyne were fully an average last week. The election excitement in the North Durham colliery districts reached its height on Thursday, when the county contest came off. There was little work done that day. It ended in the return of Colonel Joicey, who may be considered at the head of the gas coal trade of the county, and Mr. C. M. Palmer, a large coke maker, coal owner, iron manufacturer, and iron shipbuilder. Matters will now quiet down. This week will be a busy one in the shipment of gas coals over sea. The demand for best gas coals is amply sustained; and it is moderate for the second-class sorts. Prices are unchanged. The steam coal trade did better last week than the week before. The house trade was very dull. The demand for small and manufacturing coals has been fairly well sustained. The make of coke is increasing weekly.

The supply of coasting sailing vessels was in excess of the requirements of trade last week. There were few orders in the market. Shippers had a large choice. Rates were down about 3d. per ton. Steamers are now going out of the coasting trade into the Baltic; but that is not making any difference to the London or coasting markets.

There has been a stronger inquiry for gas and water pipes. Some orders are to hand. The foundries are, therefore, better employed in this trade. Generally speaking the iron factories are extremely well employed; but the pig iron trade is not very strong. Lead has gone back to a more reasonable price. The shipments of fire-bricks are very well sustained. The cement trade is quiet. Chemicals give symptoms of a revival of business. The tone of trade generally is better in the North of England.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

Six shares of the Coupar Angus Gaslight Company were sold by public auction in the Victoria Inn, Coupar Angus, last Thursday week, and the price realized was £7 2s. per share.

On Monday, the 22nd ult., in terms of an order received from the Home Secretary, Sheriff Dyce opened an inquiry in Lanark in regard to the proposed water supply scheme for that town. A number of witnesses were examined, amongst whom there were Dr. Alexander M. Adams, Medical Officer of Health for the burgh; Drs. Ewing and Somer-

ville, ex-Bailie Harvey and ex-Bailie Gilroy, Mr. James Watson, Water-Works Manager, Dundee; and Mr. Arnot, Public Analyst, Edinburgh; all of whom were called by the promoters of the scheme. A second and concluding court was held on Thursday, when evidence was taken for the chief objector to the scheme. At the conclusion of the evidence, Mr. Dickson addressed the Court, and reviewed the evidence, which, he said, had made out a clear case for the promoters.

The annual official inspection of the Greenock Water-Works took place on the 1st inst. The weather was fine, and there was a large turn-out of the members of the Water Trust, millowners, officials, &c. The company left the town about eleven o'clock and proceeded to Loch Thom, where the extensive new works in course of construction were carefully examined. The whole works were found to be in first-class order, reflecting the highest credit on Mr. Wilson, C.E., the Superintendent, while the water in store was found sufficient to provide a full domestic, sanitary, and public works supply during the statutory period from this date.

Viewed in the light of the fact that it has an important bearing upon the history of the gas manufacture in Scotland, a statement which I made in one of my "Notes" last week, that dealing with the sale of the plant at the Partick station of the Glasgow Corporation Gas-Works admits of a slight correction, which I lose no time in making. The gasholder then spoken of as having been the largest in Scotland when it was put up by the late Mr. James Beaumont Neilson, measures 80 feet in diameter, rises 19 feet high, and has a capacity of 90,000 cubic feet. Instead of these dimensions I, by mistake, mentioned the diameter as being 40 feet, the lift 20 feet, and the capacity as being 26,000 cubic feet. At the same time I may say that I am authorized to state that none of the plant was purchased at the sale for the Glasgow Corporation Gas Commissioners. Messrs. Hanna, Donald, and Wilson were the most extensive purchasers. They bought all the three gasholders—the 80-foot and 40-foot holders being purchased with the view of being re-erected elsewhere.

A somewhat peculiar gas-meter case, which has for some time occupied attention in the Wishaw Sheriff Court, was finally disposed of by Sheriff Birnie last Friday. Mr. Thomas Steel, joiner, Cambusnethan, sought to recover from Mr. Robert Morton, gas-fitter, Wishaw, the sum of £10 15s., being the difference in the alleged contract price of gas-meters supplied to the pursuer by the defender. In evidence, the defender admitted that he contracted to supply new meters of a particular make, but that in subsequent conversation with the pursuer he suggested to him that he should be allowed to substitute others for them, which, although not new, were equally as good, and that he would guarantee them. The defender, it was further stated, offered no objection to the proposed arrangement, but that was denied by the pursuer. After hearing a number of witnesses on both sides, the Sheriff held that the contract had been broken, and that the pursuer was entitled to take out the old and supply new meters, or pay the defender the amount claimed.

Arrangements are at present in progress in the centre of Cathcart's Square, Greenock, for the erection of the masonry to carry a highly ornamental cast-iron framework destined for the support of a Sugg lantern—the whole, if I mistake not, being the gift of Mr. Abraham Lyle, who was Provost of the town during the last triennial term, and discharged the duties of his honourable office with satisfaction to his fellow-towns men.

Business was done last Friday in the shares of the Edinburgh and Leith Gas Company, at an advance of 10s. Buyers offered £29 per share at the close of the market, and sellers were firm at £30.

At a meeting of the Town Council of Hawick, held last Tuesday, Provost Watson went elaborately into the particulars of a number of water schemes, reported on by Messrs. Leslie, Engineers, of Edinburgh, and gave his opinion, provided the quantity was found sufficient, in favour of the Williestruther Loch scheme, to cost about £8000. It was resolved, by nine votes to four, to proceed with the introduction of a fresh supply of water, and it was remitted to the Water Committee to consider the various schemes, and report. The Council are at present also engaged in carrying out a scheme of drainage operations which will probably cost well-nigh £30,000.

The Local Authority of Inveresk, near Musselburgh, held a meeting last Thursday, at which a Committee was appointed to negotiate with a Committee of the Edinburgh and District Water Trust regarding a supply of water; and it was further resolved that steps be taken, under the Public Health Act, to assess for the purpose. It is expected that the new water supply will be introduced into Musselburgh in the course of next month.

At the last meeting of the Edinburgh and District Water Trust, Mr. Coyne's monthly report was submitted, which stated that the number of apparatus examined for checking waste had been 5948, of which 5664 were

found in good order, and 284 faulty or in a state of disrepair. The delivery of water into Edinburgh during the fortnight ending the 6th of April was equal to 37·64 gallons per head per day to a population of 298,350.

In the early part of last week there was a smart advance in the price of pig iron in the Glasgow market, in consequence of the large majority secured by the Liberals in the elections; but as the sentiment cooled down, combined with very unfavourable news from America, the market lost all it had gained, and the closing was flat at the lowest of the week—namely, 55s. cash, and 55s. 3d. one month. The highest price paid during the week was 57s. 6d. cash. America is, for the present, quite closed as a market for Scotch pig iron, in consequence of the heavy fall in prices there.

A certain amount of dulness is still felt in the coal market. Prices are declining, and miners wages are being reduced in some districts.

Register of Patents.

APPLICATIONS FOR LETTERS PATENT.

- 1269.—HELLYER, S. S., Strand, London, "Improvements in house sinks and in the appliances connected therewith for flushing the same, and for trapping and ventilating the waste pipes thereof, partly applicable to the trapping and ventilating of house waste pipes and drains generally." March 25, 1880.
- 1290.—MACE, C., and BREWSTER, J., Sunderland, Durham, "Improvements in the construction of fire-bars, including improved apparatus for casting the same." March 27, 1880.
- 1310.—YOUNG, W. C., Poplar, London, "Improvements in the manufacture of sulphate of ammonia." March 30, 1880.

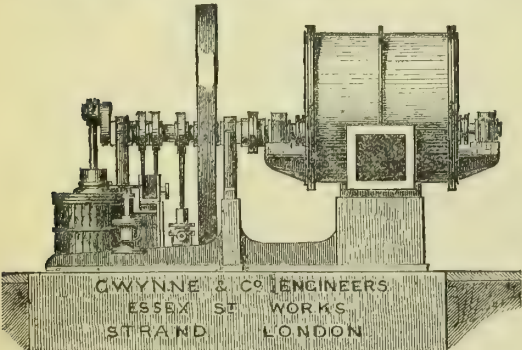
PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 3991.—TONGUE, J. G., Chancery Lane, London, "Improvements in the manufacture of gas." A communication. Oct. 4, 1879.
- 4055.—LAKE, W. R., Southampton Buildings, London, "An improved apparatus for regulating or controlling the pressure and flow of gas or other fluids." A communication. Oct. 7, 1879.
- 4077.—MACKAY, F. N., Liverpool, "Improvements in and connected with pumps for giving motion to gases and the vapour of volatile fluids." Oct. 9, 1879.
- 4084.—HENDERSON, A. G., Edinburgh, "Improvements in gas-meters." Oct. 9, 1879.
- 4229.—ENGEL, F. H. F., Hamburg, Germany, "Improvements in automatic apparatus for lighting and extinguishing gas-burners." A communication. Oct. 18, 1879.
- 4252.—LAKE, W. R., Southampton Buildings, London, "Improvements in carburetting apparatus for the manufacture or enrichment of illuminating gas." A communication. Oct. 20, 1879.
- 5052.—MILLS, E. C., Dunham Massey, Chester, and HALEY, H., Moston, Lancs, "Improvements in gas motor engines." Dec. 10, 1879.
- 330.—LINFORD, C., Leicester, "Improvements in and connected with gas-engines." Jan. 24, 1880.
- 343.—ABEL, C. D., Chancery Lane, London, "Improvements in gas motor engines." A communication. Jan. 26, 1880.

PATENTS WHICH HAVE BECOME VOID

- BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.
- 1063.—LAKE, W. R., "Improvements in gas motor engines." March 16, 1877.
- 1137.—SCHOFIELD, G., "Improvements in 'gullies' or traps for preventing the escape of noxious gases from sewers and drains generally, which traps are also applicable for water-closets and other places where noxious gases can escape into the atmosphere." March 22, 1877.
- 1209.—VERSTRAETEN, T., "Improvements in joining together the ends of pipes and tubes." March 27, 1877.
- 1246.—YOUNG, W., "Improvements in the destructive distillation of coal and other bituminous substances, the same being in part applicable to the manufacture of oil and gas." March 29, 1877.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS. **GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.**



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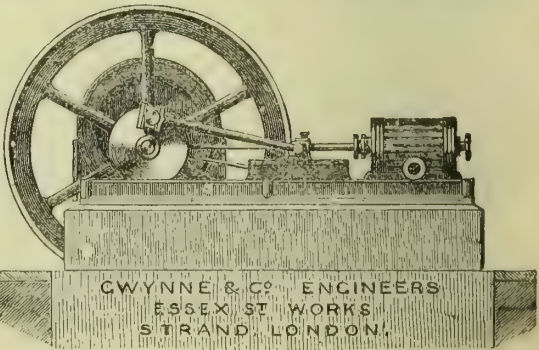
Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

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GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

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TO CORRESPONDENTS.

A SUBSCRIBER.—*The contractor, in the first instance.*
 CIVIS ROMANUS.—*Thanks for letter of the 10th inst. received. We will endeavour to get and publish quotations such as you ask for; but the difficulty is to obtain them at all reliable. Many of those published in trade price lists are very misleading.*
 H. S. G.—*The Third Volume of "King's Treatise on Coal Gas" is in active preparation, part being in the printers hands. You will see due announcement made in the JOURNAL, on its approaching completion.*
 No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
 WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 20, 1880.

Circular to Gas Companies.

THE Metropolitan amalgamations being thus far completed, gas affairs are in a state of quiescence; and they will probably remain so until a further advance is made towards the union which we earnestly desire soon to see effected. Not that this will produce any disturbance, for the policy of such combination is so obvious that all but a very few wonder why the London Gaslight Company should stand out from a union which would be most advantageous to their interests. On this point, however, we need not at present say more. Having frequently pressed the Company to join with others, we are not disposed to indulge in too often reiterated advice. We have not yet made the final appeal, which must be made when the question of the purchase of the Metropolitan Gas Companies comes up for consideration. That this question will arise is generally admitted—it is only a matter of time, which is not at present ripe for the purchase of the gas undertakings, but which is certain to come. At present no hint is given that the Metropolitan Authorities have any desire to buy up the most valuable property they could possess. They may or may not obtain the Water Companies, but in any case it will be found extremely advantageous to effect the purchase of the gas and water undertakings together. The lines laid down for the purchase of the water undertakings in Mr. Cross's Bill may very well be followed. There is the definite value of the dividends, and the probable increment of profits for a certain number of years. These taken together would, of course, represent a considerable sum, but when a Trust is issuing three and a half per cent. paper stock, it

matters little what sum their paper may represent. We shall not attempt to appraise the value of the gas undertakings, leaving that for more competent authorities to settle. But why speculate at present? Neither one purchase nor the other will be effected until we have a Municipal Government for London. It is all very well to speak of a Water Trust, but the outcry presently will be for a body that can absorb all the undertakings which furnish what are called "the necessities of life." Among these, of course, gas will form a prominent portion, and we fully expect that when an energetic reformer undertakes the reconstruction of the local government of London, the purchase of the Gas Companies works will receive a large share of attention.

We see that there is some talk of the re-introduction of Lord Elcho's Bill. We have in past times expressed an opinion that this measure did not satisfy the requirements of the situation. A stronger hand than Lord Elcho's will be required to effect substantial reformation in the present government of London. If one or two of the leading members of the Liberal party, who will probably soon find themselves in office, will take up the matter, something may perhaps be done; but we confess that the prospect is not hopeful. Metropolitan public opinion is hardly advanced enough for such a radical change as would abolish the Vestries and the Metropolitan Board of Works. The latter body, perhaps, are expecting dissolution, but we shall not attempt to hurry an event which must come by a natural process. This process may be accelerated by the action of the ratepayers, and if Mr. Beal's Association is true to its vocation, and has sufficient moral power to induce the Government to accept its opinions, we may look to it for very important results. As we have said, however, public opinion is not quite ripe for revolutionary changes in the government of London. Patient and steady work for years will be required before it will be made obvious to the Metropolitan ratepayer that it will be to his advantage to have a government which can adequately control his public affairs.

The half-yearly meeting of the Tottenham and Edmonton Gas Company was held at Tottenham on the 10th inst., and the report presented by the Directors was highly gratifying. The Company are, of course, in a position to pay maximum dividends, and to carry over, after adding £500 to the reserve-fund, a balance of £790. We notice that the reserve-fund has now risen to large proportions—so much so, we fancy, as to justify the Company in reducing the price of gas in their district. Nothing is wanted in Tottenham and Edmonton to ensure a large consumption but cheap gas. It is a common saying in the neighbourhood, however, that "Tottenham is the last place God made." We hope it will not be the last place in which gas will be cheap.

The propriety of the Walsall Town Council charging a differential rate for the gas supplied beyond the borough boundary, was called in question at the last meeting of the Corporation, when one of the members, who had given the requisite notice of his intention to do so, moved—"That in the opinion of this Council it is desirable to repeal that part of section 45 of the Walsall Gas Purchase and Borough Extension Act, 1876, which enacts that an additional charge of sixpence per thousand cubic feet shall be made for gas supplied for public or private consumption in the parts of the borough outside the limits of the Walsall Improvement Act of 1848." This proposal did not meet with the favourable reception evidently wished for it by the mover of the resolution, who frankly confessed that he had been a party to the arrangement at the time it was made, excusing himself for his early change of opinion on the ground that he was then "only a junior member of the Council, and trusted to older members doing nothing but what was right." The "seniors," no doubt judging that it was too soon to amend an Act passed as recently as 1876, promptly agreed, by thirteen votes to three, to insert the word "not" before "desirable;" and in this altered condition the motion was passed.

Following closely upon the exhibitions of gas apparatus at Ipswich and Sleaford, to which reference was made in the last number of the JOURNAL, comes one of a similar character, held under the auspices of the Corporation of Leicester, and, as recorded in another column, inaugurated by the Mayor on the 12th inst. The repetition of such exhibitions as these is unquestionably calculated to enforce upon the public mind the advantages of gas for cooking and heating purposes. To make such displays thoroughly successful, however, they should, as the Mayor very pointedly put it in his opening address, show that gas appliances can be used with economy. If it could be demonstrated, he said, that joints may be cooked or manufacturing operations carried on with greater ease and less cost

by means of gas, than if coal is the medium employed, gas apparatus would be sure to be adopted. In the face of obvious advantages, the public are, nevertheless, slow to adopt and to adapt themselves to new appliances and modes of procedure; but if, by having such displays as these, householders and manufacturers are eventually brought to the belief in the thorough adaptability of gas to many more purposes than those to which it has hitherto generally been applied, the promoters of these exhibitions will surely be justified in congratulating themselves upon having instituted a work which will have for result the immediate benefit of the gas industry and the ultimate good of mankind.

The Cardiff Gas Company and the Corporation are in anything but friendly relations. The Corporation complain that the illuminating power of the Company's gas is defective, whilst, as a matter of fact, their own Examiner reports that the power is always in excess of that required by the Company's Act. These petty squabbles are always contemptible, but they are obliged to be taken notice of. The price of the gas supplied by the Cardiff Company compares very favourably with the rate charged by surrounding Companies and Local Authorities, so the Cardiff Corporation have a clear case before them. They must either submit to the prices the Company righteously impose, or buy the works on such terms as Parliament may grant. What these terms will be we shall not presume to indicate; they must be left for the consideration of a Parliamentary Committee.

The eighth annual meeting of the West of Scotland Association of Gas Managers will be held at Hamilton on the 29th inst. Mr. R. Mitchell, of Coatbridge, is the President of the Association for this year. The advisability of amalgamating with the North British Association of Gas Managers will again occupy the attention of the members; and probably some definite conclusion may be arrived at on this question, which has now been agitated at several recent meetings. Three papers will be read—one by Mr. Niven, of Dunoon, entitled "The Elaborate and Tedious Thermometric and Barometric Calculations Relative to Coal Gas Simplified;" the second by Mr. Mayer, of Glasgow, on "Painter's Hydrostatic Joint for Gas and Water Mains;" and the third by Mr. Brodie, of Paisley, on "Gasholder Construction"—in addition to which a report on Mr. Hislop's process for the re-burning of foul lime will be presented.

EXTENSIONS AT THE NEWCASTLE AND GATESHEAD WATER-WORKS.—Three additional filter-beds in connection with these works at Throckley have just been completed. Water was admitted to them on Thursday afternoon, in the presence of Mr. Main, the Secretary of the Company, who opened the valves for the purpose. The works are of a substantial character, and have been executed under the superintendence of Mr. J. F. Bateman, C.E.

THE USE OF GAS IN LIBRARIES.—In the course of a paper read last Wednesday, before the Society of Arts, by Mr. George Bullen, F.S.A., Keeper of the Printed Books at the British Museum, the following passage occurred:—"Dry heat is the greatest enemy to books, which require proper ventilation as well as human beings. Gas is supposed to be particularly injurious; and, doubtless, the upper portion of an unventilated gas-lighted room is particularly obnoxious, so that books on shelves near the ceiling are likely to be specially injured. As to other positions, it is not clear that the heat emitted by gas is more destructive than the same amount of impure air from other systems of lighting; in fact, the library in which the books were in the worst state of powdery decay I have ever seen, was placed in rooms lighted by lamps and candles. This question, although it has long been debated, remains still unsettled."

THE BUILDING EXHIBITION AT THE AGRICULTURAL HALL.—The exhibition of building appliances, &c., to which reference was made in last week's JOURNAL, and which was opened to the public on the 12th inst., fairly well carries out the aim of its projectors to present to the public a complete collection of the various articles required in the construction, furnishing, and decoration of a modern dwelling-house. Of course, the most attractive exhibits are those in the classes devoted to furniture, ironmongery, &c., but these, apart from their artistic beauty and excellence of workmanship, can scarcely be said to have any interest for our readers. In connection with the gas industry, however, it should be mentioned that Messrs. Jones and Willis show some really beautiful specimens of wrought-iron gas-fittings and art metal work, which are rivalled though not outshone by the gorgeous display made by their neighbours, Messrs. R. Evered and Co., whose Early English gas-fittings are exceedingly tasteful, and worthy the attention of those whose fancy leads them to prefer the antique. Cooking by gas is represented by one solitary firm—Messrs. Beverley and Wyld, of Leeds—who show three of their patent gas kitcheners, lined with white glazed tiles; while gas heating and ventilating appliances are exhibited by Verity Brothers and Ritchie and Co. Kidd's combination gas and oil light affords an illustration of how the illuminating power of gas may be improved, and Stott's gas-valve shows how consumers may regulate the supply at the burners. The "Bisschop" and "Otto" gas-engines are there as examples of the utilization of gas for furnishing motive power. Water-meters, filters, closets, and sanitary appliances are well shown by Messrs. Smeaton, Ransome, and others; and in the special department of ventilation, Messrs. Boyle are conspicuous by their show of patent self-acting air-pump ventilators, by means of which the foul air of buildings of every description may be extracted without draughts or currents. In Class II.—Bricks, Stone, Concrete, &c.—Messrs. J. Cliff and Sons and Eastwood and Co., Limited, make a good display; and among the miscellaneous exhibits are articles in some way connected with building operations, from lightning conductors to luminous basements. The exhibition has a certain amount of attractiveness for the general public, and has been fairly well patronized. It will remain open until the 24th inst., and it is to be wished that success may attend the labours of its promoters.

PUMPING GAS AT BECKTON FOR DISTRIBUTION IN LONDON.

During last autumn there were erected at the Beckton station of The Gaslight and Coke Company—for pumping pure gas from the gasholders at that station to London through the distributing mains—six of the largest exhausters hitherto made. These exhausters, or pumps, were designed for the purpose of utilizing to a greater extent than before the present two 48-inch mains between Beckton and the distributing stations of the Company in London, by increasing the pressure of the gas at Beckton as the demand required.

There are three engines, each working a pair of 250,000 cubic feet per hour exhausters, making the total quantity of gas pumped per hour equal to $1\frac{1}{2}$ million cubic feet, and these have been in successful operation during the past winter. On some occasions as much as $1\frac{3}{4}$ million feet of gas per hour have, during foggy weather, been pumped for successive hours to London. So satisfactorily have the engines and exhausters done their work, that very little comparative oscillation of water-gauge occurred at Beckton, and nothing perceptible at the distributing stations in London, where the gas was sent direct to the public.

The two mains under the ordinary holder pressure would deliver 1 million cubic feet of gas per hour to London, so that the economical advantages of forcing the gas by the means described are at once apparent, as without the aid of extra pressure the necessary quantity of gas could not have been sent without laying, at a heavy cost, a third 48-inch main to London, and even then the gas would have reached town at a comparatively low distributing pressure.

It is believed that this is the first instance of gas being supplied direct to the consumers by pumping. The whole arrangement has worked so well during the past winter, that the pumping power is about to be increased by one more engine and two additional exhausters, and these are now being made by Messrs. B. Donkin and Co. They are to be in operation before next winter, when the total nominal pumping power will be equal to 2 million cubic feet of gas per hour; and this quantity it is intended to force through the existing two 48-inch mains.

During the spring and summer months the gasholder pressure is sufficient to force the gas to London, and it is only necessary to work the above-named machinery during the winter months. Therefore steam-engines of the non-condensing single-cylinder type were selected. They are horizontal, of 40-horse power nominal, and three are already fixed. Each of them is fitted with a feed-pump capable of supplying feed water sufficient to generate steam for the whole of the three engines. These engines also have a solid steel crank-shaft with double bearings, to which, by universal couplings, there are attached direct two of the 250,000 feet per hour exhausters, one on each side, their slides being fixed at right angles. These couplings are so designed as to admit of either one of the exhausters being readily disconnected and laid idle, thus allowing the engine to drive only one exhauster. They also accommodate themselves to any unequal wear that may arise, which is an important provision.

The exhausters are on J. Beale's improved patent principle, with one slide instead of two, giving a greater bearing in the drum or axle, and greatly reducing the wear and tear. The nominal speed of each exhauster to pass 250,000 cubic feet per hour is 50 revolutions per minute, and with eight exhausters at work they would give the 2 million cubic feet of gas per hour as before mentioned. They have, however, been worked at 60 revolutions per minute and upwards.

The special feature of this gas-pumping plant is its unusual magnitude, the exhausters being larger than any yet made. The pumping or forcing of so large a volume of gas as $1\frac{1}{2}$ million cubic feet per hour direct through distributing mains to the public, with little or no perceptible oscillation of gauge, is also a novelty.

The problem having been so successfully solved at Beckton, it is a question how far the same means may be adopted in other gas-works to supply gas through existing mains which have become too small for their work, by the increased and increasing demand for gas. In many works it may probably be worth consideration whether it would not be more economical to erect pumping plant similar in character to that we have been describing, rather than take up old mains and relay larger ones. This system might also facilitate new gas-works being erected some little distance from large towns, and perhaps allow the choice of sites better adapted for the delivery of coal, &c.

With this week's number is issued a double-page engraving representing two views of one of the engines, with its two exhausters attached, showing the method of coupling; also the general arrangement of the exhauster-house. To supply steam, there are six two-flued Lancashire boilers with Galloway tubes. Only four, however, are required to work at one time when coke is used, but with breeze five are necessary.

The whole arrangement was designed by Mr. G. C. Trewby, M.Inst.C.E., the Chief Engineer of the Beckton Gas-Works. The engines and exhausters were made by Messrs. B. Donkin and Co., of Bermondsey, London.

GAS MAP OF LONDON.—The amalgamation of the Phoenix and the South Metropolitan Gas Companies having been carried out, Mr. Preston Davies, of 6, Victoria Street, Westminster Abbey, announces that he is prepared to supply maps of London showing the boundaries of the Gas Companies as they are at present.

WEST BROMWICH GAS SUPPLY.—At the last meeting of the West Bromwich Improvement Commissioners, the Gas Committee reported that three months previous notice of the intention of the Commissioners to complete the purchase of the gas undertaking on the 1st of July next was given to the Corporation of Birmingham on the 30th of March.

Water and Sanitary Notes.

THE Metropolitan Water Question has once more come prominently to the front. As we announced a fortnight ago, the delegates of the Vestries were to hold a meeting on Friday last, which meeting duly came off. It was presided over by Mr. E. J. Watherston, who was the convener, and it probably took some people by surprise to find this gentleman arguing in favour of going on with Mr. Cross's Bill. We, who have nothing to say against the measure, leave Mr. Watherston to persuade the Metropolitan Vestries that the scheme propounded in Mr. Cross's Bill is the only just one that could be presented, and the only one the Companies could accept. Perhaps the best defence of Mr. Cross's measure is that which has been recently published by Mr. R. Price Williams, who, in a letter to *The Times*, has shown to demonstration what is the exact value of the Companies undertakings. He puts it on a fair basis, and states that the true measure of their value is "their net earning power." He shows that the net revenue of all the Companies in the year 1878 was £833,180, and that after paying £139,516 out of this for interest on debentures (£3,183,169), there remained £693,664 available for the payment of dividends, at the average rate of seven and three-quarters per cent. on the £8,915,555 of the ordinary stock of the Companies. Mr. Williams goes on to show that the average seven and three-quarters per cent. dividend on £8,915,555 would suffice to pay three and a half per cent. on £19,818,972. The annual net revenue of the Companies is constantly increasing, and must continue to do so; but just as this revenue becomes larger, the available profits for the payment of interest on water stock increase. For instance, for the past year the amount of net revenue available for the payment of dividends on the ordinary stock of the Companies increased to £773,455, and the amount of three and a half per cent. water stock represented by this increased revenue in the first schedule of the Metropolis Water-Works Purchase Bill amounts to £22,098,700. The inference, therefore, is, that the Water Trust has the prospect of making a profit which will be increasing year by year, and in the course of time, it may be, leave on their hands the water-works free from incumbrance.

Such is the prospect which some people think lies before Mr. Cross's Water Trust. We shall not attempt to disturb their speculations, for they are founded on calculations which have been accepted by all the Water Companies, and we may say by all accountants and speculators who are able to judge of the matter. Whether Mr. Cross's proposed Water Trust will ever exist or not, remains a doubtful question. Whoever may be the next Home Secretary, he is certain to be strongly pressed to take up the much vexed question of the Metropolitan Water Supply. Can he do better than at once adopt Mr. Cross's Bill? The Companies are satisfied with it; the Metropolitan Vestries, it would appear, are not altogether dissatisfied; but still a feeling prevails that the measure is not all that could be desired. There is a wish on the part of the Vestries to have further conferences, and eventually to meet Government officials, with whom to consult as to what shall be done in the present complex state of affairs. The Bill, if it should go on, must necessarily be referred to a Select Committee, by whom it will receive a severe examination. It is the evident desire of the Vestries that the Bill should proceed, in order that it may receive this investigation. They are, of course, by no means satisfied with the terms laid down in the scheme; but as they know that they will not obtain better, there is a half disposition to accept them. The idea at present is that another conference shall take place, to which the Metropolitan members shall be invited, so that, if possible, some sort of scheme may be concocted in order to be presented for approval to the Metropolitan constituencies and the Government. In the meantime, it would appear that the Metropolitan Board of Works are about to take up the question. Their success, we think, will be extremely doubtful, unless they choose to adopt Mr. Cross's Bill, or something very much like it. The Water Companies cannot succumb to extraneous agencies. Their value must be properly assessed, and they must have the opportunity of accepting or rejecting the terms offered. The first really reliable valuation of the undertakings has just been made, and is embodied in the present Bill. To this Bill the Companies have given their assent, and nothing that the Board of Works may do can shake the confidence in the soundness of the conclusions come to by the valuers engaged in this matter. Nevertheless, we cannot remonstrate with the Metropolitan Board of Works for making a desperate effort to buy up the water-works. It is a forlorn hope; the more so as it

is coupled with the proposal to introduce a competing supply. Now, upon this latter point we may express a very confident opinion. The Board may buy the water undertakings if they will accept Mr. Cross's terms; but a new water supply will land the Metropolis in such extravagant expenses that the rate-payers will be perfectly horrified. A new supply of water to London from any source at present accessible would cost from eight to ten millions. Add this sum to that which will be required to purchase the water undertakings as they exist, and you have the cost of the old and the new service. How far the Metropolis would be benefited by a new service, and where it shall come from, we leave others to decide. Whether it shall be a supply from the deep chalk wells in the neighbourhood of London, or whether it should be brought from the North, is a matter of no great moment. For our own part, we prefer the deep-well water, for two reasons—first, that its supply would be cheaper; and next, that the water is much pleasanter to drink. The Metropolitan Board of Works are perfectly welcome to do their utmost to secure the control of the Metropolitan Water Supply, but it will never be allowed. Nothing but a Government Commission can be entrusted with the management of the water supply until we have what some are now earnestly seeking for—a complete Municipality for the whole of London.

The annual meeting of the Sheffield Water-Works Company was held on Monday, the 12th inst. It passed off pleasantly, notwithstanding the fact that a section of the Shareholders are not precisely in accord with the directorate on certain points. There is a silly question about charges for baths, which, of course, should be strictly enforced against all consumers; and there is another as to the payment of rates in advance, which it has been decided the Company should always require. On both these questions a little difference of opinion was expressed at the meeting, but very satisfactory explanations were made, and the Directors evidently maintain the confidence of the proprietary. The dividend at present earned by the Sheffield Company is not large, but there is every prospect that their business will grow as trade improves and the town extends.

The accounts of the water undertaking of the Joint Board of the Stockton and Middlesbrough Corporations have just been audited. The Auditor shows what we knew before, that the undertaking cost the Corporations £842,296. Of this sum no less than £37,882 was wasted in expenses which ought not to have been incurred. The large sum for purchase and the amount for prospective profits could not, of course, have been avoided. The Company only obtained their just rights, and if the amount of purchase-money appears large, we can only say that the terms are such as are generally accepted. The undertaking does not appear to be profitable to the Corporations, for it would seem that, notwithstanding that the water-rates have been raised, there is a deficit of £33,652. Precepts have been issued which only brought in £10,000, leaving the Corporations burdened with a deficit of £23,652. Water is still pumped from the Tees, and the Corporations show little disposition to begin the works which would in time afford a better supply than that which is now obtained from the filthy river.

The Corporation of Wolverhampton are luckier. They took over the works of the Water Company in 1868, and last year made a profit of £1850. The accumulated balances of profits have enabled the Corporation to set aside £5000 for a reserve-fund, which will presently be wanted. It seems that the town of Wolverhampton contains 15,145 houses, of which the Corporation supply only 12,047, showing that 3098 houses are dependent on wells. We are unacquainted with the Water Act of the Corporation, but we imagine that it contains a clause which would enable them to close these wells if it could be shown that the water obtained from them was not suitable for domestic use. We hardly think that in Wolverhampton shallow wells can furnish water fit for domestic consumption. The Corporation are liberal in their dealings with the consumers, for they have already reduced the domestic rate from 1s. 6d. to 1s. 3d. in the pound; but the charge for closets is high (10s. each). A further relief will be given to the ratepayers by the gratuitous supply to the Corporation of all waters required for public purposes, causing a reduction of one halfpenny in the pound on improvement rates.

The Corporation of St. Helen's and the Local Board of Whiston are in difficulties about their water supplies. In the first case, the Corporation seem likely soon to run short of water, and they are, consequently, anxious to secure a further supply. Under the advice of Professor Hull, they fixed upon a site for some new works; but the Local Government Board have disapproved of it, and so the Corporation have to look after another source. Whiston is supplied

by the Rainhill Gas and Water Company with water of which the only fault is its excessive hardness (36°). On this account its use is condemned by the Medical Officer of Health and a considerable number of the inhabitants, the latter complaining that it disagrees with them, and is, moreover, expensive when used for laundry work; and this we can easily believe. Water of 36° of hardness would, we think, be likely to induce dyspepsia, and we are not surprised that medical men at Whiston have occasionally to recommend a change of residence for their patients.

We learn from a letter which will be found in another column that it has been decided to adopt Bischof's spongy iron process for the filtration of the water supplied to the city of Antwerp, the result of experiments carried on for several months past having proved satisfactory enough to warrant the trial.

URBAN WATER SUPPLY.

In continuing our notices on this subject, as given in the recent Return made by the Local Government Board, we propose in the present article to consider the Lancashire and Cheshire towns situated in the basin of the Mersey. This river and its feeders receive the drainage from the western watershed of the Pennine chain, where the rainfall is exceedingly heavy, averaging 38 inches; but the drainage area is not large, owing to the comparatively short run of the tributaries and main streams. On the other hand, the population in these areas is enormous, the urban population averaging nearly 900 per square mile. Although the sources of the streams are in millstone grit and mountain limestone, they flow over large tracts of coal measures and new red sandstone, the whole of the lower part of the main stream being on these rocks, some of the chief feeders flowing over small areas of coal measures before they reach the sandstone. The water supply of the Lancashire towns is much more dependent on a few very large systems, each feeding a number of smaller places, than is the case in other parts of the kingdom. In some instances the cost of works has been enormous, and could only have been undertaken by wealthy Corporations. Although, therefore, the number of towns is greater than in the Severn or Went drainage areas, the separate systems are comparatively few in number.

The Mersey is the name given to the united streams of the Goyt and the Etherow after their confluence near Stockport. The former flows northwards and westwards through Cheshire, and the latter southwards and westwards through Lancashire. Both receive water from the Pennine hills. There are three towns on the Goyt and two on the Etherow. New Mills, the largest of the former, is imperfectly supplied by a private Company from springs. Marple, somewhat smaller, is even less well supplied by old wells, but a water scheme is under consideration. Chapel-en-le-Frith is not mentioned in the Return. On the Etherow is Glossop, a large town supplied at present by a Company. Negotiations are in progress to purchase the works, but no account is given of the source or expense. Mottram is much smaller, and has no works.

Stockport, the first town on the Mersey after the confluence of the Goyt and the Etherow, is partly supplied by a private Company, and, as usual in similar cases in the Return, no information whatever is given. The remaining part of the supply is had from the Manchester Corporation. Stockport supplies Cheadle, Heaton Norris, Moseley, and Northenden. Besides part of Stockport, several places on the Mersey between that town and Lymm are supplied from Manchester. These are Ashton, Didsbury, Flixton, Hale, Mossley, Northenden, Partington, and Stretford. Lymm has water from a private Company. Warrington receives 24 gallons per head per day, drawn partly from wells and partly from a gathering-ground. The works are managed by a private Company. The cost of the works, including those not yet completed, will be equivalent to about £6 per head of the population, and the charge is about 7½d. per thousand gallons. Widnes appears to use (or waste) as much as 65 gallons of water per head per day, and even this is found insufficient. The cost of works is nearly £6 per head of the population, and the charge is only 4·8d. per thousand gallons. The water is obtained from wells in the new red sandstone. Runcorn is also supplied by a private Company from wells in the same rock, and no figures are given.

Of the towns on the Cheshire side of the new red sandstone promontory that separates the Mersey from the Dee, Higher and Lower Bebington are supplied by the Wirral Water-Works Company, who pump from the sandstone into a reservoir. Bromborough is also supplied by the same Company to the extent of 5 gallons per head per day, at a cost exceeding 15d.

per thousand gallons, but no account is given of quantity or cost to Bebington. Tranmere has a supply of nearly 33 gallons per head per day from sandstone wells. The supply is nearly constant, but is said to be insufficient, owing to the rapid increase of the population, which is probably larger than is stated. The charge is only 4d. per thousand gallons. Birkenhead receives 27 gallons per head per day supplied intermittently from deep wells, borings, and lodgments in the new red sandstone. The cost of works has been equivalent to nearly £3 per head of the population, and the charge for water averages 5½d. per thousand gallons. Wallasey, now a large place, is supplied in like manner by water from the wells in the new red sandstone to the extent of 54 gallons per head per day, the cost of works having little exceeded £4 per head of the population, and the charge being only 5·8d. per thousand gallons. The supply is constant.

Liverpool, at one time dependent on wells, the water of which, by continuous and exhaustive pumping, has shown clear indications of decreasing in purity, was one of the first of the great northern towns to go out of its district to collect water over a large catchment of rocky surface, and in 1847 the Rivington reservoirs were prepared to collect the rainfall on moors north of Bolton, in the drainage area of one of the tributaries of the Ribble. The noble artificial lakes here constructed are, however, insufficient for the rapidly increasing population, and Parliament is now sought to authorize works to take the waters of the Vyrnwy, an upper tributary of the Severn. The supply averages nearly 23 gallons per head per day. The cost of works does not exceed £4 per head of the population, and the charge is nearly 9d. per thousand gallons. Liverpool supplies the following townships, some of which are in the drainage area of the Ribble:—Allerton, Bootle, cum-Linacre, Garston, Great Crosby, Huyton and Roby, Litherland, Little Woolton, Much Woolton, Prescot, Toxteth Park, Walton-on-the-Hill, Waterloo-with-Seaforth, Wavertree, West Derby. The terms of supply are not stated.

Passing on now to the towns in the drainage areas of the chief tributaries of the Mersey, we take first the Tame. A large catchment area on the millstone grit supplies water collected into reservoirs, and supplied to the following towns in this drainage area:—Ashton-under-Lyne, Stalybridge and Mossley, Hurst, Dukinfield, Audenshaw, and Upper Mill. The total population exceeds 90,000, and there is a constant supply of from 20 to 30 gallons per head per day. The works were purchased from a Company by the joint Local Boards and Corporations of these towns. Stalybridge takes 20 gallons of water per head, and the local cost of works has been about £5 per head of the population. The supply to Ashton-under-Lyne is not stated, but the cost of works has been at the same rate. The charge in Stalybridge is 8½d. per thousand gallons. At Dukinfield, where the cost of works a little exceeds £3 10s. per head, the cost is 8·9d. At Mossley and Hurst, 30 gallons per head are supplied. Upper Mill, though included in the Act with Ashton-under-Lyne and Dukinfield, was not supplied when the Return was made up, the local works not being completed. There are two other towns in the Tame sub-drainage area—Hyde, a large place supplied from springs with 9 gallons of water per head per day; and Hollingworth, a much smaller town, also supplied from springs.

We next come to the sub-drainage area of the Irwell, where the number of towns and the crowding of the population is extreme and unequalled in England. On the upper part of the stream is Bacup, a large town which, we are told, is badly and imperfectly supplied with water. There are reservoirs, but the quantity yielded is not stated. There are also private wells. Oldham obtains its water from the Rivers Medlock and Beal. From 20 to 30 gallons per head per day are supplied under the constant system, at the cost of 7d. per thousand gallons. In addition to its large population, Oldham supplies several townships—namely, the greater part of Chadderton, Crompton, Royton, Failsworth, Lees, and Quickmere. About one-tenth of Chadderton is supplied from Heywood, and Crompton has several local wells. The general works at Oldham have cost £3 10s. per head of the total population, and there are, no doubt, local works of which no account is given, which raise the price of the water in some of the townships. Rochdale is the next town. It is supplied from a large catchment area, the water being collected into reservoirs. The supply is constant, and at the rate of nearly 20 gallons per head per day. The works have been exceedingly costly, averaging more than £8 per head of the population. Castledon, Littleborough, Whitworth, and Wuerdale and Wardle are townships chiefly or entirely supplied by Rochdale. Milnrow is supplied from the same source to the extent of one-third.

Bolton is supplied by a large catchment area, and has several storage reservoirs, which afford sufficient water for a population of 65,000 persons outside the borough limits. The town itself receives 28 gallons per head per day, the charge being 8½d. per thousand gallons. The outside population, including the townships of Astley Bridge, Farnworth, Kearsley, Little Hulton, Turton, Westhoughton, and part of Leigh, appear to receive the same average quantity, but the charge is not stated. In some of them wells are also used, and part of Leigh is supplied from Manchester. The cost of works at Bolton has not exceeded £4 per head of the population supplied. Bury is another large town supplying several smaller townships—namely, Haslingden, Little Lever, Radcliffe, Ramsbottom, Whitefield, and part of Prestwich. The supply is constant, and averages 21½ gallons per head per day. The cost of works is less than £3 per head, and the charge about 6d. per thousand gallons. No information is given as to the charge or quantity in the outside townships.

Manchester and Salford are at present supplied from extensive reservoirs collecting the water from a catchment area in the Pennine hills, but the Corporation of Manchester are authorized to take the waters of Thirlmere, one of the Cumberland Lakes. It supplies, either directly or indirectly, not less than 40 separate townships, besides the city of Manchester, selling water in bulk to nearly half this number. The townships supplied outside those now included in the boroughs of Manchester and Salford are Barton, Eccles, Winton and Morton, Blackley, Bradford, Chorlton-cum-Hardy, Crumpsall, Denton, Didsbury, Droylsden, Flixton, Gorton, Haughton, Levenshulme, Moss Side, Openshaw, Newton Heath, Prestwich (part only), Rusholme, Stretford, Swinton and Pendlebury, Urmston, and Withington. The towns supplied in bulk are Ashley, Ashton-upon-Mersey, Bollington, Dunham Massey, Godley, Hyde, Northenden, Newton, Stockport (part only), Timperley, Werneth. Altrincham, Bowden, and Sale receive their portion through the agency of the North Cheshire Water Company. Manchester takes 51 gallons per head per day at a charge of 6½d. per thousand gallons; Salford 15 gallons, at 6½d.; Atherton and some towns associated with it (Tyldesley and Shakerley), 14 gallons, at 9d.

In the sub-drainage area of the Sankey there are three towns in the district of Makerfield—Ashton, Ince, and Newton—all imperfectly supplied from wells in the new red sandstone. At Ashton, the Return gives 24 gallons per head, but the population is now much greater than at the last census. The charge is 4½d. per thousand gallons. At Ince only 12 gallons are given, at a charge of 8½d.; and at Newton, 5½ gallons, at a charge of 9½d. At St. Helen's, nearly 40 gallons of water per head are supplied from new red sandstone wells, at a charge of 3½d. per thousand gallons. The cost of works was little more than £2 per head of the population.

In the Bollin sub-drainage area Macclesfield is the chief town. Here 18½ gallons per head per day are supplied from a catchment, the works having cost less than 40s. per head of the population, and the charge being 5d. per thousand gallons. Leigh has been already referred to, being supplied from Manchester; and Bolton, Adlington, and Bollington are supplied by local wells, and have no public works. Knutsford is not referred to in the Return.

In the Weaver sub-drainage area there are several moderately large towns, but few are mentioned in the Return, and of none are there complete notices. Crewe has an intermittent supply from new red sandstone wells; Northwich, a constant supply, averaging 3 gallons per head per day from a brook and wells. Tarporley, a similar small supply. At Nantwich there is a reservoir connected with a lake; at Congleton, wells in gravel; at Sandbach, local wells; and the same at Whitchurch and Doddington. Frodsham is not mentioned in the Return.

From this somewhat imperfect account of the water supply of the towns of South Lancashire and part of Cheshire, it will be evident that there are similar or even more marked differences in quantity and charge than those already noticed in the drainage areas of the Ouse and Trent. In some cases this is due to natural and inevitable causes, while in others it would seem to be the result of accident. On the whole the towns are well supplied, and the quality of the water is good, especially where the sources are hillsides, and when the supply is regulated by reservoirs constructed to retain the surplus. On the other hand, the rivers are of little avail, and, being unfit for domestic uses, have been left to be fouled and injured by the various processes of manufacture for which their waters have been utilized. For the most part the water supply is quite independent of the lower part of the streams that flow through the district.

THE METROPOLITAN WATER QUESTION.

THE Vestry delegates, meeting occasionally in the Vestry Hall of St. Martin's-in-the-Fields, under the chairmanship of Mr. E. J. Watherston, have apparently thought it necessary to change their minds in anticipation of the forthcoming change of Ministry. They are looking to a new Parliament and a new Government to give them a new Water Bill, and have consequently revoked their former decision—viz., that it was desirable for Mr. Cross's Bill to be read a second time and sent to a Committee, it being the present opinion of the delegates that the best thing to do with the Bill would be to "throw it in the fire." A month ago the delegates thought that Mr. Cross had made "an honest endeavour" to settle the Water Question, although they deemed the terms of purchase to be excessive. On Friday last, as one gentleman remarked, they met "under altered circumstances," though he did not "wish to talk politics;" and another gentleman declared Mr. Cross had "deceived the ratepayers," though he did not "wish to say it offensively." Despite the appeals of the Chairman and Mr. Beal, the meeting resolved that Mr. Cross's Bill was "entirely objectionable," and it was decided that a memorial should be presented to "the new Home Secretary, praying the Government, when it comes 'into office, to withdraw the Bill.'" One of the delegates thought it was rather awkward to pass such a resolution in the face of one so opposite in its character adopted only a month before; but the meeting considered this little inconsistency unavoidable, and the new resolution was carried. The Chairman voted against the motion, and so we presume did Mr. Beal, as he spoke against it. The votes were nine for the motion and seven against, so it cannot be said that the delegates were unanimous.

The complaint against the Bill was that the terms were unreasonably high, and that the composition of the Water Trust was bad. Of course, the latter is capable of amendment in Committee. The terms are not thus elastic, and if the Vestries object to the price, they may as well call for the withdrawal of the Bill. Mr. Watherston took great pains to show that the terms were not excessive; but his arguments and figures fell on unwilling ears. Mr. Cross himself would have spoken in vain, even with Mr. Edmund J. Smith at his elbow. The delegates had, doubtless, been taking counsel with their Vestries and District Boards, as also with their friends and supporters, with the result that they could only see some very big figures, which they believed represented very extravagant sums of money. One delegate was convinced that the Companies works were dreadfully out of repair, and would require some millions to put them into good working order. Even Mr. Beal overlooked the fact—we presume he had not heard of it—that Mr. Cross employed Colonel Bolton to examine the works of the several Companies, and to report on their condition, so that any outlay requisite to put them into good working condition should be duly allowed for in carrying out the purchase. Mr. Beal also wanted the capital accounts of the Companies to be audited. We always thought that the capital, as well as the revenue of the Companies, was duly scrutinized by the Government Auditor. But Mr. Beal wished to have the Bill sent to a Select Committee, and he trusted to see it come out of the ordeal so thoroughly changed that its own parents should not know it again. The delegates, or a majority of them, refused to believe in the transforming power of Parliament, and desired to have the legislative bantling strangled at once. New brooms sweep clean, and it was expected that the new Government would produce a better Bill than the old. A great many absurd things were said, and the passing of the resolution rejecting the Bill was an equally absurd act, as the Chairman himself very plainly told the meeting, much to the indignation of one gentleman, who contended that the delegates "were not children."

While this little wrangle was going on at St. Martin's, there was another part of the same drama being performed at Spring Gardens, on the opposite side of Trafalgar Square. Revolutionary elements are apt to gather around the Nelson column, so that we need not wonder that some strange proposals were mooted in these quarters. The Metropolitan Board has done too little and attempted too much, in regard to the London Water Question. It has failed to carry out those powers which Parliament has placed in its hands for the benefit of the water consumers of the Metropolis, and it has busied itself with schemes, in opposition to the Water Companies, which have involved a large outlay of public money to no purpose. What the Board is now going to do is more than the Board itself knows at present. Last Friday, Mr. Selway gave notice that at the next meeting of the Board he would move that it be referred to a Committee to consider and

report as to the advisability of the Board applying to Parliament for an Act to improve the water supply of the Metropolis, the Committee to have authority to confer with Her Majesty's Government on the subject. The last clause is specially needful, presuming it is intended to pave the way for payment of costs. The Board knows perfectly well that it has no power to spend money in the promotion of a Water Bill, but it may hope in some way to get over this difficulty by the assistance of the Government. It is possible that the Board will decline to entertain Mr. Selway's proposition; but from the known position and influence of that gentleman at the Board, it is hardly likely that his proposal will be at once rejected.

We have no doubt that the impending change of Government has exercised its effect on the Metropolitan Board as well as on the Vestry delegates. All are hoping to gain favours from the new Government, such as could not be obtained from the old. Disappointment may follow such expectations, but for the present hope prevails. Concerning Mr. Selway's notice of motion, we observe that it is of a most Protean character. It takes every possible shape, as we pass on from one clause to another. At the commencement it speaks of "amending and regulating the existing Water Companies." We presume the law is to be amended, and the Companies are to be regulated; but very possibly Mr. Selway is not correctly reported, for he is not apt to err in his use of language. So far, this points to a Regulation Bill; but, unfortunately, the Board has never yet shown a disposition to carry out the regulations prescribed by the existing Act. The next clause of Mr. Selway's motion speaks of "consolidating" the Companies. This would be very well, if properly done. It would tend to economy, and to improved arrangements. The next clause is totally different, and suggests "the providing of an additional supply of pure water." Certainly Mr. Selway cannot think of reviving the defunct scheme of Sir Joseph Bazalgette, Mr. F. J. Bramwell, and Mr. E. Easton, especially as Sir J. Bazalgette declared the other day, when it was proposed to bring sea water to London, that there was no room for any more pipes under the streets of the Metropolis—not even at the West-end. Finally, Mr. Selway speaks of "any other means." Thus he would have the Board meddle with the Water Question in some way or other, though it will be seen he does not propose that the Board shall give its support to Mr. Cross's Bill.

Mr. Selway proposes a conference with the Government. The Vestry delegates, after passing the resolution rejecting Mr. Cross's Bill, decided on meeting at a future date and inviting the Metropolitan members of Parliament to join them in a conference on the Water Question. Something momentous ought to arise out of all this consultation. It is a curious comment on the system of local government in the Metropolis, that after the Vestries and District Boards have elected the members of the Metropolitan Board, they should likewise elect delegates to represent them at a voluntary council. The meeting at St. Martin's-in-the-Fields is—or ought to be—superfluous. We might say it is schismatic. Perhaps we might term it unconstitutional. Happily it has no taxing powers, except that the members may tax themselves to pay the cost of the meetings, the Vestries being pretty generally awake to the fact that they have no right to spend public money on delegates. But, in the absence of all other powers, the delegates have the power of speech, and if they are not altogether Demosthenic in their utterances, they are at least earnest in their efforts to "let the Companies know what they mean." Among other things, the delegates are going to ask that benevolent body, "the new Government," to bring in "a short Bill" to "bar the Water Companies from any increased compensation on account of the new valuation about to be made of the property of the Metropolis." According to the discussion which led to this resolution, the real meaning of the delegates would appear to be that the Companies should not be allowed to charge for the water supply according to the annual value shown by the new assessment. A Government which could entertain such a proposal must not only be less regardful of what are called "vested interests" than British Governments are wont to be, but must also have a supreme contempt for parliamentary enactments. The law provides that the Companies shall charge for the water supply in accordance with the annual value of the premises supplied. The delegates would have the law summarily altered, so that in future the Companies shall not charge on the annual value, but on something less. Speaking mildly, we may say there is in this proposal a lack of propriety which puts it utterly out of court. Yet how can we censure a Vestry delegate for proposing the very same thing which a noble Earl stood up and advocated in the

House of Lords? Nothing seems too revolutionary for some people—peers or commoners—when it is desired to coerce a Water Company.

As to the "increased compensation" of which the delegates are afraid, that is inevitable if London is to grow and the new buildings are to be supplied with water by the Companies. The customers are fast increasing, the revenue is growing, the dividends are advancing towards their statutory limit in those cases where it has not yet been reached, and the property of the Companies is yearly augmenting in value. For this reason Mr. Watherston and Mr. Beal urged the delegates to be tolerant towards Mr. Cross's Bill. To get the Bill thrown over would be to lose two years. So said the Chairman; but the delegates refused to believe it, or, if they believed it, they thought "the new Government" would put everything right at last. They would not be content unless the Bill brought forward by Mr. Cross was utterly rejected. "I hope," said the mover of the main resolution, addressing the assembled delegates, "you will let the Companies know that there shall be no more speculating on the Stock Exchange at our expense." This is very grand and defiant, but we were not aware that the speculations on the Stock Exchange took any money out of the pockets of the ratepayers, or were likely to do so. The terms of purchase in the Government Water Bill were framed without any reference to the price of shares on the Stock Exchange, and in this way Mr. Cross's oft-quoted promise to the House of Commons last year was fulfilled in the spirit, though not in the letter.

The estimate of value may be handled in various ways; but Mr. R. Price Williams, in a statement addressed to Mr. Watherston, gives figures to show that if the London Water Companies were at once to charge their full statutory rates, their net income would be directly raised from £773,454 to £1,035,534 per annum—an amount sufficient to pay interest on £29,655,710 of three and a half per cent. stock, which is of itself rather more than the price to be paid according to the terms of Mr. Cross's Bill. Beyond this we have to consider the annual increase, which is an important element in the value. Of course, attempts are made to depreciate the value of the undertakings, one argument being that the present supply is impure, necessitating the introduction of another at great cost, rendering the existing works partly useless. But repeated inquiries by Royal Commissions and Parliamentary Committees have shown that the water supply of London is substantially and practically good. If the ratepayers wish to protect their pockets, they will be on their guard against the notion of a "competing scheme." No project of the kind is likely to be adopted, and the only result of bringing it forward will be to occasion delay in the settlement of the main question. The terms on which the Companies have offered to surrender their undertakings may appear high, yet it cannot be shown that the ratepayers will be losers by accepting the terms. The only objection against the Bill is that the Companies will be large gainers by the transaction. Supposing the Bill rejected, all we can see at present is that the transfer of the water-works to a public authority will be indefinitely postponed, and the ultimate cost to the ratepayers will be increased. One passage in Mr. Watherston's statement to the delegates will scarcely fail of being verified by the course of events. It runs thus: "After taking professional advice, I am more than ever persuaded that the terms of the Bill are such as will be of advantage to the public, and that they are the best which can be hoped for under the circumstances of the case." No one has yet shown that the terms of purchase will not be "of advantage to the public;" but the overthrow of the scheme is proposed because the "advantage to the Companies" is thought to be excessive. The impatience which refuses even to let the Bill go before a Select Committee, betrays the vehemence of prejudice rather than the exercise of sound judgment.

SMETHWICK LOCAL BOARD GAS SUPPLY.—At the meeting of the Smethwick Local Board last week, the Clerk read the correspondence which had passed between the Town Clerk of Birmingham and himself relative to the transfer of the gas supply in Smethwick to the Local Board. In one of his letters Mr. Hayes stated that, as the appeal before the Lords Justices in the West Bromwich case had been decided against the Corporation, the Gas Committee did not propose to carry the litigation further. Mr. Hayes added that, in order to save further expense, the Committee would be glad to meet the representatives of the several purchasing Authorities, and endeavour to arrange the terms for the transfer of the gas supply in their several districts. The Clerk said that he had written to Mr. Hayes, asking to be informed the price required by the Corporation for the gas supply of Smethwick, and had received a letter in reply stating that his communication would be laid before the next meeting of the Gas Committee. The Board thereupon instructed the Clerk to write to their Gas Engineer, asking whether it was possible to have the gas-works completed by the end of September next, so that the Board may at that period commence to manufacture the gas required in the district.

LIGHTNING CONDUCTORS.*

This treatise is the most comprehensive and practical work which has yet been published on the protection of edifices from the effects of lightning, and it may be considered as exhausting the subject, so far as the present state of knowledge extends. Its bulk—over 250 octavo pages—would surprise any one who might imagine, as too many appear to do in this country, that the protection of any building from damage during the heaviest thunderstorm may be assured by simply fixing a metallic rod to its highest point, and bringing the end down to the ground. The most cursory inspection of Mr. Anderson's work would convince such persons that the question cannot be so easily settled, and a deeper perusal, while increasing one's appreciation of the many points of difficulty which dearly-bought experience has in many instances forced to the front, also tends to impress on any one who is responsible for the design or safe custody of a large edifice, the absolute necessity that exists for the most complete possible provision for the avoidance of destruction like that which has been caused by lightning in the past, and may be caused again at any moment by the same agency.

Commencing with a voluminous history of lightning conductors, for the better comprehension of which a brief statement of the nature and effects of electrical discharges in general is included, the early experiments of Franklin are described, and the honour which he thereby received from the scientific world of his day is recorded. Yet, as we are told, the world in general was remarkably slow to profit by his greatest discovery, that lightning, the dreaded power which so often reduced the proudest edifices of man to dust and ashes, could be led tamely and harmlessly to earth by a suitably arranged metallic rod. The eventual spread of the Franklin rods, as they were frequently termed, over Europe, and especially over America, is described in readable terms, though with an approach to prolixity which renders one somewhat impatient to reach that portion of the volume which more nearly concerns the practical necessities of the present day. Mr. Anderson, however, evidently loves his subject, and has so scattered his remarks over the whole course of his narrative, that a valuable comment is sometimes to be found among a mass of accompanying historical or biographical matter.

From a long list of trials and failures, Mr. Anderson draws the chief recommendations respecting the materials, proportions, and arrangement of lightning conductors, which it is the main object of his treatise to elucidate and enforce. After much discussion of the relative advantages of all kinds of metals in common use, he is led to prefer copper, in the form of bands or wire rope, but more especially the latter, as the most effectual and cheapest in the end. Citing Mr. R. S. Newall, F.R.S., as his chief authority for the most approved examples in modern practice, he states that copper wire rope, $\frac{5}{8}$ -inch in diameter, is the best material for the conducting-rod, which should not be insulated from the building, but, on the contrary, should be connected with any masses of metal occurring in its construction. Every principal gable or turret of a large building should be provided with a rod of this description, terminating at the top in a finial having several points, and at the bottom, or earth connection, every such conductor must be in absolutely perfect contact with the subsoil water, through the intervention of a special anchorage sunk deep in the soil, or by means of the water or gas pipes, which in every large town would make a good earth terminal. Such is, in brief, the gist of the advice which Mr. Anderson has to offer. He insists on the absolute necessity of a good earth connection, without which, as he says, a building provided with the best conductors is worse off than if it had none. And when everything has been done that can be suggested in the appointment of lightning conductors, he asserts that they may, after all, be seriously misleading in the sense of the security which they confer, unless they are thoroughly and periodically tested. After having been long in position, the conducting power of the best apparatus may become much impaired by decay or accidental injury, frequently to the earth terminal, and, therefore, probably unperceived until after irreparable damage has been done.

Some of Mr. Anderson's remarks have special interest for gas and water works managers, irrespective of the general application of his warnings to them as to other custodians of important structures. The utilization of the gas and water mains as earth terminals for lightning conductors is a matter upon which the proprietors of those articles may reasonably ask their professional advisers for an opinion, and upon which the latter need be well informed, since it is improbable that any application of the kind would be permitted if any danger might, however remotely, be expected to arise therefrom. Mr. Anderson is only able to cite a single instance in which a water-pipe was damaged by lightning, and even in that case, which is given on the authority of Father Secchi as having occurred at Alatri in 1872, the main was not actually in contact with the conductor; but the earth terminal of the latter was at no great distance from it, so that a flash of extraordinary power, failing to find sufficient connection at the proper place, leaped across the intervening space to the water-pipe, cutting in its passage a trench nearly 11 yards long and 28 inches deep, and broke the pipe which it first struck, melted the lead caulking of the next joint, and showed traces of its action at both ends of the line of main. Father Secchi, however, does not ascribe this violent action to the mere passage of the electrical discharge, but considers that the interruption which it encountered, and the resistance offered by the earth, were sufficient to develop heat enough to raise the water which was actually in contact with it into steam at extremely high pressure, which consequently exploded with extraordinary energy. Had the conductor been originally in contact

with the pipe, the charge would probably have been dissipated quietly and harmlessly. In this case, however, the pipe appears to have been buried at no great depth in soil which had become very dry after a hot summer. In this country, as in France and America, street-mains are in general so deeply laid that they are mostly, at some parts at least, in earth which is always sufficiently damp to fulfil the requirements of a good terminal, and no risk is to be dreaded from conducting by their agency the most violent discharges of electricity to earth.

The presence in buildings of large quantities of metal tubing for gas and water is also liable to cause abnormal electrical states which might lead to disastrous results, unless such piping is in all cases connected with the lightning conductors. This is a point that deserves attention, for instances have been recorded where a discharge of electricity has taken place between an insufficient conductor and the nearest gas-pipe, which has consequently been perforated and the gas ignited.

The structures commonly found in gas-works are, by the nature of their construction, generally sufficiently protected from much risk of damage by lightning. Gas-holders, and buildings with iron roofs, connected, by rain-water and other metallic piping, with the moist subsoil or the underlying network of mains, are cases in point, although all buildings, and particularly chimneys, should be specially provided with good lightning conductors.

The reality of the danger and its general imminence may be easily appreciated by referring to the statistics of life and property destroyed by lightning which are given by Mr. Anderson, who specially describes over 300 cases. This list might be almost indefinitely extended if it were necessary, but we have probably said enough to induce any one wishing for full information on this important subject to consult the comprehensive treatise under notice.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

SPENCE'S METALLIC COMPOUND AND ITS USE FOR PIPE-JOINTS.

SIR,—From the correspondence in your columns on the so-called Spence's metal, it appears that this compound is generally considered to be a new invention. This is, however, by no means the case, an identical substance having been invented and patented under the name of "ferreine" in 1856.

B. F. Ortet, the original patentee, says in his specification: "My invention consists in treating iron pyrites either alone or in combination with iron ore, or sulphur, or products containing sulphur, by which I produce a substance which I call ferreine, which is susceptible of being moulded."

The method of manufacture is ingenious, and might possibly be employed to utilize the sulphur concentrated in the purification of gas. He describes it as follows:—"I employ two boilers of a given capacity, connected by a tube adapted to their lids. In one of these boilers I place yellow iron pyrites, or other product containing sulphur, such as the sulphurets, but by preference the natural sulphuret of iron, on account of its abundance at a cheap price. In the second boiler I place powdered iron pyrites or iron ore. The fire under the first boiler being lighted, the pyrites is melted, and the sulphur (about 15 per cent.), given off under the influence of heat, distils over to the second boiler, heated to a low temperature, by means of which the sulphur combines with the iron ore in the second boiler, and produces a bi-sulphuret of iron, which I term ferreine."

By another method the patentee produces the same substance by adding sulphur to the pyrites; and it will be seen, on referring to Spence's specification, that the substance now usually associated with his name is essentially the same as Ortet's ferreine, although, of course, this substance may have been re-discovered without knowledge of Ortet's invention. However, as ferreine has now been known 24 years, and the inventor mentions its use for pipes, it is highly probable that it possesses some defect, or it would not have been so completely forgotten.

Brixton, April 12, 1880.

W. F. REID.

THE BRAY LANTERN AND BURNER, AND MR. SUGG.

SIR,—I have to ask your permission to make a few remarks concerning Mr. Sugg's defence, in your last issue, against the charge that he is infringing my first lamp patent, No. 1454 of 1879, and imitating my large slit-union burners used therein. Mr. Sugg's defence is that the burners he used were patented by him in 1874, No. 4277 (or 4227?). That means that he was then familiar with, and supplied slit-unions under that patent of, say, 40, 60, 80, and 100 candle power. The fact is, the slit-union (or hollow-top) is never mentioned in that patent, and is not shown in the drawings. But the gas world knows well that before January, 1879, when I first made them, slit-union burners of such power had never been heard of; and Mr. Sugg, having now begun to supply them, is imitating my burners—that is, following my lead—the same as I should be imitating his enlarged Argands if I were now to begin to make them.

Regarding my lantern, Mr. Sugg's defence is ambiguous; but among other things he says "that if he (the writer) will search in the records of the Patent Office under date Jan. 27, 1879, he will find his invention anticipated by me." Why is the number of the patent not given? The most striking features in my invention are the steadiness and brilliancy of the flames. These effects are produced by causing a column of air to pass up the centre of the lantern, at a suitable speed for the purpose, and placing therein flat-flames, "singly, doubly, or in clusters." The lantern Mr. Sugg has produced carries out my principles, and, what is more, by means of a lantern (not the simple form I now use), the parts of which are all to be found in my first patent. But this is the invention which Mr. Sugg says his patent anticipates. If it did, it is strange that I have been allowed to go on infringing his rights

* "Lightning Conductors: Their History, Nature, and Mode of Application." By Richard Anderson, F.C.S., F.G.S., Member of the Society of Telegraph Engineers. London: E. and F. N. Spon.

till now; and equally so that he has waited till I have made a success of it, even against his Argand, before putting in an appearance with it. The claim is an absolute myth. Your readers will be astounded to learn that Mr. Sugg has no lamp patent at the date given, nor could I find one, though I looked carefully through the whole of January and February; and further search leads me to the conclusion that he has taken out no such patent during the remainder of that year.

I have now finished with this subject, so far as your columns are concerned, and will only add, for the information of those interested in the subject, that I shall promptly resist any infringement of my patent rights.

Blackman Lane, Leeds, April 17, 1880.

GEO. BRAY.

SPONGY IRON FOR FILTERING THE WATER SUPPLY OF TOWNS.

SIR,—The question of Water Supply being now of such general interest, will you allow us to state in the JOURNAL that we have recently proved the practicability of using "spongy iron" for the purification of water by water-works? This you will see from the following letter addressed to the inventor of the spongy iron process:—

"3, Whitehall Place, London, S.W., April 7, 1880.

"Gustave Bischof, Esq.,

"Dear Sir,—We see no objection to your announcing, in any way you please, that the results of experiments on a considerable scale for several months have proved so satisfactory that we have decided on adopting spongy iron for the Antwerp Water-Works, which are now in course of construction.—We remain, yours truly,

(Signed)

"EASTON AND ANDERSON."

With reference to the purification of water by filtration through spongy iron, we need only refer to a few of the official statements made on the subject. In the Sixth Report of the Rivers Pollution Commission, p. 221, we read: "Under the influence of this material, Thames Water assumes the chemical character of a deep-well water." From the Army Medical Report for 1877 we extract: "This is a very powerful filtering substance. . . . The water filtered shows no tendency to favour the growth of low forms of life, and may be stored with impunity; water may also be left in contact with the medium for an indefinite period without undergoing any deterioration" (p. 171).

THE SPONGY IRON WATER PURIFYING COMPANY.

505, Oxford Street, W., April 9, 1880.

THE MANUFACTURE OF SULPHATE OF AMMONIA.

SIR,—The letter of your correspondent, Mr. G. E. Stevenson, the Engineer and Manager of the Peterborough Gas-Works, published in your last issue, would have passed unnoticed by me but for the concluding paragraph, in which I am charged, by implication, with failing to provide for the safety of the workmen under my control, and neglecting the adoption of such apparatus and methods of working as will best combine practical efficiency and financial economy.

The "saturator" employed at the Chesterfield Gas-Works is not an "open" saturator, as described by your correspondent, but a closed one; and, furthermore, it is connected by a large flue with a chimney exceeding 100 feet in height, and far away from the scene of operations. The minimum vacuum on the apparatus, caused by the draught in the chimney, is $\frac{1}{4}$ -inch of water gauge, which is capable of removing all traces of gases liberated during the operation of manufacturing sulphate of ammonia. The only time atmospheric air is admitted into the apparatus is when the sliding shutter is opened to effect the removal of the salt. This is but for a short period, and the aperture being a small one, no "noxious fumes can make their exit from the saturator" against the pull of a $\frac{3}{4}$ -inch vacuum. To those practically acquainted with sulphate-making on this system it is known that the "noxious fumes" are given off in the early stage of the process, and not when the salt is formed. For the purpose of adding the sulphuric acid, no necessity whatever exists for opening the saturator, and instead of the cover, or the top of it, "being removable and not sealed down," as erroneously stated by your correspondent, who says "it must be open," it is a fixture, with the flue before mentioned attached thereto; the sliding shutter being on the side of the vessel, and not on the top. The sulphuric acid can be added by means of a covered feed-tank and a pipe, by simply turning a tap and allowing the fluid to run into the saturator in such quantities as may be required. By neglecting his duty, and throwing the apparatus open, the unfortunate man Kelly, contrary to orders and to practice, chose to violate the rules of the establishment by pouring 3 cwt. of concentrated sulphuric acid into the mass of boiling ammoniacal liquor, and had partly succeeded in adding the contents of a third carboy, when the carbonic acid gas was evolved in such quantity that the flue could not remove it as fast as it was given off, and the result was suffocation.

This description of apparatus was never designed to cope with such an exceptional volume of CO₂ with the sliding shutters open, any more than locomotive engines are intended to cross rivers without the aid of bridges. Had, however, the aperture been closed, or the acid added *via* the feed-tank and pipe, all the gas would have been at once swept away into the chimney, and there decomposed by heat. But these unfortunate men did not use the feed-tank specially provided for their safety; but, guided no doubt by Kelly, preferred to court danger even unto death in the manner described.

The value of the statements of Mr. G. E. Stevenson can be appreciated by readers of the JOURNAL by referring to the loose diction of the first paragraph. For instance, we are informed that "doubtless the apparatus in use at these works is complete and perfect of its kind," and immediately after your correspondent desires to point out that "the apparatus is defective." If his statement that the evaporating system is the best be simply his opinion, we can accept the same at its true value; but if, on the other hand, it is meant to convey the conviction that it is really the best system that can be adopted, I for one emphatically contradict the assertion, and say it is not.

Your correspondent confidently informs us that he has adopted the Coffey still at Peterborough, and he also mentions two other places where it is in operation. It may surprise him to learn that this system has been in use for some 40 years, and is by no means new. In the year 1841 the application of Mr. Coffey's still, with a few modifications to

adapt it to the distillation of "gas water," was patented, and it does not even now appear to be universally in favour amongst sulphate of ammonia manufacturers. I myself had experience with the Coffey still 13 years ago, and am familiar with its advantages and disadvantages; and, for "practical efficiency and economy," I prefer the system which your correspondent condemns.

After the inquest upon, and interment of these unfortunate men, with a view of demonstrating that the apparatus was in perfect order, and not at fault, I donned some old clothing, and took up the manufacture from the point where it was left by the deceased "brewer," Patrick Kelly. With the same materials as he had at his command, I produced sulphate of ammonia of excellent quality, and extracted all the free and fixed ammonia out of the liquor. The following day I "brewed" again with great success, obtaining the maximum quantity of salt, and the apparatus has been in daily operation ever since, without any structural or other alteration, and no accident has happened, or can happen, if only the commonest care is exercised. This is, I think, as much as can be claimed for the Coffey still and evaporative process.

By those who know me personally, I doubt not I shall be readily acquitted of the serious charge of indifference to the welfare of my workmen, or of failing "to provide for their safety;" and with regard to the "efficiency and financial economy" of my management, let the working results, and the dividends of the Company for the last few years, answer.

Of the Ipswich accident I shall not attempt to speak, having no personal knowledge of the circumstances. I, therefore, leave your correspondent to Mr. Goddard, if that gentleman should think the "foeman worthy of his steel."

CHARLES EDWIN JONES.

Chesterfield Water-Works and Gaslight Company,
April 16, 1880.

SIR,—As a Manufacturing Chemist, and also a witness in the shocking accident at the Chesterfield Gas-Works on the 22nd ult., I desire to remind Mr. G. E. Stevenson that I very fully described to the jury the apparatus in use, and he will find that I stated there was a flue erected upon the top, to carry away the gases to the chimney or flue. This flue is always under partial vacuum, which I can say, from personal inspection, is a very strong one.

The Coffey still mentioned by Mr. Stevenson was introduced 40 years ago, and I cannot subscribe to his doctrine that the evaporating system (spoken of by Brande prior to 1836) or the Coffey still is preferable to the one now in use at Chesterfield.

Having had the honour of Mr. Jones's acquaintance for some years, I am satisfied that if any engineer of gas-works has the interests of his employes at heart, it is Mr. Jones; and I regret the tone of your correspondent's letter. The uniform excellent quality of sulphate produced at the Chesterfield Gas-Works is quite sufficient evidence of the Engineer's intimate knowledge of chemistry, and his care and caution in the *modus operandi* is too well known in Chesterfield to be questioned.

EDWARD J. OLIVER.

The Sheffield Chemical Company, Attercliffe, Sheffield,
April 16, 1880.

A COUNTRY MANAGER writes as follows:—"Sir,—Some years ago I purchased from a Company a small gas-works erected for the purpose of supplying a village situated in two counties, a river dividing one from the other. I am now in this difficulty: There is over the river a bridge on which is laid the gas-main, and this bridge is about to be removed to make room for a new structure. During the erection of it, a temporary bridge is to be thrown across; and, of course, I must divert the main for the time, and carry it across the temporary bridge or otherwise. Now, I should be glad to know if I can come upon any one for the expense of doing this, or how I ought to act. I have seen the contractor, and he says that in his estimate he has not made any provision for things of this sort; and that, as the top of the bridge is to be built in solid concrete, he does not think the surveyor will allow me to put the main on the bridge again at all. I think permission was obtained from the Highway Board before laying the mains; but I am not quite sure on what conditions the work was done."

[Perhaps some of our readers can cite cases, to a certain extent, similar to the one above described; and state their mode of proceeding.

—ED. J. G. L.]

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

THURSDAY, APRIL 15.

(Before Vice-Chancellor MALINS.)

BUENOS AYRES GAS COMPANY AND BOWER v. WILDE.

In this case, which has been standing over for some time, partly on account of the general election,

Mr. HIGGINS, Q.C., said he had to move for an injunction to restrain the defendant, Mr. Wilde, from issuing a certain advertisement which had appeared in the daily newspapers, and more conspicuously as a page advertisement in the JOURNAL OF GAS LIGHTING, where it was headed "Caution," and warned the public and investors in gas shares that the property of the Buenos Ayres Gas Company was not liable to make good the debentures of the Buenos Ayres Gas Company, Limited, a further issue of which had been announced by the plaintiff Company. He (Mr. Higgins) stated that the limited Company which he represented was formed on April 30, 1875, and it was not only a *bona fide* Company, but a very important one.

The VICE-CHANCELLOR asked if it was carrying on business.

Mr. HIGGINS replied that certainly it was, and lighting the city of Buenos Ayres to a considerable extent.

The VICE-CHANCELLOR further asked if it was making profits.

Mr. HIGGINS said he believed so. There was no question of that sort raised; it was a perfectly *bona fide* and important Company, which had been registered for five years under the name it now bore. The defendant was agent in England of a Buenos Ayres Company with a Spanish name, which had been in business longer than the plaintiff Company, but had never been registered. It was a rival Company in Buenos Ayres, and was no doubt also a respectable Company. He did not desire

to say anything against it on that ground. They said they were known colloquially in England as the Buenos Ayres Gas Company, which might be the case, but they were never known as the Buenos Ayres Gas Company, Limited. Before the case came into court the plaintiffs were willing to do anything to avoid litigation, and would have been willing even to change their own name if they could have done so safely; but it was found that if they altered their name here it would create difficulties in Buenos Ayres, where it would be supposed that they had come to an end, or something of this sort. The question was whether the defendant, who was the agent of a rival Company, had a right, when they advertised their debentures, to put a notice into a special journal, stating that the holders of these debentures would have no resort to the assets of the Buenos Ayres Gas Company.

The VICE-CHANCELLOR remarked that the advertisement was in its terms strictly true, he supposed.

Mr. RUSSELL ROBERTS said it was perfectly true. There was no malice unless it could be found in that statement.

Mr. HIGGINS said the truth of it made no difference if it did injury to the plaintiffs. The question was whether the plaintiffs had been damaged, and the evidence showed that the advertisement had prevented them issuing the debentures. The Buenos Ayres Gas Company was not the proper name of the defendant Company.

Mr. ROBERTS said it was the name under which it made contracts in England. Its real name was the Compagnia de Gaz, Buenos Ayres, of which the English name was an exact translation.

Mr. HIGGINS then proceeded to read the statement of claim, which set forth the origin and constitution of the Company. They had 80 miles of mains in Buenos Ayres, and lighted about 3000 out of a total of 5000 gas-lamps. The defendant Wilde carried on business in Liverpool, and was the agent in England of a Company, the name of which seemed to vary in different places, and under different circumstances. It was the oldest of the four Companies which supplied Buenos Ayres with gas, but it was not an English Company, and was not registered as such. The plaintiff Company had power to issue £200,000 of debentures, and wished to issue the remainder of that quantity. Mr. Bower, the plaintiff, held a great many of the debentures, some of which he wished to realize, and he caused an advertisement to be inserted in the JOURNAL OF GAS LIGHTING, offering for sale at par £4000 of the first mortgage debentures. The defendant then issued the advertisement he had before mentioned, occupying a whole page of the JOURNAL, and the statement, although literally true, was calculated to convey an impression contrary to the truth, to injure the sale of the debentures of the plaintiff Company, and also to injure its credit. The learned counsel was about to read the affidavit of the Secretary of the Company verifying the above statements, when

The VICE-CHANCELLOR asked if it was really worth while to continue this advertisement.

Mr. GLASSE, for the defendant, said it had never been continued. The plaintiffs were moving long after it had ceased.

The VICE-CHANCELLOR asked if there was any existing order or undertaking.

Mr. HIGGINS said there was an existing undertaking not to insert any more advertisements until the motion was disposed of.

Mr. GLASSE said he gave this undertaking long ago.

Mr. HIGGINS said if this undertaking were continued until the hearing he should be satisfied.

The VICE-CHANCELLOR said it was a curious advertisement. Company A proposed to sell some shares, and the other Company gave notice that those who bought them would have no claim on Company B. It did not look very good-natured. However, an undertaking had been given not to continue it.

Mr. GLASSE said if he continued his undertaking, the other side ought to undertake not to continue their advertisement.

Mr. HIGGINS said he should do nothing of the sort.

Mr. GLASSE said at any rate there must be the usual undertaking as to damages, and

Mr. HIGGINS acceded to this.

The matter thereupon stood over to the hearing, when the question of costs will be disposed of, unless an arrangement is made in the meantime.

SURREY SESSIONS.—MONDAY, APRIL 12.

(Before Mr. W. HARDMAN, Chairman, and a Bench of Magistrates.)

APPEAL AGAINST A CONVICTION FOR ILLEGAL USE OF GAS.

The case of the *Phoenix Gas Company v. Walter* was set down for hearing this day, on the defendant appealing against a conviction by Mr. Chance at the Lambeth Police Court, who ordered him to pay a fine of £20 for burning gas belonging to complainants without the consent of the Company (see ante, p. 281).

Mr. MANN appeared for the appellant, and Mr. BESLEY with Mr. HORACE AVOY for the respondents.

According to the statement of counsel, supported by the evidence of Mr. Allen and Mr. Jarrett, representing the Company, the appellant took a furnished house at Hethrington Road, Clapham, which respondents supplied with gas. On hearing of the change of tenancy, the Company required a deposit, which the respondent refused to pay, and the supply was consequently cut off. Shortly afterwards they found that he had re-connected his fittings with the Company's pipes, without their knowledge or consent, and consumed more than 7000 feet of gas.

Upon this evidence the Court affirmed the conviction with costs, and ordered immediate payment, with the alternative of a month's imprisonment with hard labour.

SCARBOROUGH WATER SUPPLY.—The Scarborough Town Council, who recently purchased the undertaking of the local Water-Works Company, have of late had under consideration the question of procuring soft water from Harwood Hill, for which the Company obtained an Act in 1878—the same year as the Act authorizing the purchase by the Corporation was passed. It has now been determined not to carry out this scheme, but to sink another deep well, and to pump water from the oolitic measures. The quality of the water is similar to that already supplied to the town. A boring-hole has been put down to the depth of 100 feet, near to Seamer Junction, and the water overflows at the surface of the ground at the rate of 400,000 or 500,000 gallons a day. It is beautifully bright, but is considerably harder than is generally thought desirable in other towns. Machinery capable of elevating a million gallons a day is about to be provided, and a new reservoir on the same level as the existing one at Osgodby Hill, which will supply the greater part of the town, will also be erected. In order to ensure a more efficient supply to the various parts of the South Cliff district, another reservoir will be constructed near the summit of Oliver's Mount. The total cost of these works will be about £20,000, and when completed the water supply in every part of the town will be most ample, and the pressure good throughout. The plans have been prepared, and the alterations are being carried out, under the superintendence of Mr. E. Filliter, the Engineer to the Leeds Corporation Water-Works.

Miscellaneous News.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

The Half-Yearly Ordinary General Meeting of this Company was held at Tottenham, on Saturday, the 10th inst.—Mr. JAMES BRICKWELL in the chair.

The SECRETARY (Mr. J. Randall) read the notice convening the meeting, and the following report of the Directors was taken as read:—

The Directors submit to the Proprietors the report and accounts for the half year ended the 31st of December.

The profit and loss account shows a net profit of £4791 8s. 2d., which enables the Directors to recommend the maximum authorized dividend to be paid—namely, 10 per cent. on the original £5 shares, and 7 per cent. on the new ordinary capital; and after making a further addition of £500 to the reserve-fund, which now stands at £4000, there remains a balance of £790 19s. 2d. to be carried forward.

The works continue to be maintained in very efficient condition.

The large increasing demand for gas necessitates a further considerable outlay for new mains, tenders for which are invited, and an early appeal to the Proprietors will be made to furnish the necessary funds, of which due notice will be given.

The Directors regret to announce that the declining state of Mr. Black's health has compelled him to resign his seat at the Board, and the Directors, considering it to the interest of the Company, immediately filled up the vacancy thus created by the appointment of Mr. James Warren, of Chapel House, Enfield.

Dr.		Revenue Account, for the Half Year ended Dec. 31, 1879.		Cr.	
Coals, including carriage, &c.	£6,184 3 10	Sale of gas—			
Purifying materials and sundries	290 4 5	63,224,100 feet			
Salary of Engineer	250 0 0	at 4s. 3d. per			
Wages, &c., at works	1,243 19 5	1000 feet, less			
Repairs and maintenance of works and plant, less old material sold	3,093 5 10	discounts	£13,369 5 6		
Salaries of Inspectors and Clerk	159 10 0	Public lighting and under contract	1,386 10 0		
Repair and maintenance of mains and service pipes	887 14 9		£14,755 15 6		
Repairing, renewing, and re-fixing meters	152 10 1	Rental of meters	435 11 2		
Lighting and repairing public lamps	306 18 0		£15,191 6 8		
Rent of siding	27 10 0	Residual products—			
Rates and taxes	673 19 7	Coke, less £254			
Directors' allowances	375 0 0	2s. 8d. for labour and cartage			
Salaries of Secretary and Clerks	287 10 0		£1,837 10 1		
Collectors' commission	136 1 4	Breeze	94 7 5		
Stationery and printing	43 12 2	Tar	723 10 11		
General establishment charges and incidentals	152 0 7	Ammonia and liquor, less £103 15s. 4d. for acid	687 17 9		
Auditors	35 0 0		3,543 6 2		
Law charges	2 2 0	Transfer fees	2 12 6		
Interest on deposits for gas	24 3 3				
Bad debts	56 8 5				
Total expenditure	£14,381 4 8				
Balance	4,356 0 8				
	£18,737 5 4				£18,737 5 4

The CHAIRMAN moved, and Mr. J. LIDDLE seconded, the adoption of the report, which was agreed to.

Mr. CORBET WOODALL moved—"That a dividend at the rate of 10 per cent. on the original capital, and at the rate of 7 per cent. on the new ordinary capital, for the half year ending Dec. 31, 1879, as recommended by the Directors in their report, be now declared payable."

This was also agreed to; and the meeting closed with votes of thanks to the Chairman and Directors, the Secretary, and the Manager.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health on the Composition and Quality of the Metropolitan Waters in March, 1880:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitro- gen. — As Ni- trates, &c.	Ammonia.		Hardness (Clark's Scale).	
				Sal- line.	Or- ganic.	Before Boil- ing.	After Boil- ing.
<i>Thames Water Companies.</i>							
Grand Junction	22.04	0.056	0.165	0.001	0.010	16.0	3.8
West Middlesex	21.87	0.056	0.150	0.000	0.008	15.8	3.8
Southwark and Vauxhall	21.24	0.032	0.150	0.000	0.006	16.5	3.3
Chelsea	22.95	0.032	0.150	0.002	0.005	15.8	3.8
Lambeth	23.17	0.025	0.150	0.000	0.007	16.0	3.8
<i>Other Companies.</i>							
Kent	33.19	0.004	0.435	0.000	0.003	21.2	5.6
New River	22.03	0.040	0.150	0.000	0.006	16.0	3.8
East London	23.93	0.028	0.150	0.001	0.006	17.0	3.8

Note.—The amount of oxygen required to oxidize the organic matter, nitrates, &c., is determined by a standard solution of permanganate of potash acting for three hours.

The water was found to be clear and nearly colourless in all cases but the following, when it was slightly turbid—namely, Lambeth Water Company. C. MEYMOTT TROY, M.B.

The following is Dr. Frankland's report on his analyses of the water supplied to London during March:—"Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies, and by the Tottenham Local Board of Health, was—Kent, 1.5; Colne Valley, 1.5; Tottenham, 1.6; New River, 3.4; West Middlesex, 4.2; Chelsea, 4.4; Grand Junction, 4.5; East London, 4.8; Lambeth, 5.3; Southwark, 6.4. The Thames water supplied by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies was of somewhat better quality than in February, but the Southwark Company's water was still unfit for dietetic purposes, being much polluted with organic matter. The best water from the Thames was sent out by the West Middlesex Company, but the great improvement in this Company's water, noticed since the renewal of their filters in November last, has nearly disappeared, and this water is now only slightly better than that of the Chelsea and Grand Junction Companies. All the Thames water was efficiently filtered before delivery. The Lea water, delivered by the New River Company, was of much better quality than any of the Thames waters; but that distributed by the East London Company was inferior to three out of the five Thames waters. Both these Companies sent out efficiently filtered water. The deep-well water supplied by the Kent and Colne Valley Companies, and by the Tottenham Local Board of Health, was of its usual excellent quality for dietetic purposes, and that sent out by the Colne Valley Company was suitable for all

domestic purposes, having been softened before delivery. Seen through a stratum two feet deep, the waters presented the following appearances:—Kent, Colne Valley, and Tottenham, clear and colourless; New River, clear, very pale yellow; East London, Chelsea, West Middlesex, and Grand Junction, clear and pale yellow; Lambeth and Southwark, clear and yellow."

Results of Analyses expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Mat- ters.	Or- ganic Car- bon.	Or- ganic Nitro- gen.	Ammonia.	Nitrogen, as Ni- trates and Nitrites.	Total combined Nitro- gen.	Chlo- rine.	Total Hard- ness.
<i>Inner Circle.</i>								
Thames—								
Chelsea	31.12	.225	.034	0	.239	.275	1.5	19.1
West Middlesex	30.90	.221	.026	0	.257	.283	1.5	20.3
Southwark	30.36	.328	.051	0	.258	.309	1.7	19.7
Grand Junction	29.28	.227	.039	0	.210	.249	1.5	19.1
Lambeth	31.68	.269	.043	0	.228	.271	1.7	20.0
Lea—								
New River	29.40	.174	.031	0	.277	.308	1.6	19.7
East London	35.92	.243	.043	0	.222	.265	1.8	21.4
Deep wells—Kent . . .	40.38	.076	.015	0	.432	.447	2.5	25.1
<i>Outer Circle.</i>								
Colne Valley	15.00	.070	.016	0	.324	.340	1.4	7.1
Tottenham Local Board .	41.00	.078	.019	.094	0	.096	2.9	21.5
Corporation of Birmingham*	26.14	.137	.048	.003	.319	.369	2.0	13.6
Corporation of Glasgow†	2.90	.158	.017	0	.008	.025	0.63	1.2

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.

† Analyzed by Dr. E. J. Mills, F.R.S., of Anderson's College, Glasgow.

Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

The Registrar-General publishes the following table in reference to the water supply of London during March. According to the returns furnished to him by the Metropolitan Water Companies, 136,331,201 gallons, or 619,415 cubic metres of water (equal to about as many *tuns* by measure, *tuns* by weight), were supplied daily; or 235 gallons (106.8 decalitres), rather more than a *ton* by weight, to each house, and 33.2 gallons (15.1 decalitres) to each person, against 32.7 gallons during March, 1879.

COMPANIES.	Number of Houses, &c., supplied in		Aver. Daily Supply of Water in Gallons* during	
	Mar. 1879.	Mar. 1880.	March, 1879.	March, 1880.
Total supply	557,774	579,126	129,561,232	136,331,201
From Thames	263,721	277,326	65,954,316	69,280,779
„ Lea and other Sources	294,053	301,800	63,606,916	67,050,422
THAMES.				
Chelsea	29,562	29,945	8,581,900	8,453,300
West Middlesex	51,771	53,917	10,099,458	10,710,676
Southwark and Vauxhall	82,797	89,188	23,083,273	23,650,294
Grand Junction	38,989	40,825	11,035,985	12,212,109
Lambeth	60,602	63,451	13,151,700	14,254,100
LEA AND OTHER SOURCES.				
New River	127,839	129,792	26,628,000	27,392,000
East London	118,910	122,746	29,343,000	31,551,500
Kent	47,304	49,262	7,635,916	8,106,922

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for March, 1880, as compared with that for the corresponding month of 1879, shows an increase of 21,352 houses, and of 6,769,969 gallons of water supplied daily.

EXHIBITION OF GAS APPARATUS AT LEICESTER.

An interesting exhibition of gas cooking and heating apparatus, held under the auspices of the Corporation of Leicester, who recently undertook the management of the supply of gas and water in the town, was opened to the public on the 12th inst. The exhibition was held in the Floral Hall, the galleries of which were occupied by the numerous exhibits, which were from all the well-known makers of gas-cooking appliances, and were so arranged as to enable visitors to examine the merits of the articles of one exhibitor without attention being diverted by those of his neighbour.

The inaugural ceremony was performed by the Mayor (Mr. J. Bennett), and there was a large attendance of ladies and gentlemen. In his opening remarks, the Mayor said the progress of science, as applied to business and domestic life, had received a wonderful impulse during the past half century, and the result had often been manifest in the saving of labour and the increase of personal convenience. The great principle of the division of labour, which was the motive power in advancing civilization, had been pushed to the front, and, instead of aiming at universal knowledge, men directed their attention to specialities, and to perfection in the minutest points. It was in this spirit that the present exhibition of gas apparatus had been arranged. The Chairmen of the Gas and Water Committees (Mr. Downing and Alderman Paget) and the promoters of the enterprise were convinced that both gas and water might be usefully applied to many more purposes than those for which they had hitherto been generally available, and they thought that this fact could be best brought to the public notice by having a collection of the various appliances connected with this matter in the building in which they were assembled. To make the exhibition successful, and to prove that the appliances were easily available, it would be necessary to show that they could be used with economy. The appeal to the pocket was always a telling argument, and if it could be shown that, by means of gas, joints might be cooked or bread baked in summer time for half the cost of a coal fire, a brisk demand for gas-stoves would be inevitable. Gas was cleaner than a coal fire, which on a hot day in July could most certainly be dispensed with. If manufacturing operations, too, could be carried on by the aid of a gas-engine of from 2 to 3 horse power with greater ease, less room, and less cost than an engine worked by steam, the former would be sure to be adopted. The cheapness of gas depended, however, upon whether the supply was turned off as soon as the demand for it ceased; and therefore all must remember, if they felt inclined to make use of any of the various kinds of cooking apparatus exhibited, that the question of consumption and consequent cheapness depended entirely upon themselves. If suitable arrangements were made, many a workman might be gratified by having a hot instead of a cold dinner, and with the help of the School of Cookery, have his meals comfortably and economi-

cally provided. From a social standpoint, therefore, the promoters of the exhibition might claim for it that it was likely to prove a decided gain. In addition to the gas apparatus there were some ingenious contrivances for pumping and cleansing water. Water was indispensable to life, and its absolute purity was a growing necessity. Water should not be allowed to run to waste, and the various arrangements of water-fittings, taps, &c., exhibited were intended to show the amount of ingenuity that had been displayed in guarding against the needless consumption of water. After experiments had been carefully made as to the respective merits of the different gas-stoves, it was intended to let out on hire to consumers those which were found to be best in principle, so that any persons who during the summer might like to test their efficiency would have an opportunity of doing so.

Mr. DOWNING (the Chairman of the Gas Committee) observed that notwithstanding other towns had preceded Leicester in the matter of exhibitions of gas apparatus, the Gas Committee were exceedingly glad to be in a position now to hold one. They had, however, been waiting for the completion of the new gas-works, which were in successful operation. That gas might be brought into greater use in the future than it had been in the past, everybody would be prepared to admit; and when its cheapness, as compared with coal, for cooking purposes, was considered, he hoped benefit would be derived from the exhibition. The Gas Committee were anxious, now that they possessed large works, to find an outlet for the gas manufactured; but if they could not confidently recommend its use for cooking purposes, and could not say positively that it would effect a saving—especially during the summer—they would certainly have hesitated to institute the exhibition. They, however, had abundant testimony that it would do this, and he hoped those present, and others in the town, would be induced to investigate for themselves the merits of the apparatus, and see if they could not in the future more appropriately use the privileges which the exhibition introduced to them. They were deeply indebted to Mr. Charles S. Robinson—and the town generally were indebted to him—for the assiduity he had displayed and the energy he had devoted to the exhibition, and their thanks were also due to the exhibitors.

Alderman PAGET (the Chairman of the Water Committee) briefly alluded to the share the water department occupied in the exhibition.

Mr. C. S. ROBINSON assured those present that the duties he had discharged in connection with the arrangements for the exhibition had given him very great pleasure indeed. The difficulty had been to act with strict impartiality to all the exhibitors, and if the Exhibition Committee had succeeded in doing this they would be perfectly satisfied. The object of the exhibition was primarily for the advantage of the Corporation gas department, as well as for the benefit of the consumers; but if they only obtained a result in this direction, without at the same time putting something into the pockets of the exhibitors, the Committee would be very much disappointed.

After a few other observations, the MAYOR formally declared the exhibition open, and the company dispersed to inspect the exhibits. Of these, cooking stoves formed by far the larger number. Of course, the most extensive show was made by the well-known makers, such as Messrs. Leoni and Co., Wright and Co., Beverley and Wyld, Billing, Davis and Co., and Siddaway and Sons, all of whose articles were of the quality usually associated with their names, and were exhibited in every variety. Some excellent stoves were, however, shown by makers who are perhaps not so well known. For example, Mr. Williamson, of London, exhibited a few most useful stoves, capable of doing almost every kind of cooking, yet so ingeniously contrived as to allow of their easy conversion into heating apparatus by the substitution of a copper reflector for the roasting appliances. The use of atmospheric burners allows of the maximum heating power being obtained from the gas, while none of the products of combustion are allowed to enter the oven. West Brothers, of Battersea, also had a good collection of apparatus; and so had Hassall and Singleton, of Birmingham, who showed a combined gas and coal stove—the Birmingham range—which possesses much merit as a cooking appliance. Stark and Co., of Torquay, exhibited a stove constructed on a new principle, by which a high temperature may be created and maintained with a small consumption of gas, efficient ventilation being at the same time secured. The waste in cooking with this stove was stated to be very small indeed. The same may be said of an excellent little stove invented by Mr. G. Goldsmith, of Leicester, and exhibited by Messrs. Guest and Chimes, of Rotherham. Here the ingenious arrangement of the stove enables the maximum amount of heat to be utilized, so that, though small, the apparatus is capable of rendering good service in a household. The ironing stoves, too, shown by this firm were designed by Mr. Goldsmith, and are very economical articles, as the consumption is reduced to a minimum by lifting off the iron, which also turns on the gas by being replaced. In our opinion, however, the most attractive display was made by Mr. Bellaers, of Leicester, whose goods had a nicely-finished appearance. He does not aim at anything great, but his "Auckland" cooking stove possesses so much excellence that it gained for him a prize medal at the recent Nottingham exhibition. His cylindrical heating stoves, with white or copper reflectors, are also really useful and well-made articles.

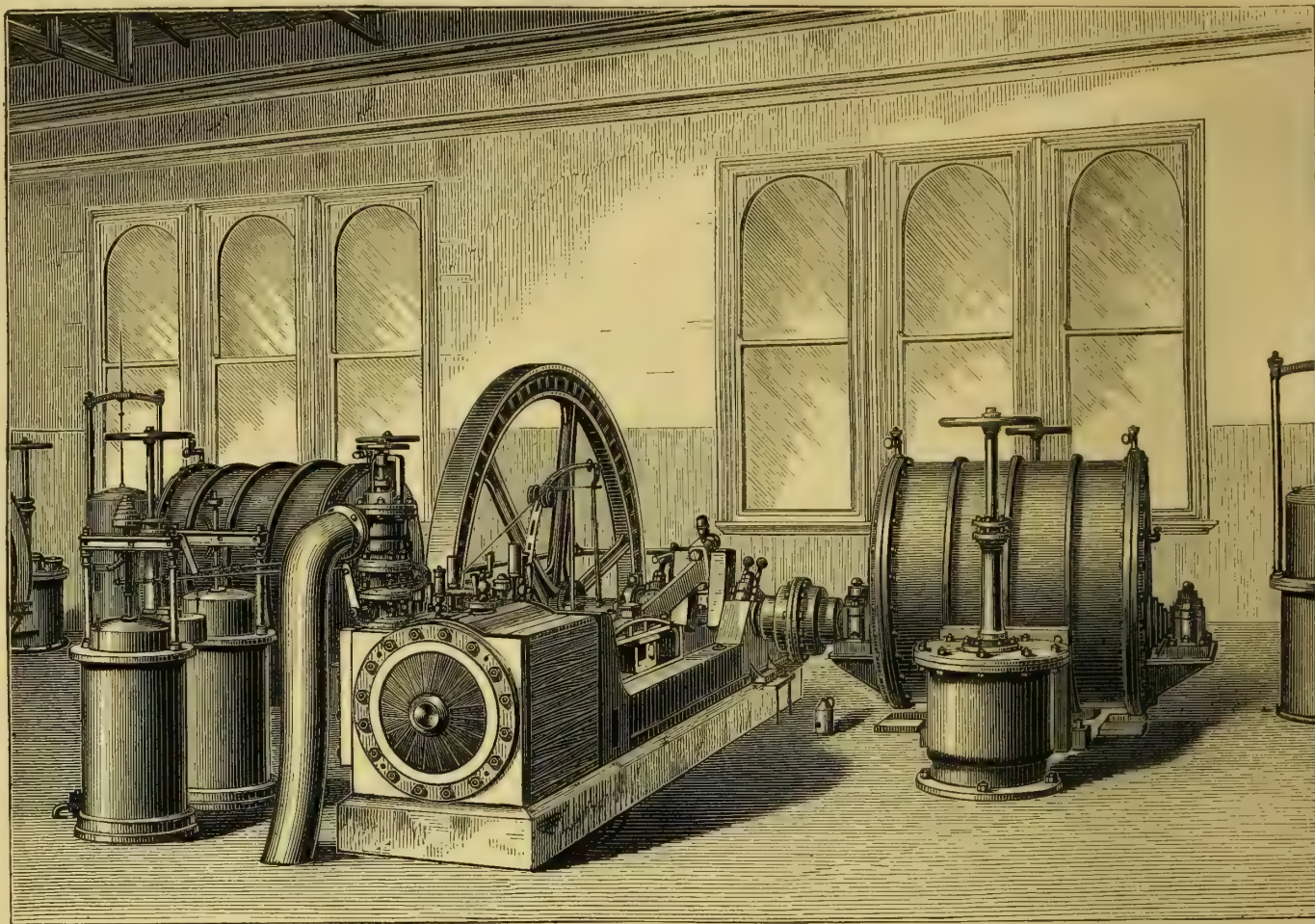
Among the exhibits which had for their object the utilization of gas for other than cooking purposes, those shown by Mr. C. J. Ward, of Nottingham, and Mr. J. Fielding, of Salford (comprising soldering-iron stoves, ironing stoves, dental reflector, gas irons, &c.), may be mentioned; while the instantaneous water heaters and gas baths of Messrs. Ewart and Son, and Siddaway and Sons attracted considerable attention. Messrs. Guest and Chimes showed one of Goldsmith's safety gas-lamps for purifying-houses and other places where explosions are liable to occur when a naked light is burning, and also one of the same gentleman's patent sight water-line indicating gas-meters, a large number of which, we hear, are in very satisfactory operation in Leicester. With these meters one of the unavoidable objections to wet meters is obviated, for the inspector can tell at a glance if water is required, and does not, as is usual, have to add water periodically, even if the meters already have sufficient. It is, therefore, claimed that inspectors' time is saved as well as inconvenience to consumers.

The economic consumption of gas for illuminating purposes was well exemplified by the several varieties of burners on the stands of Mr. W. Sugg, Messrs. G. Bray and Co., Messrs. G. E. Webster and Co., &c., &c.

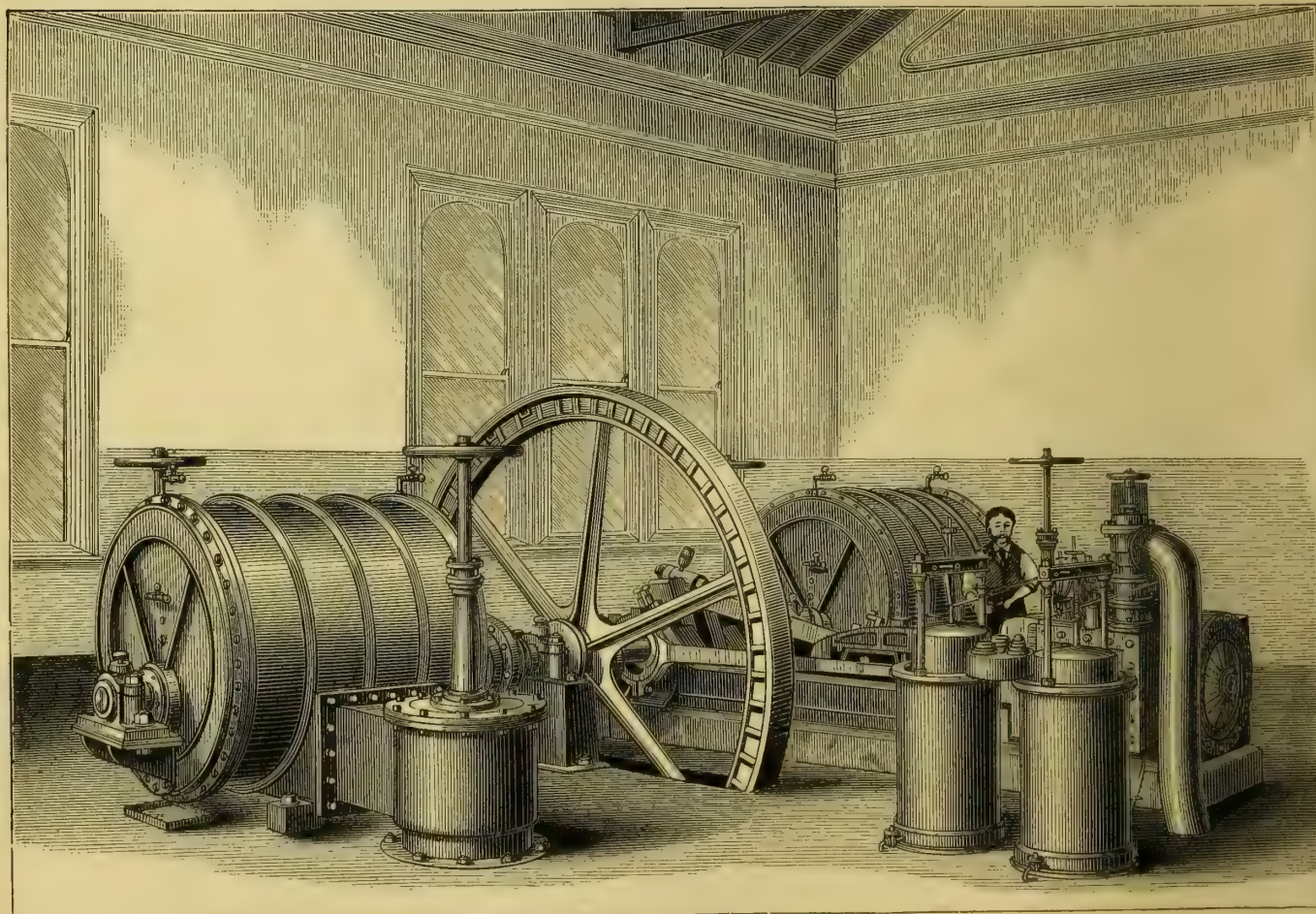
The water fittings forming a part of the exhibition consisted of a good display of cocks and valves, lavatories, waste preventers, and similar articles by well-known makers.

The exhibition would scarcely have been complete if no attempt had been made to show how gas might be used for furnishing motive power as well as heat and light. At one end of the hall, therefore, the visitors had an opportunity of seeing at work three gas-engines—one a 2-horse power patent silent "Otto," shown by Messrs. Crossley Brothers, of Manchester; another, a 2-man power "Bisschop," shown by Mr. J. E. H. Andrew, of Stockport; and the third, a patent balanced vertical gas-engine, exhibited by Messrs. C. Linford and Co., of Leicester. The two former engines are now so widely known, and their respective merits have so well recommended them to the public, that not a word need be said here in their praise. Messrs. Linford's engine, on the other hand, is a comparatively

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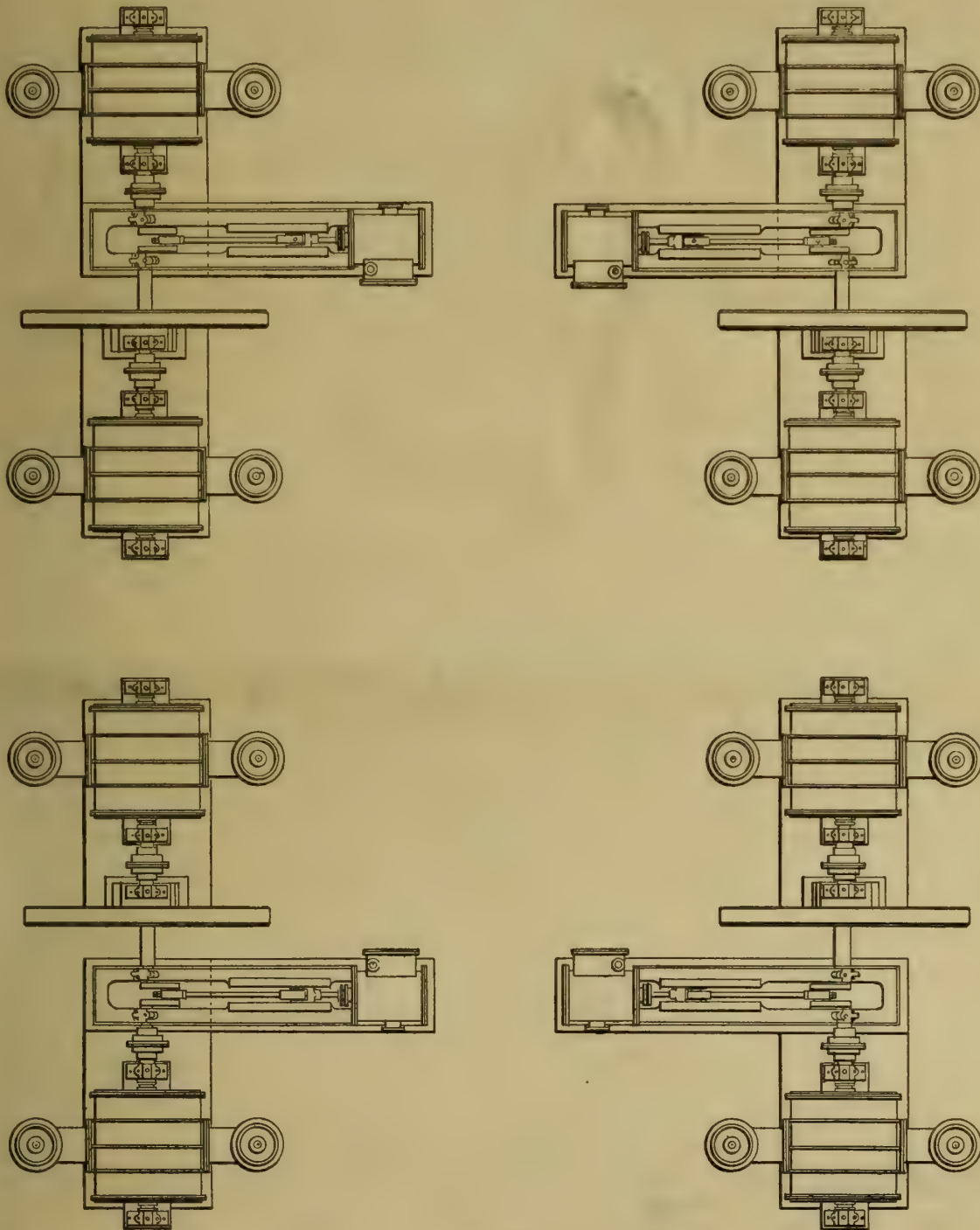


FRONT VIEW OF ENGINE AND EXHAUSTERS.



SIDE VIEW OF ENGINE AND EXHAUSTERS.

APPARATUS FOR PUMPING GAS
 DESIGNED BY Mr. G. C. TREWBY, M. Inst. C.E.; AND MANUFACTURED BY



PLAN SHOWING THE GENERAL ARRANGEMENT OF THE EIGHT 250,000 FEET PER HOUR EXHAUSTERS
AND THE FOUR 40-HORSE POWER NON-CONDENSING STEAM-ENGINES.

FROM BECKTON TO LONDON,
BY Messrs. BRYAN DONKIN & CO., OF BERMONDSEY, LONDON.

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new comer, and as such deserves some attention. It has two pistons in a working cylinder, and the power is applied between the pistons, driving them from each other, and actuating a double crank with a shaft in the centre, each crank arm being half as long as the crank of a single-piston cylinder. The cylinder being open at either end, the pistons may be easily removed for cleaning, there being no covers to take off; there are no stuffing-boxes, or glands in the engine, and no joints to leak. The force on the pistons being balanced, the main shaft bearings are entirely relieved of all the consequent friction, and only the friction from the actual amount of power transmitted remains. The operation of the engine is as follows:—Upon the charge being ready for lighting, a slide-valve which works on one side of the cylinder brings up a light, and ignites the charge, which drives out the pistons, and the power is transmitted by a new and novel arrangement to the cranks, which are arranged to operate in a suitable manner. This form of engine is said to possess several advantages. Great durability is gained by its ease of action, owing to its entire exemption from unequal strains, the main bearings having only the weight of the moving parts to support, and the pressure being uniform, the wear will be equal all round. The engine works quite smoothly, and as regularly as a steam-engine; it is almost noiseless, and possesses the advantage of control of speed, which may be adjusted to a wide range, varying from 120 to 200 revolutions per minute, without any shock or jar to the floor upon which it stands. The design of the engine renders it specially suitable for use where space is an important consideration; and, no foundations being required, a considerable item in the fixing of most engines, which operate upon a diverse principle to this, is altogether dispensed with. The engine shown was a 3-horse power one, having a cylinder 6 inches in diameter with a 14-inch stroke, and the gas consumed did not exceed 50 feet per hour. It is, perhaps, not so pretty—if such a term may be allowed—in appearance as some of the other gas-engines we have seen; however, it is not by this quality that it will be judged, but by its working capacity. It enters the market upon its qualifications for doing its work, and we think it bids fair for public patronage. The inventor claims to be the first in this or any other country who has introduced this novel form of gas-engine, which is the outcome of years of study and labour. The engine is covered by three patents (1878, 1879, and 1880), and we have been informed that at the request of several of the leading townsmen, the makers have consented to call it the "Leicester Gas Motor."

It should be mentioned, in conclusion, that no professional gentleman was appointed to pronounce judicially on the relative merits of the exhibits; but each exhibitor was allowed the privilege of having his goods tested by the Corporation officials, and a certificate was given setting forth their capabilities. This was the plan adopted at the Leeds exhibition last year, and it appears to have given general satisfaction at Leicester, as did the general arrangements of the exhibition, which were, as we have already stated, carried out under the personal superintendence of Mr. Charles S. Robinson, one of the Gas Engineers to the Corporation.

The exhibition remained open during the whole of last week, and was attended by a large number of visitors, especially in the afternoons and evenings; and it is to be regretted that an unfortunate accident which occurred on Wednesday last (through some defective work on the part of an exhibitor, and not from any negligence of the officials), by which a stall attendant, the son of the exhibitor, was rather badly burned about the face, should even for a brief period have marred what we cannot help thinking was an exhibition upon the success of which the Corporation of Leicester and all concerned may fairly be congratulated.

RIO DE JANEIRO GAS COMPANY, LIMITED.

The Fifteenth Annual General Meeting of this Company was held at the Cannon Street Hotel, on Wednesday, the 7th inst.—Mr. BARTLETT JAMES in the chair.

The SECRETARY (Mr. T. Dawson) having read the notice convening the meeting, the following report was presented:—

The Directors, in accordance with the Articles of Association, paid on the 17th of July last an interim dividend of £18,750, on account of the Company's operations up to the 25th of the preceding March, the date of the expiration of the old contract; on the 11th of October last they paid another interim dividend of £18,750, both being free of income-tax, and at the rate of 10 per cent. per annum on the paid-up capital of the Company; and they have now the pleasure of submitting to the Shareholders the annexed statement of accounts for the year ending Dec. 31, 1879, showing a balance at the credit of profit and loss account of £114,101 17s. 10d., reduced by the above mentioned interim dividends, and by the transfer of £3000 to the insurance and contingency fund on the 25th of March last, to £71,601 17s. 10d.

Out of this sum of £71,601 17s. 10d., the Directors recommend that a dividend at the rate of 10 per cent. per annum, also free of income-tax, be paid for the half year ending Dec. 31 last. This will reduce the available balance to £34,101 17s. 10d., which the Directors have disposed of as follows, viz.:—They have placed £50,000, being 2 per cent. on the paid-up capital of the Company, to a new account, called the "amortization-fund," as hereinafter explained; £6000 to the reserve-fund, for equalization of dividends, and £10,000 to the insurance and contingency fund, and have carried forward to the next account the remainder, say £3101 17s. 10d., out of which the income-tax for the past year has been paid.

The necessity for an ample reserve in the "amortization-fund" will be as evident to the Shareholders as it is to their Directors, in view of clause 28 of the new contract. That clause provides that the contract, even after ratification by the Brazilian Legislative Chambers, may be rescinded should the Government decide at the end of 15 years to adopt the electric or any other light. As such rescission could only take place in the event of the electric or some other system of lighting becoming so perfected as to supersede gas either totally or in great part, evidently the value of the Company's plant and works would thereby suffer a serious depreciation, to meet which the Directors wish to set aside annually out of profits 2 per cent. upon the present capital of the Company, to form, with the accruing and accumulating compound interest, a fund sufficient to meet, at all events, a large proportion of the depreciation referred to. And in order that the moneys composing this fund should be entirely exempted from any losses which might arise if they were invested or remained in the Company's business, the Directors propose to invest them, together with their accruing dividends, in undoubted securities, such as Consols or first-class British or Indian railway debenture or guaranteed stocks. Should no such rescission take place at the end of the first 15 years, the amortization-fund can remain available for the expiration of the Company's contract at the end of the term of 33 years, the annual percentage allotted to that fund out of profits being either diminished or discontinued, as may be decided by the then Directors and Shareholders. The Directors would here remind the Shareholders that whether the present contract terminates at the end of 15 or of 33 years, in neither case are the Brazilian Government under any obligation to purchase the works as they were under the old contract.

The Directors call attention to the new mode of stating the Company's assets, which is in conformity with the valuations made by the Government Engineers, such assets having been reduced by £77,264 19s. 6d., which is deducted from the old reserve-fund and insurance and contingency fund; the former being thereby extinguished, and the latter reduced to £43,741 18s. 6d., but afterwards increased to £53,741 18s. 6d. by the addition of £10,000 already referred to, whilst the new reserve-fund for the equalization of dividends stands at £6000.

The expenditure on No. 3 gasholder and new mains having exceeded by £78 16s. 11d. the £150,000 capitalized, such excess has been debited to profit and loss.

The Directors congratulate their fellow-Shareholders upon the favourable results of last year's operations, assisted as they have been by an increased consumption of gas over the preceding year, an improved demand for coke, and the still low prices of coals and rates of freight.

Mr. G. M. Clements, who had kindly consented to join the Board temporarily during an emergency, retired immediately upon that emergency passing away.

Mr. Alexander D. MacGregor is the retiring Director in accordance with the Articles of Association, and, being eligible, offers himself for re-election.

His Excellency Viscount de Mauá, having tendered his resignation, ceased to be a Director, and his colleagues have much pleasure in recording their appreciation of the

very valuable services, both here and in Rio de Janeiro, which he rendered to the Company during the many years that he was on the Board.

Mr. John Hollocombe, a duly registered Shareholder, who resided for many years in Brazil, and is thoroughly acquainted with the language and business of that country, having been invited to become a Director, has accepted the invitation, and already joined the Board. The Directors have also invited to join the Board Mr. William Henry Holman, whose services to the Company have been very valuable ever since its commencement, but more especially as Head Manager, which responsible post he has filled for the last 13 years (and still retains) to the entire satisfaction of the Board, who consider that his usefulness will be much increased by his thus becoming their representative in Rio de Janeiro—a necessary position formerly so ably filled by His Excellency Viscount de Mauá. The Directors still await Mr. Holman's reply.

The Auditor, Mr. Harding (of the firm of Messrs. Harding, Whinney, and Co.), also retires, and offers himself for re-election.

On the 23rd of April last the Directors issued a circular informing the Shareholders that a telegram had been received from Rio de Janeiro, to the effect that an Imperial Decree had been signed approving of the terms of a new contract with this Company; on the 5th of May last they issued another circular, informing them that the contract had been signed with the Imperial Brazilian Government; and on the 4th of June last they sent a third circular, handing a translation of the said contract. During the last session of the Brazilian Legislative Chambers this contract passed successfully through two readings in the Chamber of Deputies, but has yet to pass the third, as also the required three readings, in the Senate, or Upper Chamber, after which it will become law—a consummation which the Directors sincerely hope will be arrived at during the next session. Meanwhile the Company's operations are conducted under the terms and conditions of the new contract.

Dr.—Balance-Sheet, for the Year ending Dec. 31, 1879.

To Capital, 37,500 shares of £20 each, fully paid up	£750,000 0 0
Reserve-fund	£10,000 0 0
Insurance and contingency fund—	
Balance brought forward from Dec. 31, 1878	£106,006 18 0
Amount carried to this fund on March 5 last	5,000 0 0
	111,006 18 0
	£121,006 18 0
Less difference between the value of the assets as they stood in the Company's books on March 25, 1879	£732,705 14 8
And the value per contra according to the Government estimates	655,440 15 2
	77,264 19 6
	£43,741 18 6
Carried to this fund	10,000 0 0
	53,741 18 6
Reserve-fund	6,000 0 0
Amortization-fund	15,000 0 0
Sundry creditors in Rio and London	793 6 9
Dividend warrants still unpaid	808 2 0
Bills payable	2,895 7 2
Profit and loss—	
Balance of profit brought forward from Dec. 31, 1878	£3,297 4 1
Less income-tax for 1878	2,279 12 11
	£1,017 11 2
Net profits for the present year	113,084 6 8
	£114,101 17 10
Deduct, carried to insurance and contingency fund on March 25 last	5,000 0 0
	£109,101 17 10
Deduct, carried to insurance and contingency fund	£10,000 0 0
Ditto, to amortization-fund	15,000 0 0
Ditto, to reserve-fund	6,000 0 0
	31,000 0 0
	78,101 17 10
	£907,340 12 3

Cr.—Balance-Sheet.

By Sundry assets, being value of the Company's property in Rio de Janeiro, according to the valuations made by the Government Engineers, say—	Rs.	dols.
1. On Oct. 25, 1878, fixed plant	5,303,512 104	£396,645 2 3
2. On Nov. 6, 1878, mains and pipes in course of being laid	92,077 020	10,358 13 4
3. On Nov. 6, 1878, stores and necessaries on hand and on the way	628,098 970	70,661 2 8
	6,023,688 094	£677,664 18 3
Less value of stores and necessaries included in item No. 3, but since consumed, viz.:—		
7600 tons of coals	£18,525 0 0	
Shipments afloat	3,699 3 1	
		22,224 3 1
		£655,440 15 2
New works executed by order of the Government under clause 30		699 13 11
Stock of stores, &c., in Rio de Janeiro		44,415 4 1
Coals		12,548 0 0
Gas-fittings		3,932 18 10
Sundry debtors, being gas and coke consumers at Rio		69,472 5 11
Office furniture		134 11 6
Shipments afloat		11,439 4 3
Bills receivable, in hand		55,112 13 2
Cash in London		72,357 12 0
Cash in Rio		1,724 13 0
Interim dividends of July 17 and Oct. 11 last on £750,000		37,500 0 0
		£907,340 12 3

The CHAIRMAN said: Gentlemen, in rising to propose the adoption of the report and balance-sheet, I regret having to refer to the absence of our worthy Chairman, Mr. A. D. MacGregor, who has been prevented from attending to-day by a serious illness. Your Directors have endeavoured to make their report to you as full and as explicit as possible. Nevertheless, I will refer briefly to one or two points which I think will be interesting. In the balance-sheet we have deducted from the original cost of our plant and mains no less a sum than £77,264 19s. 6d. You are aware that previous to the termination of our old contract, the Brazilian Government, under clause 30 of the contract, ordered a valuation to be made of our property. The appraisers named were two Brazilian Engineers who bear the highest character in their own country; and although I have not the pleasure of knowing them personally, I heard, when in Rio, a good report of them from all quarters. They proceeded to the valuation with every care and strictness, and I am convinced they performed their task in a thoroughly conscientious manner. We did not hesitate, therefore, in taking their figures as the real value of our property, and seeing that the plant has now been working for 25 years, their valuation bears out what we have all along assured you, that our works and mains have always been

kept in a thorough state of efficiency. This deduction reduced our insurance and contingency fund to £43,741 18s. 6d. It became necessary, therefore, to add to it without delay, which has been already done to the extent of £10,000, making the present balance £53,741 18s. 6d. As regards the new fund, which we have called the "amortization-fund," you will all no doubt concur with your Directors that it becomes an absolute necessity. Science in our days makes such wonderful strides, that no man can foresee what may occur in a few years time. Our new contract stipulates that we shall have the preference, on equal terms, in any new system of public lighting, but our plant may, nevertheless, be reduced very considerably in value, and this depreciation must be provided for. Our working last year embraced three months under the old contract, and nine months under the new one. The profits were satisfactory; but, as stated in the report, they were mainly due to fortuitous circumstances. You will have noticed that our late Chairman, the Viscount de Mauá, has retired from the Board, and that Mr. A. D. MacGregor has been elected in his place. I cannot allow this opportunity to pass without bearing testimony to the eminently valuable services which his Excellency the Viscount has always rendered to our Company, and I can assure you that his advice and influence were of the utmost value to me during the negotiations which were carried on in Rio de Janeiro for the renewal of the contract. I will here say a word regarding Mr. Holman, whom the Directors have invited to a seat at the Board, with a view to his also acting as our representative in Brazil; and I have the greatest pleasure in assuring the Shareholders that his zeal and dedication to our service cannot be exceeded. Our new colleague, Mr. John Holcombe, has resided in Brazil ever since his youth, and his co-Directors have no doubt that his experience of the business of the country will be very valuable to them. As stated in the report, our new contract has still to pass a third reading in the Chamber of Deputies, and the customary three readings in the Senate, before it becomes law. During the last few days we have learned that a change of Ministers has taken place in Brazil, and we understand that the Legislative Body will meet early in May; but the Board rely on the spirit of justice which has always characterized the public men of Brazil. These are the few remarks I judge it necessary to make, and in conclusion I propose—"That the report and balance-sheet be received and adopted."

Mr. J. H. JAMES seconded the motion, and it was unanimously agreed to. The CHAIRMAN: The next resolution is—"That a dividend of 10 per cent. per annum, free of income-tax, be declared for the year ending the 31st of December."

Mr. HOWARD seconded the motion, which was carried unanimously.

The retiring Director and Auditor having been re-elected,

Mr. PELLY said: I think we ought all to admit that we are under great obligations to the Viscount de Mauá for the services he has rendered to the Company from the very commencement to the present time, and I therefore propose that we should not only acknowledge this in the report, but pass him a vote of thanks for his service.

The motion was carried unanimously, and the CHAIRMAN briefly returned thanks on behalf of the Viscount.

Mr. ROBERTSON: I beg to propose a vote of thanks to the Chairman and Directors for their extreme care and good management of our property during very trying circumstances. The amount of business tact, prudence, and firmness combined which they have displayed in bringing this Company into its present successful condition entitles them to our warmest thanks.

Mr. PELLY seconded the motion, and it was carried unanimously.

Mr. HOWARD, on the part of the Board, thanked the Shareholders for the vote of approval which they had passed. The best endeavours of the Directors had been exerted, he said, on behalf of the Company, and he could only assure the Shareholders that those endeavours would not be relaxed in the future.

The proceedings then closed.

THE SEWERAGE OF ABINGDON AND TORQUAY.

At the Meeting of the Institution of Civil Engineers on Tuesday, the 13th inst.—Mr. W. H. BARLOW, F.R.S., President, in the chair—the first paper read was on the "Abingdon Sewerage," by Mr. CHARLES FOOTE GOWER, M. Inst. C.E.

Being under notice to desist from any longer discharging the sewage of their town into the River Thames, the Authorities of Abingdon called upon Mr. Bailey Denton, M. Inst. C.E., in the year 1874, to advise them as to the best means of dealing with the sewage, so as to satisfy the requirements of the Thames Conservators. Mr. Denton having, with the assistance of the Author, made an inspection of the town and neighbourhood, recommended that 20 acres of land should be acquired, for the purpose of cleansing the sewage by intermittent filtration, and gave at the same time a general description of the necessary sewers, pumping-stations, and other works since carried out.

The population of Abingdon was about 6000; but provision had been made, in the construction of the works, for at least 10,000 persons. The normal flow of sewage, when undiluted, was taken at 250,000 gallons per day. The ordinary level of the Thames at Abingdon was 162 feet above Ordnance datum. In flood time it reached nearly 167 feet. The River Ock was kept up for the purpose of working mills at a level of 168 feet. The surface levels in the streets of the town varied from about 170 to 200 feet above Ordnance datum. The subsoil water in that part of the town contiguous to the Thames accorded pretty nearly with the river level—162 feet; but in other parts of the town, previous to the carrying out of the sewerage works, it was regulated by the level of the Ock Mill stream, and the consequence was that it sometimes rose, in wet seasons, almost to the level of the streets, and proved injurious to the health of the inhabitants. The sewers in Abingdon were formerly very inadequate for the duty required of them; they had been retained, however, in connection with the street gullies, to carry off rain water from the streets. The level of the land selected for the purification and utilization of the sewage varied from 165 to 168 feet above Ordnance datum. From the general surface height and contour of the town it was impracticable to bring the sewage on to this land without lifting it from 10 to 20 feet from the invert of the outfall sewer. In the design for the new sewers no rain water was to be admitted except from back yards, roofs, and other surfaces, from which it could not economically be kept out. Having regard to the purification of the sewage, and the necessity for pumping, every precaution was therefore taken to keep the quantity to be dealt with within definite limits. The level of the subsoil water in Ock Street and other places had been reduced by laying separate drains, open jointed, beneath or contiguous to the sewers.

In laying the sewers the joints were caulked with tarred gasket and cement, and in some cases were bedded and surrounded with concrete, or clay puddle, to prevent the ingress of subsoil water or the escape of the sewage into the surrounding soil. Meanwhile, the town having been without a public water supply, arrangements were made for flushing the sewers by inlets from the river, and from other sources. The main outfall sewer from the town was 18 inches in diameter, and was capable of discharging 2 million gallons in 24 hours, being eight times the estimated dry-weather flow of sewage. The secondary sewers in the town consisted of 15-inch, 12-inch, and 9-inch pipes. The lower portion of the outfall sewer was 3 ft. 6 in. in diameter, and served as a reservoir to hold the

night-flow of sewage, in connection with the pumping-station. This sewer was at times subject to considerable internal pressure from the sewage collected in it, as well as to external pressure from the subsoil water outside being 8 feet below the ordinary level of the Thames. Each engine could pump 400 gallons of sewage per minute; thus both engines working together would lift above 1 million gallons per day. In connection with the engines, a storm overflow from the pumping reservoir had been provided, to relieve the latter in case of heavy storms, floods, or accidents to the engines. Upwards of 100,000 gallons must flow into the reservoir before any overflow could take place. This provision was more than enough for the night-flow of sewage, if the reservoir was pumped empty at the close of the day.

The cost of the above-described works in the town had been £8750, including a portion of the charge for private connecting sewers, which were executed by the contractor for the main sewers up to the boundaries of private properties on each side of the street. The cost of the engines and pumping-station, including fencing of yard, weighing-machine, and sewage screens, had been £2500, of which sum the engines cost about £800. The annual cost of pumping for the last two years had not exceeded £150; but with an increase of water supply it would probably be somewhat greater. The area of land acquired by the Corporation of Abingdon was more than double what Mr. Denton at first proposed. The farm, with cottage and buildings, was let at an annual rental of £4 10s. per acre, the Corporation pumping the sewage. The works were practically completed in 1877, and from that time, with but little exception, the Thames had been free from Abingdon sewage; the land first received it, and, after passing through the soil, the effluent water flowed into the river. Samples of the effluent were found by analysis to be better in quality than the water of many of the wells in use in the town. The sewers were freely ventilated throughout the town by shafts, which were also used for inspection and flushing. The latter operation had to be put in force at least twice a week, owing to the comparatively sluggish flow, the amount of water used for domestic purposes being very small.

The second paper read was on "The Main Drainage of Torquay," by Mr. GEORGE CHATTERTON, M.A., Assoc. M. Inst. C.E.

The author stated that Torquay, on the northern shore of Torbay, had a population of about 30,000. Previous to 1878 the sewage of the town was discharged into the bay by three outfalls, and was a nuisance at low water and in hot weather. The main sewers were constantly closed at their outlets by the sea, which at high water flowed up a considerable way into the town; many of them were of insufficient capacity, and the ventilation being defective, foul gases were driven into the houses. The scheme described was designed and carried out by Sir J. W. Bazalgette, C.B., V.P. Inst. C.E. Its main features were a high and a low level system of sewers. The high-level sewer commenced near Tor Abbey, and had an outfall at Hope's Nose, the eastern extremity of Torbay. The set of the tide at the point of outfall was from the bay at all times, and at present no sewage could enter the bay. The total length of the high-level sewer was 17,030 feet, and it was 7 feet in diameter for a length of 11,387 feet. The fall was 1 in 1177. The level of the invert at the outfall was 4'6 feet below high water of spring tides. The quantity of water brought into the town daily was 600,000 gallons. The dry-weather flow of the sewers was about 1,250,000 gallons, the difference being caused by the streams, springs, and overflow of wells, which had been taken into the sewers. In constructing the high-level sewer, it was necessary to drive three tunnels—at Waldon Hill, Meadfoot Hill, and Kilmorie Hill respectively. The Waldon Hill tunnel was in Devonian limestone. It was 1150 feet long, the size being 5 ft. 6 in. by 4 feet. It was driven from two open faces, the average progress was 9'12 lineal feet per week from each face. Hand labour alone was employed, and the invert portion was lined with Portland cement concrete. The cost of the sewer completed was £1 16s. per lineal foot. The Meadfoot tunnel was 4458 feet long. The sewer was 7 feet in diameter. This tunnel was in limestone rock for the greater part of its length, but some of it was in soft ground. Hand labour alone was employed. It was driven from four working shafts. The average progress per week from each face was about 15 feet. Where the ground was limestone it was lined with Portland cement concrete 9 inches thick, while the sewer in soft ground was formed of brickwork. The average cost per lineal foot for driving this tunnel was £1 9s., and the total cost of completed sewer £2 10s. per lineal foot.

A new roadway and sea-wall were constructed along the Meadfoot beach, with the sewer under the road. The sewer consisted of a single ring of brickwork surrounded with, and founded upon, lias lime concrete carried down to the solid rock. The sea-wall that was here constructed was 1900 feet long, and was built of random-coursed limestone masonry, backed with rubble. The Kilmorie Hill tunnel was 4564 feet long. The nature of the rock varied greatly. In some places it was an argillaceous siliceous grit, with bands of pure quartz, and extremely hard; in other places it was of a shaly composition, while near the outfall it was limestone. The advance per week by hand labour was so slow that it was found necessary to introduce rock-boring machinery at the open face and at one shaft. The progress in feet per week was increased by using rock-boring machinery at the open face in the ratio of 2'33 to 1, and at the shaft in the ratio of 2'19 to 1. The cost per lineal foot was also increased, but not in a corresponding ratio. Ingersoll rock-drills were used, and the air was compressed by Sturgeon's high-speed air compressors. Dynamite was found to be the most effective and economical explosive; 11 tons of it being used without a single accident. There were 13 ventilating shafts on the high-level sewer. The flow of sewage was continuous, so that sewer gas was not generated to anything like the same extent as in tank sewers. There had been no deposit in the sewer. The low-level system received the sewage of about one-tenth of the population of Torquay. The total length was 5184 feet. Surface water was kept out of the system as far as possible. The low-level sewage was lifted about 15 feet by a water-pressure engine, with pumps in duplicate, worked by a head of 250 feet of water from the town main, and requiring no superintendence.

A contract for the construction of the works was entered into in 1875, but in January, 1876, the contractors suspended operations, having executed work to the value of about £8000. On receiving fresh tenders the Local Board became alarmed. The lowest tender was £75,000, and this did not include the cost of extra work and other items, which would have involved a total outlay of £103,327, while the Engineer's estimate for the same amounted to only £65,000. Under these circumstances the Local Board, acting under the advice of Sir J. W. Bazalgette, determined not to accept any tender, but to execute the works themselves by administration. Mr. G. Phillips was appointed Resident Engineer, and the whole scheme was completed by August, 1878, or in two years and five months from the commencement of operations by the Local Board. The total cost of the scheme to the Local Board was £66,145, a saving to the town of £87,182 by not accepting the lowest tender. The cost of the Kilmorie tunnel was £14,358, or £3 2s. 11d. per lineal foot. Of this amount, the cost of the driving was 7s. 53 per cent., of the trimming 15s. 98 per cent., and of the lining 9s. 49 per cent. The rock-boring machinery cost £1395. The execution of the works had involved a rate of about 7d. in the pound on the present rateable value.

BRAY'S BURNERS AND LANTERNS FOR STREET ILLUMINATION.

The accompanying illustrations show the burners and lanterns as manufactured by Messrs. George Bray and Co., of Leeds, for improved street-lighting purposes—the system which they advocate being, as our readers well know, an arrangement of large flat-flame burners in a specially constructed lantern. The system Messrs. Bray and Co. are introducing, though it may be said to be of only very recent date, has been tried by the public authorities of many of the principal towns of the kingdom, and in the

Metropolis; and everywhere, as far as we have heard, is giving complete satisfaction.

Fig. 1 is an elevation, and fig. 2 a vertical section of the burner and lantern which Messrs. Bray and Co. have adopted for general use. The top ventilator is composed of two cylinders, *a* and *b*, and a cover, *c*, at the top. The chimney, *b*, is open at the top and bottom, and terminating at the top of the lantern, *d*, opens directly into it. Its top terminates in such a position in the

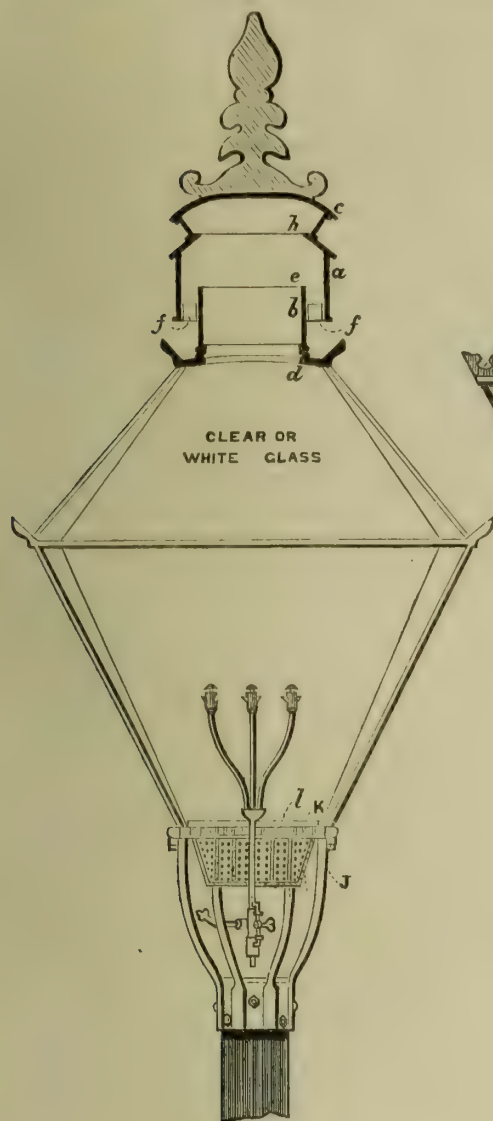


FIG. 2.

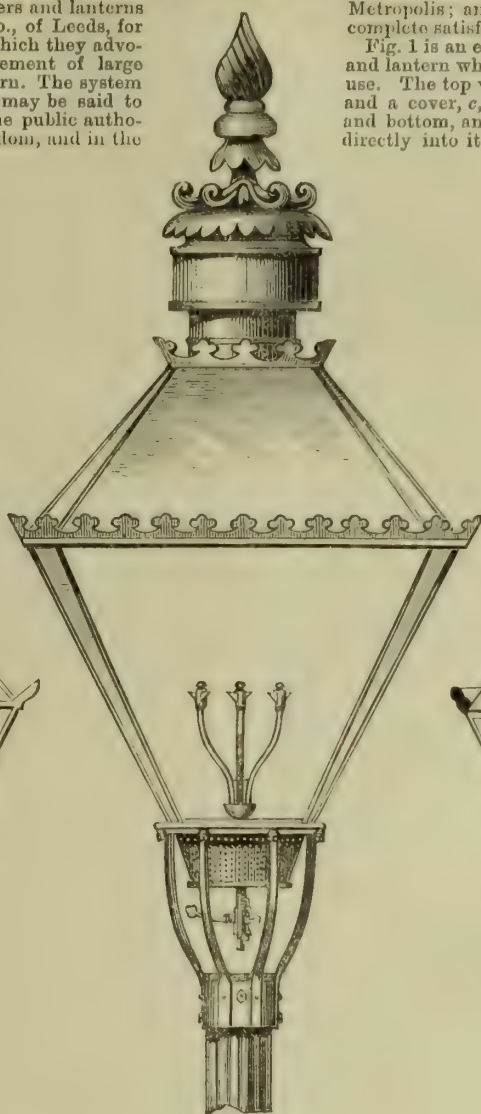


FIG. 1.

SCALE—1 INCH TO THE FOOT.

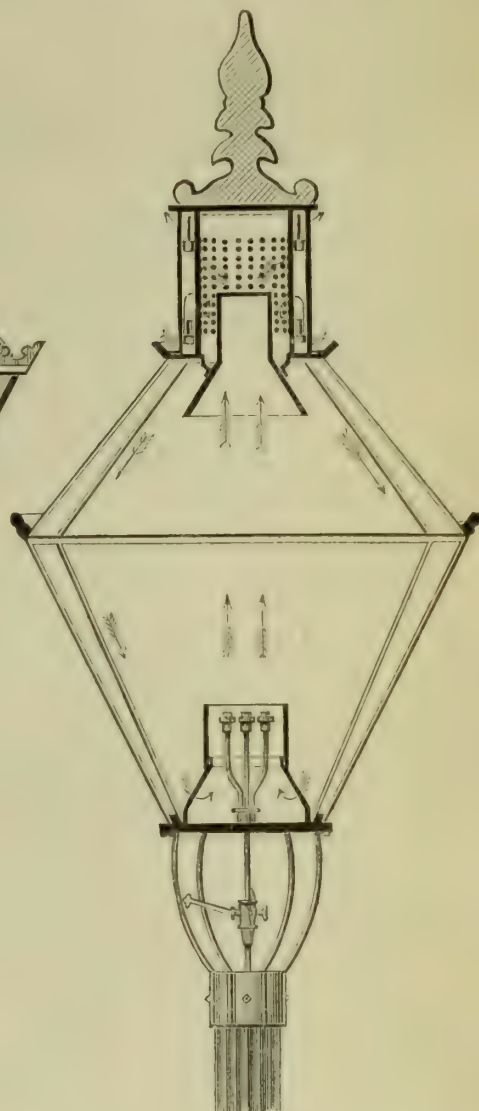


FIG. 3.

interior of the outer chimney, *a*, as, with the aid of the top cover, *c*, to prevent the wind getting into the interior of the lantern at whatever angle it strikes the ventilator. Between the inner and outer chimneys, *a* and *b*, is an annular space, *f*, of about the same capacity as that of the inner chimney. The outer chimney, *a*, is open at the top, and is fixed a sufficient distance from the top of the lantern to allow a perfectly free downward exit of the products of combustion and air. The top of the outer chimney, *a*, is partly closed at *h*, leaving an aperture of about the same area as that of the inner chimney. This closed portion is carried to a sufficient distance above the top of the inner chimney, *b*, to allow of the products of combustion and air to escape down through the annular space, *f*, when the top of the outer chimney, *a*, is almost sealed, as it is by a strong wind. It will be seen that the inner and outer cylinders, with the top cover, are so arranged that, while perfect freedom of exit for the products of combustion and air is provided, it is not possible for any current to pass into the lantern.

The inlet ventilator at the bottom of the lantern is composed of two distinct parts—the intake or diffuser, *j*, and the bed of tubes, *k*, which is covered at the top by a sheet of wire gauze, *l*. The diffuser takes in the air in its usually ruffled state, and, to a large extent, quiets it down or diffuses it, while the small tubes set vertically against each other, with the gauze on the top, ensures its passage into the lantern in a perfectly vertical and quiet state. The intake or diffuser is made of perforated metal, of sufficient depth to take in the requisite quantity of air, and has concentric rings of perforated metal placed vertically inside. It deals with the air as follows:—When the atmosphere is at rest, the air passes in on all sides in a quiet stream. When a wind is blowing, the air rushes in on one side of the diffuser only, and, striking against the concentric rings, has its force and eddies reduced by a small portion only, being turned up at a time in its passage horizontally through the ventilator, and by the currents being mixed up and turned in various directions by the perforations in the concentric rings.

By a proper proportioning of the respective capacities of the inlet and outlet, the necessary area and speed of the column of air required for dealing with the flames are obtained, and are protected in all weathers by the lantern. In this column of air flat-flame burners are set either single, double, or in clusters, to suit the circumstances and the power of flame required. All the burners are fixed either vertically or at a slight inclination from that position; while to avoid the tendency of the edges of the flames to thicken and become smoky in a current of air of this description, the burners are slightly inclined, and the under sides of the flame are protected by projections, as shown in the engravings. By these means the flames are made to curl round the reverse way of the inclination, and are

brought within the influence of more air, and the heat of the adjacent flame; the result being that the edges are made intensely white and luminous, instead of being smoky, as when burners are used in the old style.

Figs. 1 and 2, as before stated, show the lanterns Messrs. Bray and Co. have adopted for general use, in preference to figure 3, because of the necessity there is in that arrangement of a conductor chimney for conveying the required current of air to the flames. Fig. 3 is taken from the drawings of their first patent (No. 1454 of 1879), and is an arrangement whereby the top ventilator is made to answer as an inlet and outlet combined; the products of combustion going out of the upper portion, while the fresh air admitted through the perforations at the bottom of the outer cylinder passes over the conductor, and enters the lantern down its sides. The air is then conducted up to the burner—but below the flame—by a cylinder or chimney perforated at the bottom (as shown in the drawing), or raised above the bottom of the lantern at a sufficient distance to admit of perfect freedom of inlet to the air. In this lantern, as in the one previously described, the fundamental principle is to cause “a column of air to pass up in such volume and at such a rate of speed as will steady, increase the brilliancy of, and give control over the lighting power of the flame or flames submitted to its influence;” and in the column of air to “place the flames, singly, doubly, or in clusters, and in such close proximity to each other, without touching, that their brilliancy is increased, and the smoking tendency diminished.”

Messrs. Bray and Co. have also more recently introduced an improvement in the ribs of which the lanterns are made, which give a maximum of strength with a minimum of light-obstructing surface. It consists of a doubled strip of metal being placed lengthwise, edgeway up, along the centre or gutter of the inside of the lamp ribs, to which it is soldered. It is sufficiently high above the rib sides, upon which the panes of glass rest, to form a separating barrier between the panes, and to prevent each pane encroaching upon the other portion of the rib.

SHEFFIELD WATER-WORKS COMPANY.

The Annual General Meeting of this Company was held on Monday, the 12th inst.—Mr. W. COCKAYNE, Chairman of the Board of Directors, presiding.

The following report was presented:—

After payment of all expenses of the Company, interest on debentures, the sum of £31,490 10s. dividends on preference shares, and £4618 10s., the dividend after the rate of 2 per cent. per annum on the ordinary capital of the Company for the half year ending the 30th of June last, paid on the 1st of November last, there remains, including the balance of revenue account brought from the year 1878, and appearing in the account published with the report of last year, the sum of £28,240 7s. 9d., the balance of the

Company's undivided revenue. The Directors recommend that out of this a dividend after the rate of 2 per cent. per annum for the half year ending the 31st of December last shall be paid on the 1st of May next on the ordinary capital. This payment will absorb £4618 10s., leaving the balance of undivided revenue £23,621 17s. 9d. The Directors believe that it will be more conducive to the interests of the Company to limit the present dividend to the small rate recommended, than to divide a larger sum now, with the possibility of a reduction hereafter, when, in accordance with the order of the Court of Chancery, the whole burthen of the interest arising from the expenditure on works not fully productive will be borne by that portion of the Company's income applicable to a dividend on the ordinary shares.

The Directors have much satisfaction in calling the attention of the Shareholders to the fact that, notwithstanding the almost unprecedented depression of trade during the year 1879, and the large destruction of house property during the same period throughout the borough of Sheffield for street alterations, the income of the Company, derived from water-rates, has increased since the year 1878 by the sum of £467 15s. 3d. This amount is much less than that which, on an average of years, is added to the Company's water-rates, but arising, as it does, under the adverse circumstances adverted to, it affords both an excellent proof of the stability of the Shareholders undertaking, and ground for belief that, when commercial prosperity is re-established in the town of Sheffield, the water-works will be remunerative as well as safe. The additional property to which water has been laid on during the year 1879 will produce, when occupied, upwards of £1500. The Company now supply with water 59,483 houses, besides other property. This number of houses exceeds by 1489 those supplied in 1878.

In accordance with the terms on which the C preference shares were created, the holders had the option of converting them on March 30, 1879, into ordinary shares. None of the Shareholders, however, availed themselves of that option, and consequently all the C shares, being £150,000 in amount, will remain preference shares in perpetuity, the dividend being reduced from 5½ to 5 per cent. per annum since March 30, 1879. This change of rate reduces the annual preferential charge against the ordinary shares by £750, which yearly sum will for the future go to increase the amount applicable for ordinary dividend; but as the reduction commenced only on March 30, 1879, the full benefit of the change has not arisen during the past year.

The supply of water to Chapeltown began in January last, and various applications for water supply from the pipes laid to the village of Dore have also been made. These, in the opinion of the Directors, indicate the probability of an increasing demand in that district.

Since the last report of the Directors, £37 5s. per annum of the ground-rents near Crookesmoor have been sold, and contracts have been arranged for the sale of 5a. 1r. 30p. of land in the same locality to the Corporation of Sheffield, for the purpose of a recreation-ground, and of a smaller portion of land on the Crookesmoor Road to other persons. The greater part of the land described as Lot 1 in the printed particulars of sale of 1878, with Limerick Wheel and the adjoining land, are the only properties then advertised for sale which now remain undisposed of. The Directors consider that if proper prices can be obtained for these properties, it will be advantageous to the Company to dispose of them.

In the autumn of last year some public alarm was caused by a report made by Dr. Hime, the Officer of Health for the borough of Sheffield, pointing out the probability of contamination by sewage of one of the service reservoirs of the Company at Crookesmoor, and the Directors believe that the grave danger thus apprehended was popularly supposed to have arisen from the sale of parts of the Company's property there. The Directors are satisfied that the Shareholders will give them credit for being fully impressed with the paramount importance of doing everything possible to maintain above suspicion the purity of the Company's water, and they would have supposed that the public of Sheffield might have felt assured that no pecuniary temptation would have induced them to make any change in the Company's property which could have created the slightest risk of a calamity so great as the contamination of the public water supply. The facts are that before dividing into lots for sale the land which was to be sold, under powers granted after inquiry by Parliament as long ago as the year 1860, the Directors consulted Mr. T. Hawksley, Mr. J. Ayris, and Mr. Frederick Fowler with respect to the precautions to be taken to protect the reservoirs from possible contamination by infiltration, in case the land sold should be used for building purposes. Everything suggested by the great experience of these three gentlemen was carried out, and with a view to guard against pollution by smoke, the land was sold subject to prohibitions against its use for trades or manufactories by which such pollution could be caused. After those precautions, the report of Dr. Hime was certainly a matter of surprise to the Directors; but, on investigation, it appeared that the source of the alleged possible contamination was not on any part of the land sold, but in property which never had belonged to the Company at all. Believing it their duty fully to investigate the alleged danger, the Directors called in Dr. Tidy, of the London Hospital, an eminent Chemist, specially conversant with water analysis. He made a careful examination not only of the water of the reservoir, stated by Dr. Hime to be specially in peril, but of all the other service reservoirs, and of the sources of supply, and of the water drawn from the pipes in the town. He reported positively that no pollution, such as that anticipated by Dr. Hime, existed or had existed, and his report of the quality of all the water he tested was (as invariably has been the case with the water of the Company) entirely satisfactory.

In a case heard before the learned Stipendiary Magistrate of Sheffield, in the spring of last year, respecting the right of the Company to recover unpaid rates, by cutting off the supply of water of the defaulter, the Magistrate expressed his opinion that in order to preserve the remedy it was incumbent on the Company to collect all their domestic rates in advance, at the commencement of each quarter of a year, in lieu of the end, according to their previous practice. In deference to that opinion, the Company made the change in their mode of collection on March 25, 1879. The alteration is beneficial to the Company, and having been accepted without hesitation by the consumers, the Directors hope that no inconvenience has been caused by it.

The Company's Engineer-in-Chief reports as follows:—

"To the Directors of the Sheffield Water-Works Company.

"30, Great George Street, Westminster, Feb. 10, 1880.
"Gentlemen,—In accordance with your instructions, I have made the usual annual inspection of the storage reservoirs of the Company, and now beg to present my report thereon, as follows:—(1) The three Redmires reservoirs.—These reservoirs are all in excellent general condition, nothing being required except some very slight amendments of the pitching, and the laying of a few agricultural drains to carry off stagnating surface water. (2) The two Rivelin reservoirs and the depositing pond are all in good repair. (3) The three Loxley reservoirs completed and filled. The embankments and other main works are in a very satisfactory condition. In the case of the Strines reservoir, it will be desirable to take an early opportunity for re-adjusting the puddle wall and pitching to their intended heights, in consequence of the levels having been somewhat reduced by the natural consolidation of the new earthworks. The similar operation at the Dale Dyke embankment has been recently completed and approved.

(Signed) "T. HAWKSLEY."

The outgoing Board is composed of the following gentlemen:—Mr. W. Cockayne, Mr. J. W. Hawksley, Mr. H. Crookes, Mr. T. Cole, Mr. F. W. Colley, Mr. W. I. Greaves, Mr. P. Smith, Mr. S. Roberts the younger, and Mr. H. Jubb, all of whom are eligible, and offer themselves for re-election.

The CHAIRMAN moved—"That the report of the Directors for the past year, now produced, be approved of and entered on the Company's minutes."

Mr. HAWKSLEY seconded the motion.

Mr. S. SMITH observed that in the report for 1878 there was a statement to the effect that the Company expected to be able to supply manufacturers with water on reduced terms. He should like to ask if that proposal had been responded to, and whether a number of manufacturers had taken the water, and so increased the revenue to any considerable extent.

Mr. G. HIDES said he noticed in the report that the Company's work in connection with Chapeltown was actually complete, and that they had commenced to supply water there from the 1st of January last. He had seen some mention about other applications, and he wished to ask whether there had been any tangible applications in regard to extension in that direction, and whether the Directors intended to report as to the outcome of any such applications. He would like further to know whether anything had transpired in reference to the application regarding a supply of water to Handsworth Woodhouse. The Directors, he believed, had had this in contemplation in certain things they had done, and as the Shareholders only met once a year, he thought it desirable to have all the information they could possible get for the welfare of the concern.

Mr. F. E. SMITH said he objected to one clause in the report, and that was in reference to the payment of rates in advance. He felt that if he did not raise some objection to it, it would appear as if the Shareholders all agreed cheerfully to pay five quarters water-rate in one year. He did

object most strenuously to this. He, of course, felt that the Water Company had the power, and therefore, perhaps, the less said the better. But he felt that if the report was allowed to go out showing that the Shareholders received the arrangement quite cheerfully, it would seem as though they all agreed to it. He, however, protested, and would say that it was not at all necessary, in the case of ordinary tenants who had been in the town for a very long period, and had always paid their rates promptly, to require their money in advance.

Mr. P. SMITH, in reply to the first question, said he believed there had not, up to the present, been any considerable increase in the trade demand, owing to the fresh scale which the Company had adopted for supplying large consumers. That scale of charges had been adopted by the Company after very careful consideration, and he believed it was one which would be viewed very favourably indeed by the consumers when there was an ordinary state of trade. The trade of the town had, however, been exceedingly bad, and the Company were pleased to find that they had not lost ground as regarded their trade consumers. The Company now had a well-considered and carefully-settled scale by which they could deal with consumers of all kinds, whether large or small; and they certainly hoped in the future to do a larger business on this account. Mr. Hides had noticed that the Company had supplied Chapeltown, and asked whether there were any further applications from outlying districts. He (Mr. Smith) believed that during the past year there had not been any further applications. One district had made application, but it was beyond the Company's parliamentary limits. They were, therefore, obliged to refuse it. As regarded Handsworth Woodhouse, the people there were short of water, and were desirous to have it from Sheffield. The matter, however, was in negotiation, and the Shareholders must leave it in the hands of the Directors, who would, if they could, arrange matters mutually satisfactorily. Mr. F. E. Smith had asked a question as to the rates being payable in advance. He could not tell what was the feeling of the consumers, in whom Mr. Smith seemed to be very much interested. All the Directors knew, and all they were interested in, was that the rates had been very freely paid without any objection being raised. The Directors had not met with any difficulty. They were not before acting in an illegal, but perhaps in an informal manner, by collecting at the end of the quarter, because the law required that the general rates of the Water Company should be collected in advance on the first day of each quarter. This plan had not been adopted by the Company, because it had been their practice to collect at the end of every quarter. The difficulty had always been this, that when they started the new system of collecting in advance, they must, in the first instance, collect two rates together—one for the quarter which had passed under the old system, and the other for the quarter which was just beginning under the new system. That course they thought would be very inconvenient to the ratepayers, and they went on in the old way. The present plan had been forced upon them by the decision, or rather the strongly-expressed opinion, of the Stipendiary Magistrate of Sheffield, that by not collecting their rates in advance they were running a risk of jeopardizing some legal interests. Therefore the Directors had thought it necessary, in the interests of the Shareholders, to collect the rates in advance. As to collecting from one man in advance and from another at the end of the quarter, it could not commend itself to the Shareholders good sense for a moment. They must have the same system throughout. There had been no opposition to it, and no ill-feeling engendered. They had overcome that point very nicely, and they were now going on the regular system of collecting the rates in advance.

The motion was then put, and carried unanimously.

On the motion of the CHAIRMAN, seconded by Mr. HAWKSLEY, a dividend at the rate of 2 per cent. per annum was declared.

The retiring Directors were then re-elected.

Mr. J. WILSON moved a vote of thanks to the Chairman.

Mr. F. BURNBY said before the resolution was put he should like to move that the Shareholders present had thorough confidence in the Directors with regard to the management of the bath question. He saw, in looking over a list at one of the banks, that some of the Shareholders were subscribing to oppose the Water Company.

Mr. BLAKELOCK SMITH (the Company's Law Clerk) said some of the Shareholders were not only subscribing, but were actually on the Committee of the Association for the purpose of opposing the Company.

Mr. BURNBY said a house divided against itself could not stand, and, therefore, he moved that they, as Shareholders, should go hand in hand, and let the Directors know they had their entire confidence and support in the action they were taking.

Mr. G. WARRISS seconded the resolution, believing that every Shareholder in the meeting had full confidence in the Directors as to their action in relation to the bath question. If they were acting illegally, it was not right, either on the part of Directors or Proprietors, and he considered the sooner the matter was settled the better. Still, he had confidence in the Directors, and thought they would do what was just, right, and proper. He was exceedingly sorry to see that some of the Shareholders of the Water Company actually started the Association which was now opposing them. He went to the Association meeting, and was very sorry to listen to some of the remarks made by those who were connected with the Company.

Mr. S. SMITH said before the resolution was put he should like to make a few remarks. He was a Shareholder, and not a very small one, and he thought the action of those who were opposing the Company on the question of baths was right. He believed their action was right, because for some years past a number of persons had not been paying their bath-rate, whilst others had been paying. He held it was right on the part of the Company that they should take legal proceedings against some of the defaulting persons, so as to have the matter settled, and that it was also right on the part of others who thought they were not called upon to pay their water-rent twice over—because that was what paying for baths really meant—to oppose the Company's action. The Company had not been quick enough in settling the law on the subject. The law might have been settled some time ago without going to very great expense. He expressed the hope that when the Directors had obtained the opinion of the Court in which the action was laid, they would not go to a higher Court, and so needlessly throw away a lot of money. When they had obtained the opinion of the Court, the Directors would be free from any blame in the matter, inasmuch as they had done all that could be expected of them, and it was undesirable to throw away the money of the Company in protracted legal proceedings. He should be very glad indeed to have the matter settled. The sooner it was settled the better—better for the Company because it would put a stop to much ill-feeling which at present prevailed.

Mr. G. HIDES recommended that the resolution should be withdrawn, for one very cogent reason, that inasmuch as the Directors had taken action in the matter some six or eight weeks ago, and it had been fairly before the community as well as the Proprietary, and they had voted the old Board back again without a word of demur, they had practically given the Directors their fullest confidence.

Mr. P. SMITH said with regard to the baths, Mr. Blakelock Smith had been throughout most anxious to avoid legal expense, and so induced the Directors. He (Mr. P. Smith) was not going to make any accusation

or to say where the blame lay, but the Company had at last been forced into litigation. The matter now only waited the pleasure of the Court to decide it. He could not say exactly when it would be decided—probably before many months were over—or whether it might be necessary to take it to a higher Court; but it was evident that the matter must be settled, and settled in such a manner that it could not be re-opened. Notwithstanding what Mr. Hides had said, he should prefer to have the resolution put, as it would be well for the Directors if they could be assured that in the course they were now pursuing they had the support of a large body of the Shareholders.

Mr. BURNBY said the reason he should put the resolution was because he had seen the names of Shareholders upon the list of subscribers to the Association formed against the Company. If there had not been those names, he should have thought that the whole of the Shareholders had confidence in the Directors. It would seem that some of them lacked that confidence, otherwise they would not have taken an active part against the Company. He should, therefore, put the resolution.

The resolution was carried with only four dissentients. Mr. JEFFREY seconded the vote of thanks to the Chairman, and, the motion having been carried, the proceedings were brought to a close.

WOLVERHAMPTON CORPORATION WATER SUPPLY.

At the Meeting of the Wolverhampton Town Council on Monday last week—the MAYOR (Mr. John Jones) presiding—the following report of the Water-Works Committee was taken as read:—

The Water-Works Committee have pleasure in laying before the Council the duly audited balance-sheet and account of income and expenditure of the water-works for the year ending Dec. 31, 1879, from which it will be seen that a profit of £1850 18s. 8d. has been made.

When your Committee presented their report on April 1, 1879, there appeared an accumulation of profits amounting to £2659 9s. 8d., from which, in accordance with the resolution of the Council, there has been set apart as a reserve-fund a sum of £5000.

Your Committee have reduced the domestic rate on houses in the municipal borough from 1s. 6d. to 1s. 3d. in the pound on the poor-rate assessment, and the rent for water-closets to a uniform charge of 10s. per annum for each closet. It is very satisfactory to find that, notwithstanding these reductions, the income from water in the year 1879 was £19,497 1s. 8d., or only £40 12s. 11d. less than that of 1878. The working expenses have, however, been greater than usual. This is partly in consequence of some considerable repairs at the different pumping-stations, but principally by the waste of water caused by the frost in the earlier months of the year, when the daily consumption of water averaged about 3 million gallons, or nearly 1 million gallons more than the usual quantity.

Your Committee, believing that the water-works undertaking will be able to maintain its present position, and considering that the reduction last year was made entirely in the interest of the consumers of water, think that the time has now arrived when they may recommend some relief to the general body of ratepayers. They, therefore, propose that the next improvement rate should be relieved from the payment of the £400 hitherto charged for water used by the Corporation in watering streets and other public purposes. This recommendation, if adopted by the Council, will be equivalent to a diminution of 4d. in the pound on the improvement rate.

The balance-sheet issued by the Committee showed that the total income amounted to £20,191 3s. 9d.—of which £19,497 1s. 8d. was received from water-rents and sales of water. The total working expenses were £9179 8s. 5d., while the repayment of loans, and payment of interest on the remainder, absorbed £9160 16s. 8d. The profit, therefore, was, as stated in the report, £1850 18s. 8d. The capital account amounts to £232,355.

The Committee also presented a statement of the capital and revenue expenditure, &c., during the twelve years which have elapsed since the Corporation obtained possession of the water-works, and from it we extract the following particulars:—

Year.	Income.	Expenditure.	Profit.	Loss.	Percentage of Working Expenses to Gross Receipts.	Coal Consumed per Million Gallons of Water Pumped.	Coal Consumed per Million Gallons of Water Distributed.	Gross Cost per Million Gallons of Water Distributed.
	£	£	£	£		Tns. cwt. qrs.	Tns. cwt. qrs.	£ s. d.
1868	13,263	12,711	552	..	36.2	..	..	..
1869	13,517	13,376	141	..	40.2	..	..	..
1870	14,371	14,122	249	..	39.9	..	..	..
1871	14,518	15,138	..	620	42.7	..	..	..
1872	14,984	15,843	..	859	45.2	4 11 3	8 7 2	..
1873	15,793	16,412	..	619	46.9	4 6 2	8 1 2	27 5 4
1874	16,564	16,526	38	..	45.3	4 5 0	7 19 0	25 6 4
1875	17,387	16,574	813	..	43.3	4 5 2	8 1 2	23 5 1
1876	18,174	16,483	1691	..	40.7	4 4 1	7 13 1	22 7 7
1877	19,289	17,587	1702	..	43.1	4 4 2	7 18 0	24 11 10
1878	20,066	16,647	3419	..	36.6	4 3 2	7 16 0	21 4 6
1879	20,141	18,290	1851	..	44.3	4 8 3	8 8 1	21 7 3

In the municipal borough there are 15,145 houses, of which 12,047 are supplied with water from the Corporation water-works. There are, therefore, 3098 houses in the borough, the inhabitants of which are still dependent upon wells for their water supply.

Alderman EDWARDS, in moving that the report be received and entered on the minutes, called attention to the fact that notwithstanding the severe winter, which had occasioned breakage of pipes and extra pumping, a handsome profit had been made by the Water-Works Committee.

Alderman BANTOCK, who seconded the motion, thought it would be satisfactory to the public if some explanation were forthcoming as to the cause of the increase in the working expenses from 36.6 per cent. in 1878 to 44.3 in 1879.

Alderman WALKER observed that there was a satisfactory explanation forthcoming in the circumstance that, as stated in the report, there had been extra expenses for repairs at the different stations, and more especially that there had been a very large extra expense in consequence of the last severe winter. This had necessitated the pumping of 50 per cent. more water than the average quantity, the proportion being 3 million gallons per day, as compared with 2 millions.

The motion was carried, and the Council proceeded to other business.

STOCKTON AND MIDDLESBROUGH CORPORATIONS JOINT WATER BOARD.

The Monthly Meeting of this Board was held on Monday, the 12th inst., when the report of the District Auditor (Mr. J. Radford) was received. It was addressed to the Chairman and Members of the Board, and in it he said: "In pursuance of section 52 of your Water-Works Act, 1879, I have audited the accounts of receipts and expenditure from the time you got possession of the works from the old Company—viz., July 1, 1878—to Feb. 14, 1879, as directed by the Local Government Board, the latter date being nearest to the 25th of March, as named in the section, and when similar accounts close, the audits will in future be for a year ending as near as possible to March 25. Though but for seven months, the audit involved the examination of—(1) The heavy law and parliamentary expenses for obtaining the Act, £27,601; (2) those for the arbitration to settle the sum for compulsory sale and prospective value of the works above the 25 years purchase—£10,181—of the maximum statutory dividend

of the old Company—viz., £466,175; (3) the award for compulsory sale and prospective value, £213,802; (4) the old Company's debts and their cost of arbitration, £121,137; (5) stamp duty on conveyance, £3400—making a total of £842,296. It is much to be regretted that the law and parliamentary proceedings should have been marked with so much hostility. Had more pacific counsels prevailed, a great deal of money might have been saved to the ratepayers. There may have been faults on both sides, but it was surely injudicious to offer £5 for 'compulsory sale and prospective value,' when £213,802 was awarded. The above offer led you into that serious item of £10,181 for arbitration costs, besides letting you in for those on the other side, and so swelling the debts due from the Company to the large sum of £121,137. When litigation runs so high as in these instances, there is practically no check on the charges of legal, parliamentary, and engineering talent. Had the contention been for a principality instead of for a moderate water company, more expense could hardly have been incurred. As your Act does not give the Auditor the usual powers of disallowance and surcharge, I can only report, and in doing so it is not easy during a four years warfare to say that particular items are wrong, and might not be justified by circumstances at the time they were paid. It does, however, appear to me that auxiliary forces were brought into alliance with the Corporations at considerable cost. Likewise, that £1684 was a large sum to pay the owners of Dinsdale Dam in respect of their opposition; also, £37,000 was large for surveying and boring; £4500 was large for engineering; and £12,456 for Solicitors, Parliamentary Agents, and Counsel's fees, irrespective of the arbitration. Under a peaceful view of the subject, such outlay could hardly have occurred."

Mr. J. DODDS, M.P., after referring to this report, moved—"That Mr. James Radford, the District Auditor, be reminded that his duty is to audit and examine the accounts, and to report to the Board on the accounts audited and examined, and that consequently his observations on the policy of the respective Corporations of Stockton and Middlesbrough are alike impertinent, unjustifiable, and in excess of his duties."

This motion was seconded and carried, after the words "alike impertinent, unjustifiable, and" were struck out.

A report was then submitted to the Board preparatory to its being laid before the two Corporations, which was afterwards ordered to be done. It stated that the capital account showed an excess of expenditure over receipts amounting to £33,652 16s. 2d., of which £16,000 had been spent by the Corporations. The Board, on Feb. 10, issued precepts on the Corporations, which had since been honoured, for £10,000, leaving £23,652 19s. 2d. still unborrowed, and it would be necessary for the Board to retain a considerable amount of undivided profits. On Feb. 14 this stood at £14,916 2s. 5d., but although they had retained this large amount, they were under advances from their banker to the extent of £12,980 3s. 7d. The revenue account during last year exhibited a considerable growth, having reached £42,236, against an average of slightly over £40,000 in the years ending June 30, 1877 and 1878 respectively. This was due, in great measure, to the increased charges for water. The expenses of the Board had also increased, and were £1006 7s. in excess of that of the average expenditure of the Company for the years named above. Acting under resolutions passed by the Board, the Corporations made application to the Local Government Board for a Provisional Order to facilitate the discharge of the Board's duties, and to postpone the obligation of the Board to begin the works authorized by the Act of 1876, and they would wait with anxiety the result of the application, because, should it be unsuccessful, it would be necessary for the Corporations to consider most earnestly how they would best discharge the duties imposed upon them by their Acts, without laying on the ratepayers of the town too great a burden. The prospect of a revival of the industries of the district made it incumbent upon the Corporations to prepare for an increased consumption of water, and before many months elapsed it might be the duty of the Board to ask the Corporations to consider the propriety of carrying out the provisions of the statute as to new works, or of applying to Parliament for powers to modify the provisions.

ON THE USE OF WATER IN ASCENSION-PIPES.

By Mr. W. A. WOOD, of Syracuse, U.S.A.

[A Paper read before the Central New York Gas Engineers Association, Feb. 19, 1880, and extracted from the "Official Report" in the *American Gaslight Journal*.]

At our last meeting, the statement was made that an adequate remedy had been found for freeing and keeping clear the stand-pipes in our retort-house. The necessity for some such remedial agent is generally acknowledged by those running with high heats; and from the interest manifested in this matter, it was thought a more elaborate account of our operations might not prove unacceptable to the Association.

The method adopted was brought under our notice, in May last, by the Superintendent of the Homer and Cortland works, whose foreman had been experimenting, and had derived much benefit from the use of water, either evaporated from an iron vessel placed within the mouthpiece just before sealing the retort, or introduced above (through a syphon), and allowed to trickle down the inside of the stand-pipe. We have since learned that the use of water in either manner is by no means novel; but the idea was certainly original with the gentleman mentioned above, and the general surprise at the simplicity and efficiency of this "water cure," expressed by those present at our August meeting, proves that the system is not very widely known in this section of the gas world at least. Mr. Jones, the Superintendent of the South Boston works, affirms that he employed a similar method for relieving his pipes so long ago as 1851, and further states that he found no evil effect arising from its constant employment, although not using it at present, as he finds relief through petroleum residuum, which he uses as an enricher.

Wherever the honour of discovery or invention may properly belong, our experience has convinced us that the judicious introduction of water inside the pipes can be unequivocally commended. Different methods of applying the water may suggest themselves to different engineers. With us, the main water-supply pipe is run along the front of the stack, and wired to the stand-pipe just below the flange connecting the ascension and bridge pipes. A pillar-cock is introduced at the centre of each stand-pipe, and below this a syphon is tapped through (fair with the inside of) the stand-pipe, having sufficient seal to overcome any back pressure in case the exhauster is shut down. The syphon is of 1-inch pipe, capped with a 3-inch reducing coupling, which serves as a funnel to receive the water from the pillar-cock above. The funnel is placed, say, 3 inches below the cock, permitting the flow of water to be observed from the floor below. The water is introduced drop by drop, and, with a little care, the amount may be so adjusted that it will moisten the entire length of the longest pipes, and still be nearly, if not entirely dissipated, before reaching the mouthpiece. The tar, as it collects, finds no foothold on the moistened surface of the iron, and, like water from the traditional goose's back, slides down into the mouthpiece, where it is easily cared for.

Our stoppages, previously common to all the pipes, and most frequent and obstinate in those leading from the upper retorts, after the water was turned on, occurred only in the pipes connecting the lower retorts, and just above the mouthpiece. The obstruction consisted of a mixture of tar and dry carbon, and gathered very rapidly after the charge. A cylinder-

shaped reamer of steel, 4 inches in diameter, with a cutting edge on top, was substituted for our ordinary stand-pipe auger, and this introduced into the mouth of each pipe before charging, together with the water dripping in from above, has banished the bugbear of stopped pipes from our works.

Several difficulties were apprehended from the contact of the hot gas with water at such an early stage of the process; but a thorough test has proved them all imaginary.

Providing a free passage for the gas, and obviating the frequent removal of lids, an increased yield necessarily followed. With old benches, and a portion of coal partially damaged by fire, the yield for May was 4'85 feet per lb. of coal. With no other condition changed, other than the introduction of water, the yield for the succeeding month of June was 5'09 feet, and there was no appreciable diminution of candle power. The heat of the stand-pipe is ample for vaporizing the water, and, with moderate care, a dangerous quantity need never reach the retort. The vapour is doubtless returned to the main, and condenses as water, there being insufficient heat to decompose the steam, so that liability to surreptitious production of water gas, and its concomitant, carbonic oxide, is not imminent.

Again, so small a quantity of water cannot materially affect the temperature of the gas, and naphthalene deposits, which were with some reasonableness anticipated, have not appeared.

With us much trouble is experienced, in purification, from the nature of our water. Containing, as it does, a large percentage of lime, a calcareous deposit results from its union with the sulphur in the gas. This limey product accumulates very rapidly in the chambers and overflow of the washer.

We apprehended the most serious objection to the use of water in our stand-pipes, fearing a deposit that would be even more refractory than the tar; but the incrustation, if any, forms so slowly that we have, as yet, been unable to find it.

After a six months trial of this method of relieving our pipes, we can find nothing that militates against it, and have adapted it to all our benches. The change in the retort-house is marked. Fourteen lids off in five hours—a wood fire burning around two stand-pipes; melting milesians ramming red-hot irons down from above in others, encouraged by all that official vituperation could accomplish—was a typical morning's experience in May last. Now, with tar fires burning off from 1600 to 2000 feet in five hours, lids are never removed except for drawing the charge. A Sabbath-like quietude pervades the retort-house between charges, and the necessity for professional expletive no longer exists.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

So far as all classes of round coal are concerned, the supplies coming into this market are considerably in excess of the demand, and there is no indication that they will be anything else than abundant for some time to come, as the means of production are now so great that it would require a very much larger increased consumption than there is at present any prospect of, to absorb the output of coal which the Lancashire collieries are capable of producing. At present a good deal of short time is being worked, but this does not prevent the accumulation of heavy stocks, and prices have now reached so low a point that colliery proprietors are unable to make further concessions, although buyers who are in the position to take off large quantities promptly are able here and there to purchase at under current figures. The average selling prices at the pit mouth are now about 8s. per ton for best Wigan Arley, 6s. to 6s. 6d. for inferior sorts and Pemberton four-feet, and 5s. to 5s. 6d. for the common Wigan mines. A few inquiries are cropping up for gas coals, but there is nothing yet doing to test the market, and only a rough guess can be given at prices. For the better classes of Lancashire screened gas coal about 8s. per ton at the pit would probably be asked, with inferior sorts ranging as low as 6s. per ton. Any improvement in the coal trade is entirely confined to engine classes of fuel, and with regard to these there is generally a firmer tone. Slack, which of late years has gone more largely into consumption owing to altered boiler appliances, is in good demand, whilst supplies are short in consequence of the small quantity of round coal now being screened, and fully 3s. 9d. to 4s. per ton is asked for good sorts at the pit mouth; whilst many consumers having now to fall upon burgy, this class of fuel is better to dispose of, and 4s. to 4s. 6d. per ton is about the average price for good qualities at the pit mouth.

In the shipping trade there is very little doing, although a few more inquiries have been coming to hand within the last few days.

In the iron trade there has been a very depressed tone, with a decided downward turn in prices. Local makers have found themselves unable to

stand against the lower prices ruling in other markets, and during the past week list rates for Lancashire pig iron have been reduced to 65s. per ton, less 2½ for delivery into the Manchester district, whilst 2s. 6d. per ton below this figure would not be refused if good orders were offered. All descriptions of finished iron are also easier, Lancashire bars being now obtainable from makers at about £8 per ton for delivery into the Manchester district.

The leading firms amongst the local engineers, machinists, and founders are reported to be fairly employed.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

There was not any improvement in the trade of these parts last week. Prices are by an effort prevented from receding. The steam coal trade, notwithstanding the fact that the Baltic is now open to business, was flat, and, with some exceptions, the collieries were for a time busy. Loading turns were short. A pretty good business was transacted in best gas coals. Cargoes were shipped over sea. Prices remain unchanged. The demand for second-class gas coals is falling off. There has been an improvement to note in the shipments of coke to the Mediterranean and the Baltic. Prices are, however, off and on, about the same; but coke manufacturers are more keen of business than they were a month ago. It may be reported that the market is well supplied with all sorts of coals; that any prospect of establishing an advance in prices was less hopeful last week than the week before; and that the "golden age" to coalowners—of large advances in prices—is, and is likely to long remain, a dream of the past. The coal market of the North of England is void of every element of speculation, and a quiet, humdrum sort of business is doing.

The iron markets of the North showed a tendency to lower rates last week. The shipments of iron to the United States are getting less.

The demand from the Continent, before noticed, of material for the renewal of furnaces, &c., is still continual. The shipments of fire-bricks and fire-clay goods are pretty general to most of the European ports. The demand for chemicals, of which so much was expected from the United States and Europe, is disappointing, and the Newcastle chemical market was very bare of orders last week. Prices could hardly be upheld.

The coasting freight market is represented by 4s. per ton steamers to London, 7s. sailing ships to the North of France, and from 6s. to 6s. 6d. to the English Channel ports, all to load gas coals. There was an abundant supply of handy coasting vessels last week, which were difficult to place. The shippers had the command of the market.

The value of lead, spelter, and metals of that description, showed a slight improvement last week. But it was very little. There was a large delivery of lead in pigs on the Tyne from Spain. As regards goods of that kind (red and other lead included) the period of inflation is over. Business is working back to a normal state, and it is fully anticipated that these goods will realize their nominal value and no more.

TAMPERING WITH A GAS-METER.—At the Ayr Burgh Court, last Thursday, Bailie McLachlan on the Bench, John Christie, manufacturer of aerated water, residing in George Street, Wallacetown, was charged, under the Sales of Gas Act, 1839, with having tampered with his gas-meter so as to defraud the Newton Gas Company. He pleaded not guilty, but was convicted on evidence, and sentenced to pay a fine of 10s., with £2 of modified expenses, with the alternative, in default of payment, of fourteen days imprisonment.

APPLICATIONS FOR LETTERS PATENT.

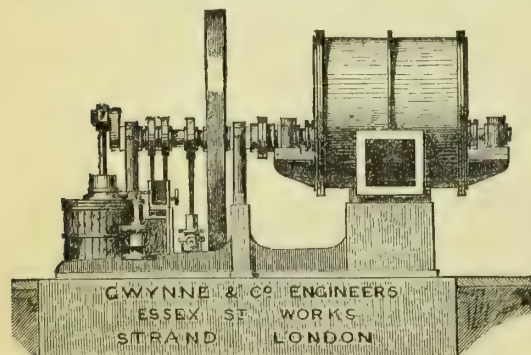
- 1456.—LOWE, C., and GILL, J., Manchester, "Improvements in the manufacture of certain coal tar and residual products." April 9, 1880.
- 1461.—BOULNOIS, H. P., Exeter, Devon, "Improvements in the means of effecting absorption of noxious sewer gases." April 9, 1880.
- 1476.—JENSEN, P., Chancery Lane, London, "Improvements in the production of light and heat, and in apparatus for same." A communication. April 10, 1880.
- 1478.—MANN, W., Gunnersbury, and WALKER, W. T., Highgate, London, "Improvements in apparatus for the purification of coal gas." April 10, 1880.
- 1492.—SHANKS, J., Barrhead, and SIM, W., Glasgow, N.B., "Improvements in water-closets, and in valvular apparatus for the same, and applicable otherwise." April 12, 1880.

The **GRAND MEDAL of MERIT** at the **VIENNA EXHIBITION**, **TWO MEDALS** at the **PHILADELPHIA EXHIBITION** and **TWO MEDALS** at the **PARIS EXHIBITION**, have been **AWARDED** to **GWYNNE & CO.** for **GAS-EXHAUSTERS, ENGINES, and PUMPS**; Also **27 OTHER MEDALS AWARDED** at all the **GREAT INTERNATIONAL EXHIBITIONS.**

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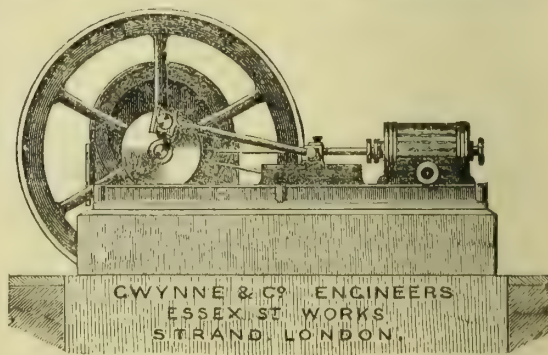
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52,500 EXHAUSTER, with Horizontal Engine combined.

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TO CORRESPONDENTS.

J. M.—*Such a proceeding would be decidedly illegal.*
A SUBSCRIBER (Lancashire).—"No notice can be taken of anonymous communications." To this rule we do not make any exception. If you will send your name and address (not for publication), an answer shall be given to your queries.
No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 27, 1880.

Circular to Gas Companies.

THE Metropolitan gas world still remains in a state of quiescence. It is natural that it should do so, considering the prosperous condition of all the Companies. The sliding scale has worked so well that those undertakings which share its advantages are now paying a considerably enhanced dividend over that previously enjoyed. The London Company alone pay a mere ten per cent., when, by amalgamation, the Shareholders might receive at the present time at least another one and a quarter per cent. We confess that we do not understand the policy of this Company. Nothing has been more clearly proved than that combination improves the circumstances of every Company joining with others in the supply of gas. If the London Company had availed themselves of the opportunities offered, their Shareholders might at this time be receiving eleven and a quarter per cent. Still, we must acknowledge that there are some who prefer what they call a "safe" ten per cent. to the additional advantages which might be gained by a resort to the sliding scale. In the case of the London Company, the ten per cent. is perfectly safe; but, after all, it must be remembered that before many years are over it will be necessary for them to go to Parliament for more money, and then we know what will happen. The measure they now have before Parliament does not, as our readers know, make application for additional capital; so for the present, and for two or three more years, the London Company will be free to make a safe ten per cent. Presently, perhaps, the Shareholders will become alive to the advantages of the sliding scale, and put some pressure upon the Directors, and induce them to seize a chance which will enable the Proprietors to participate in some of the benefits which

have accrued from the new order of things. We imagine we see signs that such a movement is not far distant. There were ominous hints thrown out at the last meeting of the Company, and other matters showed that the Directors might not be averse to the dissolution of the Company, if only a good opportunity presented itself. This opportunity may any day be afforded, and we are perfectly certain that no single Proprietor in the Company would regret the circumstances which brought it about. It certainly does seem deplorable to see a Company like the London lag behind, and not avail themselves of the advantages which modern gas legislation confers. We have said that the opportunity of combination might easily be found. The Company have been wooed on both sides of the water. They may unite with the Chartered, unless we are greatly mistaken, or they may combine with the South Metropolitan. We shall not presume to indicate in which direction their choice should lie; but this we may say, that union of some kind is essential to the welfare of the Company. Whether a northern or a southern combination would best conduce to the interests of the Proprietors, we must leave the Directors to determine; but we regard combination on one side or other of the river as essential to the best interests of the Company.

The electric light does not progress much in the Metropolis. The Société Générale d'Electricité recently made proposals to the St. James's Vestry (Westminster) to light up Regent Street, at a cost of 2½d. per lamp per hour. When, however, the Vestry examined the matter, they discovered that it would land them in the expense of laying a three-inch tube from the Charing Cross bridge to Regent Street. The expense of the new light, the Vestry have calculated, would have brought upon them a charge of £18 15s. per annum for each lamp which now costs them £3 ls. 4d. Little profit is likely to be obtained from a speculation of this kind, and we are by no means astonished that the Vestry have declined the Electric Light Company's tempting offer, conveyed through their Engineer, M. Gaudet. That gentleman must go where money is more freely expended, if, indeed, expended at all, and light the streets of Teheran on the credit of the Shah. It is wonderful to read that Mr. Edison has thrown up the electric light business, and gone off to California to extract gold from poor quartz; but there is a great deal to be done in this direction, and we have little doubt Mr. Edison will return to Menlo Park a richer man than if he had remained there and continued making carbonized paper horseshoes. In the meantime, other inventors will find an ample field for the exercise of their ingenuity. Mr. Edison having abandoned the business, leaves a fair field and "no favour" open to every one who is disposed to try his hand at the electric light. It is curious to see how few of the inventions have established themselves in the Metropolis. The Jablochhoff and Siemens systems appear to be the only two that have satisfied public opinion. These may be said to have to a certain extent established themselves in popular use, the former especially so. We shall, no doubt, presently be flooded with inventions; but "sufficient for the day is the evil thereof." The electric light will continue to exercise the ingenuity of mechanical inventors, who will, no doubt, in time, succeed in making it some sort of success—a success, perhaps, superior to that of M. Jablochhoff; but we shall probably have to wait a long time before this is effected. What the Brush system may do when it comes to England we cannot tell; in America it seems to have had a great success. And perhaps the invention of Mr. J. M. Bois, who proposes to utilize the force of the Lower Falls of the Genesee River at Rochester, N.Y., will assist in extending its employment, and show that tidal rivers can be used in all countries to produce force. But the force generated by these falls is not intended to be employed exclusively for driving machinery for the production of the electric light. It is designed to supply motive force to all the machinery in the city, including the tram-cars. This will be effected by means of a supply of compressed air, which will furnish the motive power, and at the same time distribute the force. We rather regret that compressed air is not more extensively used in this country. It might, we think, be economically employed in preference to steam or hydraulic power for the actuating of gas stoking machinery.

We publish to-day our usual abstract of the accounts of the Paris Gas Company. These, it will be seen, are presented in a form which greatly differs from those of our large Companies. Perhaps the accounts of the Manchester Corporation most nearly resemble them, but those of the Paris Company embrace a greater variety of detail, set out with much precision. The growth of the business of the Company since they obtained their concession has been little short of mar-

vellous; in the course of twenty-three years the consumption of gas having more than quintupled. When it is remembered that this large increase in consumption has not been brought about by any reduction in price—for gas in Paris is dear, and the Company do not reduce their charge—and that Paris does not grow with anything like the rapidity of our own Metropolis, we come to the conclusion that gas in the French metropolis is regarded as a necessary of life. In proof of this we may instance the continually increasing consumption for other than illumination purposes. Every year adds largely to the sale of heating and cooking appliances, and further to the disposal of gas-engines for the production of mechanical force. It is astonishing to see the large amount of gas consumed in Paris for this latter purpose. We wish we could get some idea of the quantity consumed in London for the same object, but only roughly approximate returns would be obtainable. Going out of our way for a moment, we may refer to the fact that some of the Syndical Chambers of Paris are agitating for a reduction in the price of gas; but, seeing that by an arrangement with the Municipality the Company share equally with them all the profits which accrue in excess of those sufficient to pay the Shareholders ten per cent., we do not think they are likely to succeed in obtaining a reduction. From the Company they might; but from the Municipality—never! Coke has been a difficulty in Paris, as everywhere else; but the Company appear to have cleared their yards by selling at very low prices. The loss on this residual is, however, to some extent compensated for by the considerable profits made on manufactured products. This result should encourage the Chartered Company, who, we believe, are succeeding well with the treatment of residuals. We do not, however, know exactly what they are doing, beyond the fact that they distil tar and manufacture sulphate of ammonia. Presently we hope they will imitate the Paris Gas Company, and commence the manufacture of artificial fuel, for which they must find a readier sale than their neighbours across the English Channel. The Company's artificial fuel-works have been in operation since 1873, and have brought them a very large profit, but nothing like what might be made by the Chartered Company at Beckton, if they undertook the business. Let us sum up. The total expenditure of the Paris Gas Company for the year reported upon was £1,790,000, and the receipts were £3,049,000; showing a balance in favour of revenue of £1,259,000. Adding the balance brought forward from the previous year, there remained a total of £1,263,000. Deducting the reserve to meet outstanding claims, there was a balance available for distribution of £1,256,000. Of this, after paying maximum dividends, a sum was left amounting to £760,000, divisible equally between the Shareholders of the Company and the Municipality. No wonder the Syndicates desire to see the price of gas in Paris reduced.

The sixth half-yearly meeting of the North of England Gas Managers Association was held at Newcastle-on-Tyne last Saturday, Mr. W. Ford, of Stockton-on-Tees, the President of the Association, occupying the chair. After the routine business had been disposed of, the Members and Associates took train to Jarrow, where, by the kindness of the Directors of the South Shields Gas Company, the new works were opened to their inspection. The centre of attraction was Mr. Warner's new stoking apparatus, which was at work, and the details of which were closely scanned. Mr. Warner read a paper on the subject, which was received with marked attention, and elicited considerable applause. The Members and Associates afterwards adjourned to the Railway Hotel, where an elegant repast was provided. Mr. Ford again occupied the chair, and was supported by the Mayor of Jarrow, Mr. Henderson and Dr. Armstrong, Directors of the South Shields Gas Company, and about sixty other gentlemen connected with the gas industry. Various suitable toasts were drunk, and a pleasant and instructive evening passed. A full report of the proceedings will appear in our next issue.

The more the use of gas is understood, the stronger becomes the interest of consumers in its employment, therefore we rejoice to see an eminent Engineer like Mr. W. Sugg going to Hull to deliver a lecture to the members of the Literary and Philosophical Society on the "Scientific Use of Coal Gas." The lecturer last Tuesday drew a large audience, and was listened to with great attention. Next week we shall probably be able to place the leading points of the lecture before our readers.

The Council of the Institution of Civil Engineers intimate that they have accepted, on behalf of the Students, an invitation from Mr. George Livesey, M. Inst. C.E., to inspect the works of the South Metropolitan Gas Company, Old Kent

Road, where a concrete gasholder-tank of large size is now being constructed. The visit has been arranged for Friday next, at three p.m., at which hour the Students are requested to assemble at the works.

In the first list of gold medals awarded at the Sydney (New South Wales) Exhibition, the closing ceremonial of which took place last Tuesday, we notice the names of three firms connected with the gas industry in England:—Messrs. George Glover and Co., Chelsea; Messrs. Beverley and Wyld, Leeds; and Messrs. Lloyd and Lloyd, Birmingham.

Water and Sanitary Notes.

It is quite certain that Mr. Cross's Water Bill is now dead. Whether it will ever be revived or not depends upon circumstances over which, at the present moment, perhaps no one has any control. "New men, new measures." We can hardly suppose that with the advice of Mr. Fawcett any attempt will be made to carry out the provisions of Mr. Cross's Bill. It is, as we have said, dead; and, admitting the fact that some change is absolutely necessary in the present Water Supply of London, it remains to be settled upon whom the new arrangements shall devolve. So far as we have at present any evidence, the members of the Metropolitan Board of Works seem perfectly insensible as to the financial position they will be required to take. They are now made perfectly acquainted with the terms of purchase which the Companies will accept, and which have been looked upon as binding. The Government which has just escaped from office can never revive Mr. Cross's projected measure. It has gone over to "the majority," and there it will remain in limbo. Truth to say, Mr. W. R. Selway, at the meeting of the Metropolitan Board of Works last Friday, showed but little reason for any interference in Metropolitan water affairs. He candidly admitted that the Thames and Lea, although not perfectly satisfactory sources of supply, might be accepted as not unwholesome ones. We fail to see that much better sources could be found within any reasonable distance around the Metropolis. Chalk water is, of course, to be found within the Metropolitan area; but, apart from that, a full supply for the whole or half of the Metropolis is not to be expected. Say what we will, the water of the Thames and Lea must be resorted to for a continuous supply. It can always be relied upon, and the water is singularly constant in quality—no mean recommendation. We have spoken of Mr. Cross's Bill as lost, but there can be no reason why it should not be revived, and the late Government valuator, Mr. E. J. Smith, in a letter to Mr. E. J. Watherston, published in *The Times*, shows excellent reasons why, in the interests of the ratepayers, the Bill should still be carried through. He calculates that a large immediate saving will be effected, which will leave a surplus of profit available for public purposes; that this surplus will increase annually by substantial increments; and that at the end of twelve years the Metropolis will practically obtain the works for nothing. Under these circumstances, we say that as the Companies are satisfied with the bargain they have made, why should not the ratepayer be with the bargain made for him? It was made in all good faith and sincerity, Mr. Cross being anxious to do his utmost in carrying out the purchase.

Nothing, we fancy, is likely to come of any proceedings the Metropolitan Board of Works may be induced to take relative to the Metropolitan Water Supply. Their failure was so conspicuous when they before attempted to duplicate the supply, that we can see no reason for a belief that they will succeed better this time. Everything, of course, depends upon the view Her Majesty's new Government may take of the matter. It must be expected that for this year, at all events, they will not find time to go into the question unless they take Mr. Cross's Bill as it stands, hurry it through the preliminary stages, and send it to a Committee. Even then the deliberations of the Committee must be so prolonged that with the utmost diligence it will be found difficult to pass the Bill before the next prorogation. We have as yet had no decisive announcement of the desire of the ratepayers with respect to the water supply. We know they want a change, but perhaps they themselves hardly know of what that change shall consist. The quality of the water is impugned; and, strange to say, although a much more liberal supply is given than is furnished to almost any other town in the kingdom, complaints are made of a deficiency in quantity. On this score, however, the Companies are entirely free from blame. The Metropolitan Board, if they came into possession of the works to-morrow, could do no better. To remodel the water supply of the Metropolis would require active exertions extending

over at least ten years, and would cost many millions of money, which the Metropolitan Board might find some difficulty in raising. Putting all things together, we are inclined to agree with Mr. Runtz in thinking the Board had better leave the matter alone, and allow things to follow their own course.

The Glasgow Corporation Water-Works are not highly profitable; still, they bring a clear gain to the Corporation, which, however, is not large. The estimates for the current year will be found in another column, from which it will be seen that the Sub-Committee on Finance calculate upon having a surplus for the year 1880-81, after paying all charges, and setting aside £24,525 for a sinking-fund—being at the rate of one and a half per cent. upon the amount of money borrowed. The current rates of eightpence in the pound within, and elevenpence in the pound outside the limits of compulsory supply, are to be continued, together with a public water-rate of one penny in the pound.

The indebtedness of Local Authorities increases at a rather alarming rate. The Rochdale Corporation having borrowed £499,300 for water-works and sewerage purposes, now desire to raise further money to the extent of £75,000, making over half a million. An evident desire is exhibited to shirk, if possible, the formation of a sinking-fund. There are people in Rochdale who share the views of Alderman Chamberlain, of Birmingham, and think that when Corporations borrow money it should remain a permanent debt, owing by all posterity. There is something to be said on this side of the question, but Parliament does not share the view. Rochdale will, no doubt, get an extension of time before they are compelled to commence their sinking-fund, but we imagine that a commencement must sooner or later be made.

An alarming outbreak of typhoid fever, which has occurred at Perth, is ascribed to an irruption of the unfiltered and polluted water of the Tay into the pipes conveying water about the town. An investigation has been ordered, and samples of the water have been sent for analysis; but after all this trouble has been taken we may possibly be told that the outbreak came of infected milk. At all events, it appears that over four hundred of the inhabitants are laid up, and require the attendance of some eight doctors. Here is a chance for an enterprising correspondent to write to the newspapers that the cause of the death of the victims of the Tay Bridge disaster was sewage poisoning; but then we may refer them to the case of the Munich doctor we lately noticed, who cured a number of his patients by administering to them the filthiest of concentrated sewage.

INDUSTRIAL NUISANCES.

It is a matter for much regret that so many of the industrial enterprises of the age should be subject to the charge of injuriously affecting the health of the community, or of the parties more immediately connected with these undertakings. There seems to be something anomalous in the circumstance that wealth and wages should thus aggravate the sicknesses of mankind, and shorten the duration of human life. There is, indeed, a brighter side to the question, and one which seems to carry with it the lesson that it is not the trade which kills, but the blunders which are committed in carrying it on. The primary consideration is to get a profit. The sanctity of human life appears as a subordinate consideration. First of all, there is the industry—whether mining, manufacturing, or trading. Secondly, there is the nuisance, either in the form of conditions unfavourable to the habits of those engaged in the work, or hurtful to others dwelling in the neighbourhood, and possibly injurious to both. Thirdly, we reach the stage at which the sanitary evils have arrested attention, and efforts are then made to reconcile the interests of trade with the rules of health. England has struggled into the third stage, and a striking illustration of the condition of things is afforded by the reports which embody the researches of Dr. Ballard on what are called “the effluvium nuisances arising in connection with various manufacturing and other branches of industry.” These reports have their place in the annual volumes of the Local Government Board, and in the Blue-book just issued by that department the inquiry appears to have come to an end.

From his concluding remarks, we learn that in the course of his investigations, commencing in 1875, Dr. Ballard has visited more than 850 separate trading establishments, distributed over nearly all parts of England and Wales, and a few of them in Scotland and Ireland. In very many of these establishments, if not in the majority of them, more than one offensive process was being conducted. Dr. Ballard states, as worthy of special notice, that only on five occasions has he been denied the privilege of examining any works which he

desired to inspect. The works which were thus closed against the Government Officer were of comparatively small magnitude, and the denial was susceptible of explanation on the ground that either the proprietors had within a recent period been prosecuted for nuisance by the Local Authorities, “or” “had been irritated by the injudicious interference of their” “technically uneducated officers.” In all other instances Dr. Ballard, when he had explained his object, was welcomed, the proprietors or the managers conducting him through their works, and taking “infinite pains” to explain the details of their processes. These parties freely, and in some cases repeatedly discussed with Dr. Ballard, in the most unreserved manner, points of leading importance as relating to his inquiry. Such testimony shows that the parties who are carrying on these industries either have confidence that they are already doing their best to conduct their trades without offence, or are ready to adopt any reasonable plan for mitigating or remedying such evils as exist.

The scope of the present report is a wide one, and the report itself is extensive, occupying not far short of three hundred pages. The manufacture of coal gas comes under review, the special features attended to by Dr. Ballard being illustrated by the aid of photography. This portion of the inquiry will be treated in our columns in a separate and distinct form, and will not be further adverted to now. What is called the “manufacture of horsehair” furnishes a curious chapter. There is the horsehair proper, obtained from the manes and tails of the equine race, in addition to which there is cowhair and pig’s hair. These materials are manipulated at sundry establishments, so as to be fitted for various purposes, such as the manufacture of horsehair cloth or seating, the stuffing of chairs, and the production of brushes. The manes and tails of horses are obtained from England, South America, Australia, and Russia. The best horsehair comes from English stables, and the dirtiest pig’s hair is from Germany. A lamentable danger exists of fatal disease being communicated by the dusty matters given off when hair is infected with what is called anthrax, or Siberian plague. The principal source of danger, as implied by one of the designations, exists in the use of Siberian manes. The risk in this respect besets the workpeople at every stage up to the time when the hair arrives at the dye-vat. The infected dust is even capable of carrying the disease to parties outside the works. Evidence to this effect is afforded in a report by Dr. Russell, the Medical Officer of Health for Glasgow. The dust collected in the dusting machine is sometimes transmitted to a distance to dealers in manurial matters, doubtless with risk to the parties thus concerned. It is further suggested that some of the mysterious cases of blood poisoning, occasionally met with in London and elsewhere, may be due to poisonous hair-dust. It is some comfort to know that the dyeing process, owing to the heat employed and the materials used, affords a complete disinfecting process. Otherwise serious suspicion might attach to sundry articles of furniture.

A kindred subject to the above is afforded by the rag and bone industries of our large towns. We are reminded that in London the rag and bone shop is not always content to hide itself away in a back street, but, in some instances, comes to the front, so as to be seen in large thoroughfares. Metropolitan marine store dealers not only purchase, store, and retail old metal of any kind, glass bottles, crockery, and the like, but almost any description of domestic refuse, including grease, bones, and rags. Peculiar peril attaches to the rag business, and we should expect to find that the mortality among these traders was especially high, though we are not certain as to the figures. The marine-store dealer seems to revel in old clothes and discarded shreds. It is chiefly with these that he blocks up his front shop, his back parlour, and the yard outside. Then there is the odious fat, the indescribable kitchen-stuff, and the grease of all descriptions, together with the mouldering bones, all combining to create a deadly smell, which, when the house is closed at night, would seem enough to kill the inmates. To the public the rags are especially obnoxious. These come from all quarters, are brought without any sanitary considerations to govern the transaction, and, doubtless, in many cases, abound in “germs,” or whatever else may be supposed to constitute the proper vehicle of infection. Such “stores,” we are told, must be a constant source of danger to “lodgers” and passers-by, especially when dust, arising during the sorting of the rags, is carried by the wind outside the house. We may bid the public, “Beware of the black doll.” It may seem almost ludicrous, but it is no less lamentable, that on one occasion a coroner’s jury in St. Giles’s declared in their verdict that the death of a man was accelerated by the foul effluvia from a rag and bone shop next door.

Bye-laws from the Metropolitan Board and the Urban Sanitary Authorities are to be our protection against the marine store dealer. But who is to protect us when the Urban Sanitary Authority itself goes wrong? Dr. Ballard denounces the dust-bin, the dust-cart, and, more or less, the dust-yard. The "Authority" itself has its rags, its bones, and its marine stores. We read of "offensive heaps of town refuse," examples being given at Plymouth, in 1875, and at Lancaster, in 1876. We have a graphic picture of a London dust contractor's yard, and the dust-yards appertaining to the Vestries, when the latter undertake—as some of them do—their own "dusting." We are told of the "soft core" and the "hard core," as well as the "breeze," and the ashes. The manipulation of the refuse is an offensive process, and has in some cases led to legal proceedings. Nauseous odours are given off, and unwholesome dust flies about. Of the latter we have a notable instance in respect to the dust-yard which sent unsavoury particles into the reservoirs of the Southwark and Vauxhall Water-Works Company some years ago. The nature of the material, says Dr. Ballard, was "indefinite," but at any rate it "might" have contained something infective. The London "dusting" is a big business. One contractor, having a wharf in the Paddington Basin, stated in a recent trial that he alone sent away by canal 57,000 tons of refuse in a single year.

Brick-burning is a nuisance which haunts the suburbs of London. It is necessary to have bricks, if houses are to be built; but, if we could have the bricks without any preliminary nuisance, it would make life happier to a good many people. Dr. Ballard goes into the mysteries of clamp burning and kiln burning, introducing us to the nomenclature of "cutters," "yellow seconds," "pickings," "paviours," "common stocks," "grizzles," and "place-bricks." This is a descending scale, and we should like to know exactly what kind of article a "place-brick" can be, as well as the reason why it has such a semi-political designation. London has the ill luck, or the good luck, to have a quantity of brick-earth round about it, and this, we presume, facilitates building operations which are so rapidly swallowing up market gardens and fields. A great part of London has passed through the pug-mill, and the "outer ring" is growing by virtue of the same process. Brick-burning is recognized by Dr. Ballard as a very common cause of nuisance, burning in clamps being especially offensive. "About London," it is stated, "in new neighbourhoods where brick-earth is dug on the spot, and bricks are made for use on the spot close to inhabited houses, the nuisance is notorious, and has frequently given occasion to legal proceedings being taken to bring about its suppression." Volatile empyreumatic matters of organic origin, "probably in some variety," combine to create the offensive odours chiefly given off in clamp burning, and this element of offence varies with the nature of the clay. It happens that the London and Kentish clay is particularly disagreeable in this respect, and matters are made worse by the dreadful rubbish mixed up with the fuel. Clays of the older geological formation can be burned without offence; but, despite the defects of the raw material, there would be a vast improvement in the state of things round London if a suitable kind of fuel were used. Another nuisance consists in the burning of stiff clay into what is called "ballast." Where building operations are going on, the clay that is dug out is burned into the condition of "ballast," in order that its removal may not be the occasion of pecuniary loss. Where an estate of several acres is being covered with buildings, the production of "ballast" is a somewhat important piece of economy. Some care, however, ought to be taken to avoid the infliction of a nuisance on the people who have been tempted to take up their abode in the suburbs, hoping to breathe a purer air than is to be found in the heart of London.

Dr. Ballard might have said something about the pungent vapours given off during the burning of weeds, a species of suburban nuisance almost equivalent to the burning of bricks in clamps, or the production of ballast. There is also the travelling furnace of the locomotive, which of late years has plagued many a pretty spot with smoke made "stickable" with steam. But these are subjects probably outside his ken, and Dr. Ballard certainly finds abundant material while keeping within the letter of his instructions. The smoke nuisance presents itself very forcibly in relation to the manufacture of Portland cement. The effluvia from cement works is partly that of ordinary coal smoke, but complaint is especially made of an odour, more or less powerful and offensive in its character, resembling that which arises from clamp brick-burning about London. Cement works generally throw out large volumes of smoke and vapour, sufficient to cloud the air and

obscure the view, and sweeping at a low level over a considerable tract of country. At Southampton, persons residing at least a mile from the works were found to complain of the nuisance quite as much as, or rather more than those dwelling in the immediate vicinity. Dr. Ballard states that a medical man, whose testimony he can implicitly rely upon, and whose practice is extensive enough to include Northfleet, where some of the largest cement works in the kingdom are situated, and where the atmosphere is commonly charged with the emanations from the works, has noticed, since the establishment and extension of these works, "a marked deterioration in the general health and aspect of the population." The people do not, he says, as was formerly the case, bear the robust appearance of country labourers, but are generally pale and pasty-faced, and diseases have altered to a lower type than was customary when first he knew the place. This gentleman adds that the depression of health which he has observed is greater in extent than would be accounted for by the other conditions which have been associated with the increase of the population in the thirty-five years during which he has known the neighbourhood. Nevertheless, the cement trade, in common with others, has its capabilities of improvement, and in various parts of the kingdom the nuisance is being abated.

Potteries are well-known sources of annoyance. There is not only smoke from the fuel, but there are acid vapours from the process of salt glazing. Still, it is found perfectly practicable to reduce the smoke nuisance in a very considerable degree, and proof to this effect is afforded by a change for the better in the air of the pottery towns in North Staffordshire. Lime-burning gives off smoke and poisonous gases. The manufacture of coke and breeze does much to load the air with smoke and fumes. Mr. J. Lowthian Bell computes that, in addition to the smoke, the coke-ovens in the county of Durham annually discharge into the air between 60,000 and 80,000 tons of sulphurous acid. This occurs not generally in the county, but in sundry limited areas where the industry is carried on, and where the nuisance is therefore concentrated. The breeze-ovens in the neighbourhood of Dudley are especially guilty of producing smoke. In fact, we are told, "These ovens, for their size, produce more smoke at a low level than any other business carried on in the Black Country." The burning of "spoil banks" in the colliery districts adds to the general pollution of the atmosphere. The firing of these banks is said to be often spontaneous; but whether this be so or not, the annoyance produced is no small matter. The smoke and fumes are described as "copious, very disagreeable, sulphurous, and suffocating." When the heap is near the dwellings of the people, the nuisance is sometimes such as to render the houses quite uninhabitable, if the wind brings the smoke in that direction. "Under such circumstances," says Dr. Ballard, "people have had to get up in the night and leave their houses."

We might pass through a long list of trades accused of creating nuisances, but for the present we cannot go into the details relating to them. Thus we have brought before us the manufacture of sulphate of ammonia and sal ammoniac, the distillation of tar, the dipping or varnishing of iron pipes, the manufacture of artificial or patent fuel, of asphalt, of lamp-black, of carbolic acid, of aniline, and of aniline colours, as well as the distillation of oil shale, the preparation of paraffin, the manufacture of sulphuric acid, of salt, of alkali, of bleaching powder, and of glass, together with the calcination of ironstone and tap cinder, the calcination of arsenical ores and the refining of arsenic, copper smelting, lead smelting, the refining of gold, and numerous other processes. A wide range is thus travelled over, and many of the facts are very interesting. Upon the whole, the review is a hopeful one. If a hundred years hence all the trade nuisances which now exist in England are fairly got rid of, and no new ones arise to take their place, the reader who happens to live in that happy period, and gets hold of these reports, will be led to wonder how people endured the state of things thus portrayed. Certainly, human existence is not altogether so pleasant as it ought to be in the midst of the civilization of the present age, and thousands of lives must lose their due share of enjoyment through the presence of evils which only require for their removal a reasonable amount of care and expenditure. In other words, our current civilization is partial, and needs development in certain neglected particulars. We have killed off the wolves, and pretty nearly extirpated the highwaymen; but we have set up smoky chimneys, and scourged the country with chemical vapours, whereby we have grown rich on the one hand, and impaired the sources of enjoyment on the other.

WATER ANALYSIS.

The recent publication of Dr. Frankland's convenient little volume on this subject;* the important memoir by Dr. Tidy read and discussed last year before the Chemical Society, and published in its *Journal*;† and the volume published as long ago as 1868, and now appearing in a fifth edition, by Professor Wanklyn and Mr. Chapman,‡ in which Dr. Frankland's title was anticipated, contain the literature of a subject which has of late years assumed extreme importance, but concerning which there is a haze of mystery and obscurity that assuredly ought not to exist. It is certainly very much to be regretted that there is no common and recognized method of procedure in this department of chemistry, but it is almost discreditable that not only are the results of analyses given in discordant chemical expressions, but even the figures are not in the same terms, so that a comparison of results is impossible without performing an arithmetical operation. So long as one chemist expresses his results in 100-1000th parts, another in grains per gallon, and a third in milligrammes, or parts in a million; while one estimates ammonia as a total, another separates free from organic ammonia, and the third regards the quantity of what is called albumenoid ammonia as of vital importance; while one adopts the combustion or evaporation method to determine the actual quantity of organic contents of water, and another accepts the permanganate method to discover the quantity of oxygen required to oxidize the organic matter present; it is evident that the comparison of analyses effected by the pupils of the various schools cannot be satisfactory or conclusive, because they cannot be compared. Surely the time has come when methods of analysis giving the quantity of organic carbon and nitrogen and its condition or history in some intelligible form, the quantity of nitrogen as nitrates, the quantity of chlorine, and the hardness, in similar terms, should be so far agreed upon that results can be compared, and those who are not chemists will then be able to form some opinion as to facts. We believe all our most distinguished chemists would agree that this is possible. It only needs that each should give way in some matters that are not essential, but rather belong to the individual. Dr. Tidy well and properly observes in his paper (*Journal of the Chemical Society*, Jan., 1879): "I am afraid the public have taken note and are taking note of chemists' differences, and distrust our work accordingly. Nor indeed is their distrust to be wondered at, deeply as it is to be lamented."

In Dr. Frankland's book we find stated, in a compact and convenient form, the requirements of a water analysis, and in an appendix examples of typical analyses. He begins by pointing out the fact that complete and ultimate analyses are by no means called for in ordinary cases. He points out the unimportance, in a sanitary sense, of the dissolved gases, which vary but little in waters of very different kinds, and of which the presence of a smaller or larger quantity does not affect the goodness of the water; the difference, in fact, lying chiefly in the quantity of carbonic acid. The separate estimation of the quantity of each of the saline matters and of each organic constituent of the suspended matters, may in like manner, and for the same reason, be omitted. The processes adopted to determine the quantities of inorganic solids, the ammonia, the chlorine, the nature of the hardening ingredients, and the presence of poisonous metals, if any, are those which are really important, and a knowledge of them and of the amount of nitrates, and lastly, but of chief importance, the means of estimating approximately the proportion of the organic elements in a sample of water, are the objects to which attention is really required, and to the elucidation of which the volume is dedicated. Professor Frankland considers that there is no process, short of the actual combustion of the organic matter present in water, which affords thoroughly trustworthy evidence of the organic carbon and nitrogen, and of the fitness or otherwise of the sample for dietetic purposes. The "ignition" and "albumenoid ammonia" he merely mentions, and evidently disregards. The former is described by Dr. Tidy in his memoir, and he considers it is not satisfactory, as failing to show that, in carrying out the process—(1) no organic matter is lost, (2) that all the organic matter is burnt off, and (3) that no organic matter is added. Notwithstanding this, he adopts it in the analysis of sewage, and thinks that in some respects it may be indicative, and suggestive in other cases. The ammonia process, described by Mr. Wanklyn as "a sort of combustion process, with ammonia for the ultimate product," has for its object the comparative determination of the nitrogenous organic matter by the quantity of ammonia yielded by the destruction of the organic matter, this quantity being called "albuminoid ammonia." (Wanklyn's "Water Analysis," 5th Ed., p. 31.) Dr. Tidy has considered in detail the advantages and disadvantages of this method, and has given some remarkable illustrations of its failure in important cases. He points out the very important fact that the quantity of albumenoid ammonia in peaty water is very large, although it has never been proved that such water is in any sense injurious; and, on the other hand, that in waters regarded by Mr. Wanklyn as exceedingly bad, the albumenoid ammonia is almost nil. For these reasons apparently, as he quotes Dr. Tidy's paper and gives no other reference, Dr. Frankland rejects them.

In the commencement of his work, following Mr. Wanklyn in this, Dr. Frankland describes the preliminary considerations in water sampling, the quantity required, and the tests that should be

applied to determine the presence of mineral poisons, the nature of refuse from manufactures, the action on soft lead, and the cause of turbidity. Having thus opened the subject, he proceeds to show in what way the total solids in solution can be best determined. To determine the organic contents, he prefers the combustion method. He describes the precautions required in evaporation, and believes that "the proportion of solid residue left on evaporation affords an approximate, though somewhat rough indication of the comparative purity of water." This, no doubt, is true in a certain sense, although it must not be concluded that waters showing a large residue are necessarily bad. It is with water as with many other things, we must be content with the best we can obtain under existing circumstances, and absolute purity is practically unobtainable. A tolerably good river water at hand is often better than deep well water or lake water from a distance, though theoretically superior.

In speaking of quality, Dr. Frankland adheres throughout to the strict technical use of the words "impurity" and "pollution," applying them to all foreign substances present in water. This is to be regretted, as they are eminently misleading when referring to the quality of water for ordinary purposes, and are certain to foster prejudices both unfair and mischievous. According to his use of these terms, all mineral waters, including those especially recommended for dietetic purposes, might be quoted as exceedingly impure, and loaded with polluting matter.

The determination of the ammonia is the next point considered. It is admitted that the actual quantity of ammonia present is, of itself, no guide to the purity of the water, as there are many cases of deep-well water in which the quantity is large, though there has been no access of animal matter. As, however, ammonia in water is very commonly caused by animal matter in a state of incipient decomposition, and is found in water polluted by sewage, in shallow well water, and in some cases in river water, the quantity present in a given quantity of water is regarded as an essential inquiry, and its presence is suggestive of evil.

Chlorine is present in water chiefly as a constituent of common salt, and this is so uniformly found in the liquid excrement of animals, that its presence in water is also to be distrusted. At the same time, a certain quantity is certainly washed out of the air and soil by rain, although the proportion of this is not constant. The quantities allowed by Dr. Frankland as due to these causes are 0.22 parts per 100,000 for rain water, 1.13 for upland surface water, 2.49 for spring water, and 5.11 for deep-well water. The history of the water must, therefore, be known before its value can be ascertained. It is evident that there are special cases in which these quantities are enormously exceeded without danger.

The estimation of nitrogen as nitrates and nitrites is not difficult, and may be effected in one of three ways. Each is described at some length in Dr. Frankland's book, and each has its own advantages. He prefers that which involves the decomposition of the salts into nitric oxide, and the measurement of the gas evolved.

The methods for determining hardness that are suggested involve nothing new, and they have been too often described to require notice here.

The method of determining organic purity by the use of permanganate of potash, originally suggested by Professor Forchhammer in 1850, approved by Dr. Miller and other eminent chemists, and brought into use by the late Dr. Letheby, has been perfected by Dr. Tidy, and appears to produce results so satisfactory, as compared with the combustion process, when carried on under the most favourable conditions, that Dr. Frankland admits its usefulness and general accuracy in waters of moderate purity. It is elaborately described by Dr. Tidy in his memoir, and its advantages are discussed. The prominent objections to the combustion process, which is still regarded by Dr. Frankland as the only secure method of determining the organic elements, will also be found fully stated in that memoir.

It must not be supposed that the analytical determination of the foreign substances present in water is sufficient to justify a conclusion as to the quality of the water without a due consideration of all circumstances, not only those indicated by the association of the elements, but those under which the water has or may have acquired them. No chemist, however able and intelligent, is justified in giving an opinion as to water submitted for analysis without knowing the history of the water, except, of course, where there are definite poisons present which enforce an absolute condemnation.* Neither the ammonia nor the nitrogen, neither the salt nor the hardness, may be regarded alone, without reference to this history. Thus it is that while mere analysis is easy, the estimation of waters for sanitary purposes must always require very great judgment as well as long experience.

Dr. Frankland gives in an appendix a number of typical analyses of waters of various kinds and of various qualities. Adopting a classification suggested originally by Dr. Parkes, and modified by Dr. Tidy, he groups all waters into two sections—upland surface waters, and waters other than upland—and each section he divides into four classes—viz., waters of great purity, of medium purity, of doubtful purity, and of no purity at all; determining the value in each case by the permanganate process. This classification may be useful in some cases, but it is hardly of general application, inasmuch as "upland surface waters" is a very vague expression. The analyses given in this appendix are valuable, and are, we believe, chiefly

* It is well that this should be borne in mind by engineers and others who occasionally send waters for analysis with merely a number or other private reference. It is not fair to the chemist to require an opinion as to the goodness of water, without communicating its source and the circumstances under which it has been obtained. Generally the chemist should take the sample himself.

* "Water Analysis for Sanitary Purposes, with Hints for the Interpretation of Results." By E. Frankland, Ph.D., F.R.S., &c. London: Van Voorst, 1880.

† "The Processes for Determining the Organic Purity of Potable Waters." By C. Meymott Tidy, M.B. *Journal of the Chemical Society*, Jan., 1879.

‡ "Water Analysis: A Practical Treatise on the Examination of Potable Water." By J. Alfred Wanklyn, M.R.C.S., and Ernest Theophrastus Chapman. London: Trübner and Co. Fifth Edition, 1879.

quoted from the celebrated Sixth Report. We venture to suggest that they would be less liable to misconception if the estimate of what in this work Dr. Frankland still calls "previous sewage contamination" were left out. This expression is, no doubt, explained (see pages 95-98), as it has often been, and to those who understand the explanation it really means nothing that in any way affects the value of the water; but when we are told that rain water falling in London on Nov. 8, 1873, contained 1490 parts in 10,000 of this mysterious essence—that the deep-well water from the magnesian limestone contains, on an average, nearly ten times as much, and the upland surface water from the lower London tertiaries none at all, we confess to a feeling of wonder that so misleading a title should continue to be used in reference to waters whose real value for dietetic purposes is not, and cannot be, in the smallest degree, influenced by so ugly an expression. The term has been withdrawn from the official returns describing the state of the London water, and it would be well if it could be expunged from the literature of analytical chemistry.

We have already alluded to some of the reasons of Dr. Tidy for rejecting Mr. Wanklyn's "albuminoid ammonia" process, and have pointed out that they are fully recognized by Dr. Frankland. This method is, however, by much the easiest of all for determining the organic constituents, and for that reason is very widely adopted. It is described in detail in Mr. Wanklyn's volume already referred to, and one of the means of determination involves the precise comparison of shades of colour. A possibility of personal error is thus introduced, which detracts very seriously from the value of a method which appears in other respects to be doubtful in its conclusions. We are not aware that Mr. Wanklyn has replied to the objections to his method, but we observe that he still adopts it in his determination of the organic contents of doubtful waters. The best, easiest, and safest method of estimating organic matter is, no doubt, the great problem to be solved in water analysis; but as it is not agreed whether the combustion process, the permanganate or oxygen process, or the albuminoid process, is the right one,* it would seem reasonable that in all cases of dispute the analytical chemist on each side should be expected to give his results, not only in the way he thinks best, but also in the terms adopted by his *confrère*, and in such form that they admit of immediate comparison. If no other agreement can be arrived at, we may at least expect so much, and we think that in time it might be found possible to obtain, by common consent, a middle way that should satisfy all parties. At any rate, and first of all, there might be a consensus in the matter of arithmetic.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

PUMPING GAS AT BECKTON.

SIR,—You describe and illustrate very clearly, in the last number of the JOURNAL, the No. 5 exhaustor-house and machinery at Beckton. Kindly permit me to mention that the building, with its elaborate foundations and other accessories, for housing-in Messrs. Donkin and Co.'s exquisite engines and exhaustors, was designed and erected, in the usual routine, for this Company by me.

V. WYATT, Constructing Engineer.
The Gaslight and Coke Company,
Beckton, North Woolwich, April 22, 1880.

SIR,—In the JOURNAL of yesterday, which I received this morning, I observe there is an article on "Pumping Gas at Beckton for Distribution in London;" and it is therein stated that "it is believed to be the first instance of gas being supplied direct to the consumer by pumping." This, however, is not the case, for in 1876 this subject engaged my attention. The works of this Company at Linacre are situated some distance from Liverpool, and, in fact, are our local "Beckton;" and most of the gas made there is transmitted for distribution to other works in various parts of Liverpool by means of a large connecting-main, so arranged as to allow the gas to pass directly to the consumers. In consequence of the increasing demand for gas, it was decided to enlarge the power of this main by means of pumping machinery at Linacre, which I determined should be of such a character as to permit of the gas being sent directly from the exhaustors, or rather pumps, to the distributing mains; and in April, 1878, an order was given to Messrs. Gwynne and Co., of Essex Street, Strand, to erect two non-condensing single-cylinder engines, each having a crank-shaft with double bearings, to which there are attached direct two 63,000 cubic feet per hour exhaustors, thus giving a total power of 252,000 cubic feet per hour.

I enclose for your inspection a plan of the exhaustor-house, with boiler-house attached, in which are fixed two of Galloway's patent boilers (with space for a third); and it will be observed that the arrangements at Beckton are, except as regards size, almost an exact copy of the machinery at Linacre. On giving the order to Messrs. Gwynne and Co., they informed me that the arrangement I had designed was the first of the kind they had undertaken.

In conclusion, I may observe that the machinery has worked very satisfactorily, the gauge on the outlet hardly showing any perceptible oscillation, and has in all respects accomplished the purpose for which it was designed; and that Messrs. Gwynne and Co. are now duplicating the apparatus, so that next winter a forcing power of 504,000 cubic feet per hour will be ready for use. Having solved this problem satisfactorily at Linacre, I am glad to find that my friend Mr. Trewby has copied it at Beckton—for I cannot admit the novelty of his arrangement—

* We have not alluded in these remarks to Mr. Wanklyn's "moist combustion process" recently introduced. It is described in the last edition of his book, p. 53; but, inasmuch as he has thought it right to protect it by letters patent, it has no value for general application.

and there is every reason to believe that, as you remark in your article on the subject, the system may come into general use.

Liverpool United Gaslight Company,
Engineer's Office, Duke Street, Liverpool, April 21, 1880.

[The plan referred to by our correspondent, together with drawings of the engines and exhaustors which Messrs. Gwynne and Co., as they state in a letter which we print below, have kindly furnished, are in the hands of the engravers. In an early issue we hope to publish them, together with a more extended notice of the apparatus referred to in Mr. King's letter.—Ed. J. G. L.]

SIR,—Referring to the engraving in the JOURNAL of the 20th inst. of the apparatus for pumping gas from Beckton to London, said to be designed by Mr. G. C. Trewby, and manufactured by Messrs. Bryan Donkin and Co., we confess that the description applying to the same has created in our minds no little surprise, inasmuch as we patented this very arrangement in December, 1871 (as a reference to our patent No. 3449 of that year will prove), and the patent was taken out by us at that time with the object of accomplishing what is now claimed as a novelty.

In the early part of 1876 we made a great many experiments on exhaustors (single, double, and treble, and their various combinations), and we then found that our patent of 1871, which has been copied at the Beckton works, and is an infringement, did not accomplish to our satisfaction the object we had in view. As a result of these experiments, we patented again in August, 1878, a new system of securing absolute equality of pressure in gas exhausting and pumping machinery. Some of the Engineers of The Gaslight and Coke Company inspected our apparatus at work in 1876, and, singularly enough, this same Company had our new system in operation in two of their establishments several months prior to the erection of the machinery by Messrs. Donkin and Co. at Beckton.

Mr. W. King, C.E., Engineer to the Liverpool United Gas Company, was the first gas engineer who had the courage to try on a large scale our new system of exhausting and pumping. In 1878 we erected for that gentleman at the Linacre works a complete set of exhausting and pumping machinery to convey the gas to Liverpool, direct to the consumers, in a continuous supply, absolutely free from oscillation, and this is what has never yet been accomplished, unless by ourselves—the Beckton arrangement not excluded, although our early system has been copied. The machinery has been in use at Linacre for over twelve months, and, we believe, has thoroughly and satisfactorily answered all the intentions of Mr. King. We are at the present moment constructing a duplicate set for the same establishment, and we shall do ourselves the pleasure of supplying you with a set of drawings showing the arrangement that we there adopted. The Linacre Gas-Works under Mr. King's charge are, therefore, the first in this country that adopted our new system, and to Mr. King is due the credit of first realizing the advantages to be obtained by carrying into practical working the non-fluctuating invention secured by our patents.

GWYNNE AND CO.

Essex Street Works, Strand, W.C., April 22, 1880.

P.S.—We have erected several other sets of our patent non-fluctuating machines at gas-works, where they are working most satisfactorily. Detailed particulars will be sent with our drawings.—G. AND CO.

THE BRAY LANTERN AND BURNER, AND MR. SUGG.

SIR,—I had hoped that the correspondence on this subject would have been closed with my last letter; but I cannot allow Mr. Bray's communication, appearing in your issue of the 20th inst., to pass unanswered, and I trust you will give me an opportunity of publishing my reply.

I say that Mr. Bray's lanterns and burners, so far as there is any similarity between his and mine, are copies of my inventions; and, so far as they differ from mine, they are only adoptions of old ideas.

My "shadowless lantern" was registered in January, 1879, in pursuance of the Designs Copyright Amendment Act, under the head "Useful." Mr. Bray's lantern was patented in April, 1879, nearly three months later. I send you a drawing of my registered "shadowless lantern" as I exhibited it recently at Birmingham, and I ask any one of your readers to compare this with the specification drawings of Mr. Bray's lanterns, and (remembering the earlier publications of mine) say whether mine are copies of them, or whether Mr. Bray has copied mine, so far as the lantern itself is concerned.

And here I have to inform you, Sir, that the drawing of Mr. Bray's lantern, fig. 3, p. 601 of your last issue, is *not* what it is stated to be—viz., a copy taken from the specification of Mr. Bray's first lantern patent—but an *altered* copy. The object of the alteration can only be to mislead your readers, and, therefore, I beg that you will, in justice to me, publish the *real* specification drawing alongside that of my flat-flame lantern, in order that they may be able to make the comparison I have spoken of.

The improvement in my hollow-top steatite burners is properly described in my patent specification. The original hollow-top steatite burners I gave to the public years ago, and they were generally in use long before Mr. Bray took out a patent for burners. There are thirteen sizes of them, and my No. 12 will consume nearly as much gas as, and give better results than those used by Mr. Bray in his quadruple-flame lately shown at Birmingham. But, apart from this, are two burners, in other respects alike, not imitations, because one happens to be larger or smaller than the other?

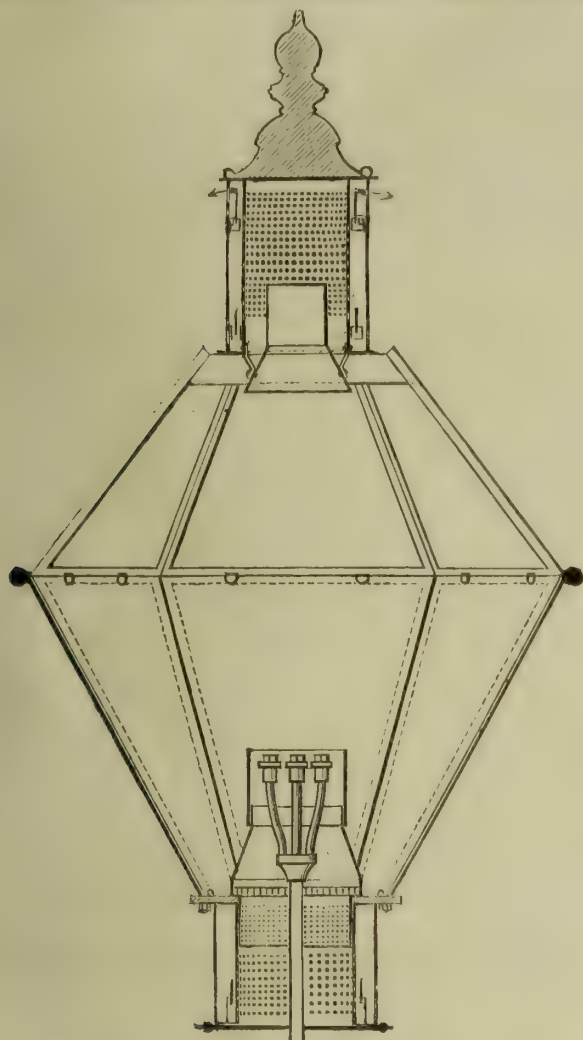
The combination of burners is no novelty. I could point to lanterns in many parts of the kingdom (and I have no doubt your readers could also) in which several flat-flame burners have been combined to give one strong light. In particular, I myself put up several combination burners on the Beckton pier some years ago. They were composed of four hollow-top steatite flat-flame burners in one lantern.

The gauze at the bottom of the lantern is also old. It is used in the lamps at the East India Docks for the very purpose of steadying the flames of the lamps in exposed places, and at the same time to allow a free supply of air.

The only thing now left is the arrangement of vertical tubes. When

I ventilate from the bottom of the lantern I use one tube instead of several. What novelty or advantage does the latter possess, except that of greater expense and trouble?

In conclusion, Mr. Bray has adopted my lantern even to its very ribs and reflectors. He has adopted my hollow-top flat-flame burners under another name. He has adopted the well-known principle of combining burners. He has adopted the old wire gauze protection at the bottom of the lamp. He has added to these a quantity of vertical tubes instead



Cross Section of Bray's Lantern and Burner; copied from Drawing in Specification of Patent (No. 1454) dated April, 1879.

THE MANUFACTURE OF SULPHATE OF AMMONIA.

SIR,—In reply to the letter of Mr. Jones in your last issue, I will simply ask him a few questions, and if he will answer them I shall be perfectly satisfied.

1. Is it, or is it not, the fact that the flue connecting the saturator with the chimney was in the habit of becoming choked with water, causing a stoppage of the draught, and that the man formerly in charge was dismissed by Mr. Jones because he complained of this defect?

2. Is it, or is it not, true that Mr. Jones was away in London when the accident took place; that no competent man was left in charge of the factory; and that no printed instructions exist for the guidance of the workmen in this or any other department of the Chesterfield Gas-Works?

3. Is it, or is it not, true that Mr. Oliver supplies Mr. Jones with sulphuric acid; and that he and Mr. Taylor, of Derby, are intimate friends of Mr. Jones; and that, while they were called as witnesses to prove the completeness of the apparatus, no one was present to watch the case on behalf of the deceased workmen?

4. Is it, or is it not, the general custom at these works to pour the acid into the saturator (whether by an opening in the top or at the side is immaterial) instead of using the acid tank and feed-pipe?

The Coffey still in use at Peterborough is a very different thing from that introduced 40 years ago. It was designed by the late Mr. Hathaway, Manufacturing Chemist at the Crystal Palace District Gas-Works, and is so great an improvement on previous apparatus of its kind, that the disadvantages of the latter do not exist, but the advantages are greatly increased.

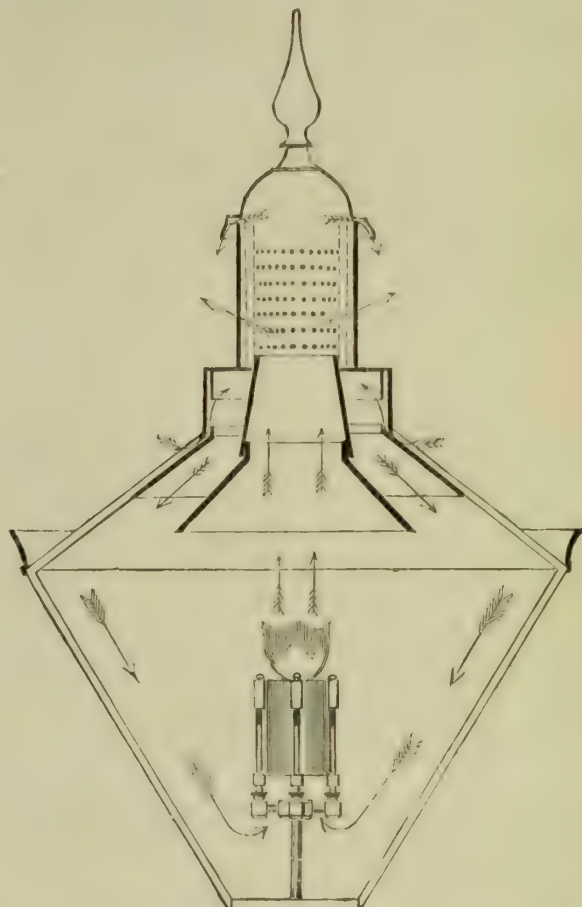
I know of no disadvantage resulting from the combined Coffey still and evaporating process, except that admitted in my first letter—viz., increased expenditure of fuel. The most obvious advantages are—(1) the closed saturator, which cannot be opened during operations to introduce acid or anything else; (2) the automatic continuity of the process—the liquor is raised by a steam-pump into a tank overhead, and delivered by gravitation through the still in a continuous stream, and if the acid be pumped up, as can be done, the only manual labour consists in stoking the boiler and fishing the salt out of the evaporating pan; (3) the quality of the sulphate is far better and more uniform than by the concentrated process, inasmuch as the neutralized liquor is allowed to stand in a settling-tank before being run into the evaporating pan, whereby the impurities in suspension are deposited and separated

of one. And he patents this amalgamation of adopted ideas, and then accuses me of having infringed his patent.

I leave the matter to the good sense of your readers and to the arbitrament of the Courts of Law, if Mr. Bray persists in his declared intention.

Vincent Works, Westminster, S.W., April 24, 1880. WILLIAM SUGG.

[It is right to mention that the drawings of Mr. Bray's lanterns and burners, given in last week's issue, were copied from tracings with which Mr. Bray himself supplied us, together with the description of them we published. We have, however, had another illustration prepared from the drawing in the patent itself, and give it below, together with an illustration of Mr. Sugg's registered "shadowless lantern," in order that our readers may make the comparison our correspondent asks for.—ED. J. G. L.]



Cross Section of Sugg's "Shadowless Lantern" with Flat-flame Burner, as shown at Birmingham, March 10, 1880; registered January, 1879.

from the liquor. I have seen samples of sulphate from some of the largest works in the kingdom, manufactured on the system that Mr. Jones employs, and they were all inferior to the salt produced by my apparatus. The fumes from the saturator pass through an acid catch-box, and then away to a condenser. From thence, after all traces of ammonia are eliminated, and returned, condensed, into the tank, the dry sulphurous gases are burnt, and pass out at the top of a high chimney. If it be required to take out the fixed ammonia, the waste liquor can be treated with lime, and passed through a second still, or the original liquor may be first treated in the same manner in a separate tank, and after the carbonated lime has been allowed to settle, the clear liquor may be passed through the still.

Mr. Jones may be a competent chemist; but, as a knowledge of chemistry is an essential part of the education of a gas engineer, Mr. Jones may reasonably suppose others also to possess it.

GEORGE ERNEST STEVENSON.

Gas-Works, Peterborough, April 21, 1880.

Legal Intelligence.

HANTS, WILTS, AND DORSET SPRING ASSIZES.

WINCHESTER, THURSDAY, APRIL 22.

(Before Justice HAWKINS.)

FORGERY, EMBEZZLEMENT, AND FRAUD BY A GAS-WORKS MANAGER.

William Barrett Swaine, alias William Barratt, 31, described as a gas engineer, was charged on four indictments with forging and uttering eight certificates of shares in the Swindon Gas and Coke Company, with intent to defraud Ann Pedder Boniface, Elizabeth Eagles, and others, in December last. He was further charged with obtaining two sums of £25 and £22 10s. with intent to defraud. The facts of the case were fully reported in the JOURNAL as recently as the 2nd ult.

Prisoner, who pleaded guilty, admitted two previous convictions for fraud, but said that although he had resolved not to go "outside" the law again, he had been led astray by another. He said he did not wish it to be thought that he was insensible of the gravity of the crime he had committed, but he considered it was due to his wife and family to state a few facts. When in prison on a former occasion he resolved that on obtaining his liberty again he would endeavour to regain the position he had lost. When he came out of prison he was without a friend in the world. He had no one but his wife and family, and for some years they laboured hard together. He filled two offices of trust in an inferior position, but he ultimately obtained the one where the present crime was committed. He had

in the meantime changed his name twice, because he was in debt previous to his conviction, and he had been much harassed by persons to whom he was justly indebted, but who wanted payment of their debts when he was not in a position to discharge them. He had not been in his last situation more than a fortnight when he was recognized by a person whom he had known in prison. He asked prisoner for employment, which he could not give him, but he did give him 10s. to pay his fare to London. He failed to go there, and threatened to expose him (prisoner) to his employers if he did not give him more money, when his wife and family would have been thrown on the world again. Foolishly he gave the man more money, and this was the first step which brought him into difficulties again. From time to time these demands were renewed, and it was in endeavouring to make the payments that he was led again into crime. He had a delicate wife and four young children, and his wife was again just about to be confined with another child, and they were at the present moment in circumstances actually wanting bread. The wife, with her four children, had only 5s. a week allowed them for their support, and one of the children was so afflicted that it required to be constantly watched. Under these circumstances he cast himself on the mercy of the Court, hoping that they would warrant his lordship in extending mercy to him.

Justice HAWKINS, commenting on the serious offence to which the prisoner had pleaded guilty, observed that persons who committed crime seldom did so without involving others in the consequences of their acts, which should be considered by them before they permitted themselves to come within the operation of the law. A judge had often to struggle between his own feelings and the demands of public justice, and if he gave way to the former, very many would escape the just punishment of their crimes. The prisoner had had printed in London false share certificates of the Swindon Gas Company, and had passed them off as genuine, to persons who could ill afford to part with their money. He hoped the sentence he was about to impose would not be thought too light—five years penal servitude.

MIDDLESEX COURT OF QUARTER SESSIONS, WESTMINSTER. SATURDAY, APRIL 17.

EAST LONDON WATER-WORKS COMPANY, APPELLANTS, v. THE STAINES UNION ASSESSMENT COMMITTEE, RESPONDENTS.

This was an appeal by the Company against a revaluation made by Mr. William Marshall, of their auxiliary works in the parish of Sunbury, the result of the revaluation being an increase in the rateable value from £2720 to £5241. When the appellants appeared before the Assessment Committee in October last, they were represented by Mr. Finlay, who contended that the works were merely an auxiliary source of supply, and only required during a dry season, and then for but a few weeks. In 1878 the cost of keeping them in working order had been a great loss to the Company, as in that year they could have dispensed with them entirely. He contended that when in use they should be rated upon the same principle as brickfields, that is, according to their yield, and when not in use upon the principle laid down in the case of *Staley v. Castleton* (33 L. J., M. C., 187), as a warehouse for the machinery. Mr. Marshall, who gave evidence in support of his valuation, maintained that, inasmuch as there was no annual exhaustion of the *corpus*, the brickfield case would not apply. He said that Parliament was asked in 1867 for powers to construct the works, and the Company's Engineer, Mr. C. Greaves, supported by Mr. F. J. Bateman, gave to the Committee of the House of Commons appointed to inquire into the matter, most potent reasons for their construction. If the works were necessary then during a period of drought, how much more so must they be now, when the amount of water required was nearly doubled. Mr. Marshall also submitted that the principle had been conclusively settled by the decision in the Birmingham Canal Case (19 L. T., N. S., 311), where the Lord Chief Justice, in delivering judgment, said: "With regard to the engine-house, it has a certain value by reason of the land or the building erected upon it, and of the machinery attached to that building, all of which is necessary for the purpose of the canal. It is situated in Birmingham, it is only made available and put to a particular use on certain occasions, or, if you like, in certain contingencies; nevertheless, it must always be there. It has a certain value with respect to the land, and the buildings upon it and the machinery permanently affixed to it, and in that respect I think it ought to be rated, whether it is used all the year or not." The Assessment Committee thereupon declined to make any reduction, which caused the Company to give notice of appeal.

Mr. MEAD, on behalf of the appellants, now informed the Court that they had abandoned their intention of appealing.

This course was assented to by the Court, and an order for costs was made upon the Company.

SALFORD HUNDRED QUARTER SESSIONS.—MONDAY, APRIL 19. (Before Mr. W. H. HIGGIN, Q.C., Chairman.)

APPOINTMENT OF AN AUDITOR OF THE STRETFORD GAS COMPANY'S ACCOUNTS. An application having been made to the Court on behalf of Mr. C. A. Burghardt and Mr. A. Sussum, as representatives of the Stretford Gas Consumers Vigilance Committee, praying for the appointment by the Court of an Auditor to examine the accounts of the Stretford Gas Company, with a view to obtain, after the Auditor should have presented his report, an order for the reduction in the price of the gas charged by the Company,

Mr. S. TAYLOR, who appeared for the petitioners, said he made the application under the 35th section of the Gas-Works Clauses Act, 1847. He understood that Mr. Nash, who appeared for the Company, was prepared to consent to the order asked for. What he (Mr. Taylor) applied for was the appointment of an Accountant to go through the books of the Company. This gentleman would be agreed upon between the parties. The trouble, therefore, of fixing upon somebody to examine the books would not devolve upon the Court.

Mr. NASH said he practically consented to the application made by the Vigilance Committee.

The CHAIRMAN: What is meant by the Vigilance Committee?

Mr. NASH said that the Committee consisted of a number of gentlemen who had banded themselves together for the purpose of cheapening the supply of gas to Stretford. He (Mr. Nash) lived at Stretford, but he had always been perfectly satisfied with the price charged.

The CHAIRMAN: Mr. Nash, you had better go into the witness-box yourself.

Mr. NASH: Oh, no. The Company wish me to say that they have no desire to oppose any proper investigation of the accounts. On the contrary, they are most anxious to assist the petitioners.

The CHAIRMAN read a paragraph in the petition, from which he said he gathered that the petitioners complained that the consumers were overcharged, and that money had been paid to the Shareholders of the Company which, under the provisions of the Act of Parliament, they were not entitled to receive.

The Court granted the application, and Mr. William Aldred, of Dickinson Street, Manchester, was ultimately chosen as Auditor, his appointment being approved by the Company.

ST. HELEN'S COUNTY COURT—WEDNESDAY, APRIL 21.

(Before Mr. T. P. E. THOMPSON, Judge.)

NOTICE REQUIRED BEFORE INCREASING THE PRICE OF GAS.

In the case of the *Widnes Local Board v. Gardiner*, the plaintiffs claimed to recover the sum of £9 18s. 9d., for gas supplied under the following circumstances:—

The Widnes Local Board obtained an Act of Parliament in 1875 empowering them to extend their limits of supply, and also to charge 6s. per 1000 feet for gas. The defendant, who was in the employ of the Ditton Iron Company, was a consumer prior to that year, and originally was charged at the rate of 4s. 6d. per 1000 feet; but when the Local Board arranged to supply that Company with gas, the defendant also arranged with the Board to be supplied at 6d. per 1000 feet more than the price charged to the Company. This agreement was continued for some time, until the price was reduced in Widnes to 4s. per 1000 feet, and accordingly there was a corresponding reduction made to the defendant. However, at the commencement of the year 1878, the Board began to charge at the rate of 6s. per 1000 feet, which was continued down to the end of March, 1879, when the price was again reduced 1s. per 1000 feet. The defendant had paid at the rate of 4s. per 1000 feet down to March, 1879, and it was contended, on behalf of the plaintiffs, that the defendant having had notice that in future the Board intended to charge 6s. and then 5s. per 1000 feet, if he continued to use the gas he was bound to pay the full price, and if he did not intend to use it he should have had it cut off. It transpired, however, that on July 25, 1878, the defendant wrote to the plaintiffs, saying that as he had not had any intimation of an increase in price he should refuse to pay more than the price originally agreed upon, and telling the Board to cut his supply off. The Board, however, did not do so, and defendant's counsel contended that he (defendant) was not liable for the amount of the increase over and above the price agreed upon at first, after he had once given the Board notice to cut off his supply.

Mr. THOMPSON agreed with this view, and pronounced judgment for the defendant, with costs.

Leave of appeal was given.

The Board further sued Messrs. R. and P. Leather for £1 8s. 8d. for gas supplied.

In this case it appeared that the defendants became consumers of the Board's gas in 1876, at the rate of 4s. 6d. per 1000 feet, and continued to pay this price regularly till the end of 1877. At the commencement of 1878 the Board began to charge 6s. per 1000 feet, and when they sent in the quarterly account at the end of March, the defendants refused to pay more than at the rate of 4s. 6d. per 1000 feet, as they had not had notice of the advance.

Mr. THOMPSON held that the plaintiffs ought to have sent notice to the defendants of their intention to increase the price of the gas before it was consumed, and not afterwards. He, therefore, gave judgment for the defendants.

There were several other cases of a similar character to this one, in all of which judgment was given for the defendants.

In reference to the case which was reported in the JOURNAL of the 13th inst.—in which the North Middlesex Gas Company were summoned by Dr. Breeze for an alleged deficiency in the supply of gas to his house, while a cross-summons was taken out by the Company against Dr. Breeze for non-payment of his gas account—Mr. Johnson, the Inspector of the Company, attended at the Highgate Petty Sessions yesterday week, and said he had to ask permission of the Bench to withdraw the summons taken out by the Company, as Dr. Breeze had paid the amount which was due, and had intimated that the supply of gas at his residence was now satisfactory. There being no objection raised, the summons was accordingly withdrawn.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

METROPOLITAN BOARD OF WORKS.

At the Meeting of the Board on Friday last—Sir J. M. Hogg in the chair,

Mr. SELWAY brought forward the following motion, of which he had given notice:—"That it be referred to the Works and General Purposes Committee, to consider and report as to the advisability of this Board applying to Parliament for an Act to improve the Water Supply of the Metropolis, either by amending and regulating the powers of the existing Water Companies, by consolidating their undertakings, by providing an additional supply of pure water, or by any other means the Committee may deem desirable, with authority to confer with Her Majesty's Government thereon." In moving its adoption, he said the subject of the Metropolitan Water Supply, which was one of great importance, did not then come before the Board for the first time. They had had it under consideration on former occasions, and it probably would not now have been brought forward again but for the changes which were taking place in relation to Her Majesty's Government, which led to the supposition that the Water Bill introduced by the late Home Secretary might be considered to be defunct. Therefore the ground was again opened. So long as this Bill stood in the way, the Board could not take any action whatever in regard to the matter; but it occurred to him that, as soon as the Bill was dead, it was the duty of the Board once more to enter upon the consideration of this great question. In framing his notice of motion he intended to make it as wide as possible, and he felt assured that he had laid himself open to the charge of indefiniteness. Gentlemen might say that he had not in it expressed any preference for one course over another; and that was true. But he had drawn the notice in the way he had done, in order that the Works and General Purposes Committee, to whom he trusted the matter would be sent, should not be bound to any one scheme which he might have shadowed forth as having a preference for. It would be for that Committee to consider the various schemes which might be brought before them. There was a general feeling abroad that the Water Companies of the Metropolis might very well be subjected to further legislation and control, and legislation in this direction would not be novel. There was the Water Act of 1852, which had three very special objects in view. It provided that no water should be sent into London from below Teddington Lock; secondly, it provided that no reservoirs or aqueducts within the immediate neighbourhood of London should be left open, but were to be covered; and, thirdly, it provided that the water should be effectually filtered. Then there was the Act of 1871, which professed to be an Act for securing a constant supply of pure and wholesome water; but in reading through that Act he failed to see where the pure and wholesome water was to come from. The supply with which London was furnished was at present largely intermittent, and in many instances was small in quantity. He thought, taking the broad average, that the water supplied to the Metropolis was probably sufficient; but in many instances this was not so. From some cause or other, in the poorer districts of London it was a very common thing indeed

for houses to be many hours and even days unsupplied with water. It might not always be the fault of the Water Companies—he did not charge them with this; but merely stated the fact. Then the rates were not uniform, and in many instances they became, as he thought, unjust and oppressive. The powers which the Water Companies had to fix rates upon dwelling-houses varied. For a house valued at £80 rent, the rate of one Company was as low as £1 8s. per annum, while another Company's rate was as high as £2 12s. per annum. For a house of the value of £50 per annum, one Company's rate was as low as £2 6s., and the other Companies went gradually up until they reached £3 17s. A house of £100 value was rated by one Company at £4, and the others went up gradually to £6. For houses of £200 value the lowest rate was £6 10s., and the other rates went up gradually to £11. Those charges included one closet in each case; and he found the very singular fact, that in one house of a certain value a closet would be charged at 4s. per annum, while a closet in the larger houses was charged 20s. per annum. He apprehended that the quantity of water used in a water-closet was the same in one house as in another, and he failed to see why such heavy charges should be made. There were singular charges by some of the Companies; for instance, they charged linendrapers a heavier rate for supplying their shops than they charged some other shopkeepers. Why this was done he failed to see. He could understand why beer-shops should be charged heavier for their water supply, as they might draw largely from it; also cowkeepers, because milk might be diluted. As the water-rate was charged upon the value of the house, there was this singular anomaly, that as the rating value of the house went up from time to time, and the assessment rose, so the Water Companies made advances, without giving any additional supply of water whatever, either to a house or to a shop; and no allowance was made on account of the increased value of premises owing to their being devoted to trade purposes. A shop was charged at its value, and not in regard to the water supplied to it; therefore the charges pressed very heavily indeed upon shopkeepers and owners of any large premises. One very essential point in the future regulation of the water supply of the Metropolis must necessarily be that the water supply to every house should be registered by meter. At present the cost of a water-meter was very large, and it was thought that it would not pay to have a meter fixed in every house; but no doubt a cheap and effective meter would be devised if this system were to be adopted. A second most important thing was a better supply of water for extinguishing fires. Captain Shaw told a Committee of the House of Commons that his requirement—which he called a moderate requirement—was 2000 gallons of water per minute, to be supplied to 14 engines, which would be at a very large fire. That was less than 150 gallons per minute to each engine, and was equal to 3 million gallons in the 24 hours; but it was only 1-40th of the total daily supply to the Metropolis. Happily, great fires did not take place every day, nor were they continuous. Captain Shaw required, on an average, 1-40th part of the total supply, and yet all the Engineers of the large Water Companies said this was a quantity which they were utterly unable to supply. Before the same Committee the Engineer of the New River Company spoke of this as being an extraordinarily large supply, and the Engineer of the East London Water Company said it was a quantity of water which no Water Company could supply at any one spot at one time. It was evident, from what the Water Companies engineers themselves said, that it was an awkward requirement of Captain Shaw, that even only 1-40th of the total supply of a day should be consecrated once and again to extinguishing a large fire. That was not the worst point. It was not only that the Water Companies could not supply the quantity, but they could not supply it at an adequate pressure. The Engineer of the East London Water Company said that they could not supply it even from the surface, much less with a pressure so as to make it effective. He (Mr. Selway) supposed the members knew what often happened in a case of fire. A fire broke out a few Sundays ago in his neighbourhood. An acquaintance of his, a member of the Vestry, who happened to be passing, told him it was 14 or 15 minutes before there was any supply of water, and when it did come it only rose about 2 feet from the ground, and was utterly inadequate for fire purposes. The Board would not be surprised to hear that the whole place was entirely destroyed, though Captain Shaw had a number of fire-engines and men upon the spot. Therefore they wanted the Water Companies to be regulated for those purposes amongst many others. Something should also be said upon the quality of the water which was supplied. There were about 120 million gallons, on an average, brought into the Metropolis every day, and of that quantity the Thames and Lea together supplied about 100 million gallons, the remainder being derived from deep wells. The waters from these two rivers were filtered and sent into the Metropolis, but it was a question whether the filtering effectually removed all impurities, and Major Bolton, in his last report, spoke of the turbidity and colour of the water. He (Mr. Selway) was aware that in large districts of the Metropolis excellent water was supplied; but in the south of London, very bad water relatively was delivered to the consumers. He would like to see a uniform charge all over the Metropolis, and, so far as could be, a uniform quality. He failed to see why the poorer inhabitants should be supplied with an inferior article. It was known that an abundant supply of better water could be obtained from the deep wells in the chalk strata, and from some of the valleys lying round London; and there would be no difficulty in bringing a large quantity of pure water into the Metropolis. It was a question whether those advantages could be obtained by regulation only, or whether they would not be better obtained by consolidation. One management would give uniformity of rating, and probably of quality, and economy would certainly be the result. If the Water Companies were consolidated, why should not the Board be the authority for controlling and regulating the water supply. In the Act of 1871 they were named as the Local Authority, and he failed to see why they should give up being the Central Authority for London, and differ from other Municipal Authorities over the whole kingdom. Dublin, Liverpool, Manchester, Birmingham, and other great cities and towns, managed their own water supply, and London was the exception. It might be said that the Board were not large enough or wise enough for such a purpose. If not, let them have a larger and a more clever Board; but, at any rate, the Metropolitan Board of Works, however constituted, should be the authority for managing the water supply. If a second supply were brought into the Metropolis, vested interests must be respected. They always respected vested interests very strongly in this country; but he had yet to learn that the existing Water Companies had a monopoly. There was no reason why an additional supply should not be brought into the Metropolis, as the concerns were simply trading Companies. If Parliament had allowed eight Companies to come into the Metropolis for the purpose of supplying water, why should they not allow another body to form the ninth? The Act 18 & 19 Vict., cap. 120, authorized Vestries and District Boards to sink wells, purchase or rent streams, or do anything to bring water into their respective localities, for the purposes of street-watering or for gratuitous distribution to the ratepayers. Why could not the whole of the Vestries combine through their representatives on the Metropolitan Board? Let every Vestry supply water gratuitously to the inhabitants, and for street-watering purposes and fire

purposes; and let the water now supplied, which was admitted in many instances to be not of the purity it might be, remain for mere cleansing purposes. If the Companies were not moderate in their demands, a new service must be pressed for, and one day a new service must come. He would say nothing about the scheme which the Board had in contemplation some time ago—a scheme which had very many strong points for its recommendation; but they must have a better supply of purer water, supplied at adequate pressure, and the charges should be regulated and controlled. He had no preference for either of the schemes he had mentioned in his resolution, but he asked that the Board would send it to the Works and General Purposes Committee, where it would obtain that careful consideration which every important matter received at the hands of that Committee, and the result, after conference with Her Majesty's Government, would be the production of some scheme or other which he hoped and believed would be for the benefit of the ratepayers of the Metropolis.

Mr. Cook, in seconding the motion, said that perhaps the most important question of local government was as to the supply of pure water. It was one of the primary necessities of life, and certainly the water supplied to the Metropolis could not be said to be pure or abundant enough, and it was not supplied at sufficiently high pressure. The charge made for water upon those who had to drink it was out of all proportion to the supply given to people. The scheme before Parliament in the early part of this year was notoriously an improper one. If there were no other evidence, the rising of the price of shares on the Exchange was sufficient to condemn the scheme. The difference between the value of the Water Companies, as expressed by the valuation of their shares on the Stock Exchange before the promulgation of the terms of the purchase, and after those terms became known to the public, would have been more than sufficient to have given the Metropolis the scheme for a constant supply of pure water at a high pressure, which the Board wanted to bring into Parliament two years ago. The difference in the value of the shares, if capitalized, would have been something over ten millions. Sir Joseph Bazalgette estimated that a constant supply of water at high pressure all over London would cost about ten millions. Under Mr. Cross's Bill, had it become law, the public would have been in the position of paying a price to the Water Companies so much above the value, that the difference would have given a fresh supply of pure water for the Metropolis. It was evident from this fact that the Bill never could be carried into law, and under the circumstances it seemed most probable that the Government would bring in a new scheme. There was no other body in the Metropolis capable of managing the water except the Metropolitan Board, and unless they neglected their duty, they were bound, in the interests of those they represented, to endeavour to do something towards supplying that great deficiency, and to do it as soon as ever they could.

Mr. Jones said the Board stood in an awkward position as to this question. They had been assured by Parliament that when they attempted to regulate the Water Supply of the Metropolis, they were doing something for which they had no power. Therefore all they could do, in such a case, was to make abstract propositions, and no more could be done when the motion went to the Works Committee. Not one shilling could be expended in reference to any suggestions, because the House of Commons had declared that the public benefit of the Metropolis was not involved in the supply of water to it; but every one else would have believed they had the right to manage the water supply. The House of Commons distinctly declared, in the Indemnity Act obtained last year, that the Board were going beyond their power in taking any cognizance of the water supply. Discontent in relation to the water question was no new thing. When authority was given for a 4 per cent. charge to be made upon the assessments as the recompense of the Water Companies, the assessment of London was about half what it was now. Mr. Selway had pointed out that there was no connection between the improved assessment of London and the additional rate which the Water Companies were enabled to charge. The assessment on the valuation of houses was not selected by the Companies themselves. It was forced upon them for the purpose of limiting the charges they were to make. When it was settled that they should only charge 4 per cent., it was never contemplated that they would at each new valuation increase their charge. There was also discontent as to the quality of the water, and the obligations of the 4 per cent. on the assessment were that the Companies should provide pure water with constant pressure, which he understood they did not do. Dr. Frankland declared that in the year 1878, 60 million gallons of water were polluted with sewage matter; 52 million gallons were occasionally so polluted; and 7 million gallons were of unexceptionable quality. To rescue themselves from this position, two courses were open—they could either make the Companies their agents, under new conditions; or, by a totally fresh supply, leave the Companies to do the best they could.

Mr. TURNER moved the adjournment of the debate until next Friday, as the matter ought not to be hurriedly decided upon.

Mr. FOWLER seconded the motion for an adjournment.

Mr. RUNTZ did not see the necessity for an adjournment, as it appeared to him that the Board were powerless in the matter. All they could do would be to go to Her Majesty's Government, and ask them to take up the question. Up to the time of the passing of the Indemnity Act last year, he believed the Board were within their powers in doing what they had done to get a supply of pure water for London. But that Act declared that they went beyond their powers, and after this declaration they could not spend sixpence on the question. In the early part of 1870, the Commission of which the Duke of Richmond was the Chairman said it was desirable that the supply of water to the Metropolis should be in the hands of a public authority rather than in the hands of commercial companies. He thought the Board had already enough work to do, without having the management of the water supply. If the Board had that management it would come to this, that the water supply would be managed by officers appointed by them, and they would remain partially ignorant of what was taking place. He thought an adjournment would be no good; but if the question were referred to the Works and General Purposes Committee for them to confer with the Government with a view to immediate steps being taken to improve the water supply of the Metropolis, he would vote for it.

Mr. RICHARDSON thought the discussion should not be adjourned, but he disagreed with the remark as to the Board not being able to deal with the matter because they had so much work on hand. He suggested that the question should be referred to the Works and General Purposes Committee to consider as to the advisability of the Board taking further action with respect to the improving of the Water Supply of the Metropolis. They need not bind themselves to go to Parliament at all. He thought the Directors and Shareholders of Water Companies were in such a turmoil, in consequence of the feelings which the Water Bill called into play, that they would be ready to give up certain matters for which they had made claims.

The debate was then adjourned till Friday next—17 members voting for the adjournment, and 7 against it.

Lieut.-Col. Bolton's report on the examination made of the water supplied by the Metropolitan Water Companies during last month, says

that the state of the water in the Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated) was good from the 1st to the 3rd, when it became very bad, and remained in a bad condition until the 13th; it then improved in quality, and continued in a good state for the remainder of the month. The highest flood state of the river at West Molesey during the month was 3 feet above summer level, and the lowest 6 inches above the summer level, the rainfall being 0.31 inch. The water in the River Lea was generally good during the month. [These remarks refer to the condition of the water previous to filtration.] The water at all the intakes was in a better condition during the month of March than in February. The filtration was efficient, the water supplied by all the Metropolitan Water Companies having been clear, bright, and properly filtered.

GLASGOW CORPORATION WATER SUPPLY.

At the Meeting of the Glasgow Water Commissioners on the 15th inst., the Sub-Committee on Finance submitted the following estimate of the revenue and expenditure for the year from May 28, 1880, to May 28, 1881:—

Glasgow Corporation Water-Works.

Expenditure—		£117,724
Deficiency in river supply revenue account		5,273
Sinking-fund		22,950
Surplus		1,177
Total		£117,121
Revenue—		
Domestic water-rate, in	£38,662	
Less abatements	2,838	
	£35,824	
Domestic water-rate out	£27,889	
Less abatements	1,354	
	26,535	
Public water-rate		£62,359
Trade charges		11,962
Supplies by meter		23,844
Builders, arrears, costs, ground annuals, &c		40,305
		1,820
		£140,290
Testing and stamping account		100
Balance from revenue account, year 1879-80		£140,390
		6,734
		£147,124
<i>River Supply Works.</i>		
Expenditure		£6,238
Sinking-fund		1,575
		£7,813
Revenue		2,510
Balance carried to debit of Glasgow Corporation Water-Works revenue account		£5,273

The Sub-Committee also agreed to recommend the Water Committee to report to the Commissioners that they are of opinion—(1) that the sum to be set apart as a sinking-fund for the said year 1880-81 should be £24,525 (that is £22,950 for the "Glasgow water account," and £1575 for the "river supply account"), being at the rate of 1½ per cent. on the amount of money borrowed; (2) (a) that the amount of the domestic water-rate to be assessed and levied within the limits of compulsory supply for the said year 1880-81 should be continued at 8d. in the pound, (b) that the amount of the domestic water-rate to be levied for the same period upon and from the occupiers of all dwelling houses, and of such parts and portions of all shops and buildings as may be used as dwelling-houses beyond the limits of compulsory supply, but included within the limits of the Glasgow Corporation Water-Works Act, 1855, should be continued at 11d. in the pound, and (c) that the public water-rate should be continued at 1d. in the pound; and (3) that no alteration be made on the present table of rates and charges for supplies of water (excluding river supply water) for other than domestic purposes.

The Treasurer reported that the revenue collected as at March 29 was—		
1878-79		£118,667 6 1
1879-80		119,944 10 6½
Increase		£1,277 4 5½

BEVERLEY CORPORATION GAS SUPPLY.—Mr. J. S. Davy, one of the Local Government Board Inspectors, held an inquiry, on the 15th inst., into an application from the Corporation of Beverley, as the Urban Sanitary Authority, for a Provisional Order under the Public Health Act, to partially repeal, alter, or amend their local Act, so as to provide that the sums borrowed on the gas-works, under their Act, may be re-borrowed, and the Corporation enabled to establish a sinking-fund for the liquidation of the sums so re-borrowed. It was explained to the Inspector that only a comparatively small sum is required to be borrowed—viz., £9000 or £10,000—which would extinguish the whole of the debt on the gas-works, the latter being valued at £35,000 or £40,000. The time asked for repayment was 60 years, so that the present generation should not be saddled with the whole of the cost.

ROTHERHAM CORPORATION WATER SUPPLY.—On Friday, the 16th inst., one of the Local Government Board's Inspectors held an inquiry at Rotherham, on the application of the Corporation to the Central Board for a Provisional Order to alter and amend certain of their local Acts, with respect to the borrowing powers and the repayment of sums borrowed or to be borrowed. The Town Clerk (Mr. G. W. Hodgkinson) stated that the actual intention of the application was to relieve the rates of the borough, and if the Council were successful in procuring the Order in the terms in which it was applied for, there would be a saving to the ratepayers of about £1500 per annum. The financial bearings of the application were fully explained to the Inspector. It was pointed out that there were special circumstances connected with the Corporation's finances which rendered it very necessary that the application should be granted. The town, it was stated, had been forced into the acquisition of a water supply over and above its actual present requirements, owing to the action of the Doncaster Corporation, who tried to include the Rotherham watershed in their late scheme of water supply. The area of the borough also was very large, and mains had had to be extended into thinly-populated parts of the district. There was at present, therefore, no adequate return for the revenue expended, and last year alone a deficit of £1895 on the water-works account was shown. The Inspector promised to recommend the case to the Local Government Board as favourably as possible.

IMPROVEMENTS IN GAS-STOVES.

At a recent meeting of the Philosophical Society of Glasgow, Dr. JAMES ADAMS read a paper on "Improvements in Gas-Stoves," which was illustrated by a heating-stove of his own invention in operation. He commenced by saying that twenty-five years ago he had read to the Glasgow Medical Society a paper on "Heating by Gas," when he also exhibited a stove made to his own design. It was his belief that the stove in question surpassed anything of the same kind since open to public observation; but it was liable to drawbacks which he then failed to overcome, and, therefore, he put aside his conception. Nevertheless, he retained his desire to see it realized, being sensible that he had made a substantial step in advance, and he had kept himself informed of, and had noted with interest all that had since been done in this connection. About 18 months ago he entered with zest upon a practical investigation, feeling assured that the principles were sound that he had assumed for his guidance, and had practically embodied in his infant conception. After describing the complex character of coal gas in respect of its composition, he went on to say that when coal gas was burned its constituents were transformed into other gases and vapours, and that on this point there was much popular ignorance, as it was assumed that because no smoke and no marked odour might be perceptible, combustion had left behind it nothing injurious. There was a hazy conception that perfect combustion meant something like practical annihilation; but, in point of fact, the invisible, mal-odorous, inflammable gas had been merely transformed into invisible, non-odorous, non-inflammable gas. The carbon had united with the oxygen of the atmosphere, and formed carbonic acid—a deadly poison if inhaled pure; and the hydrogen had also united with the oxygen of the air and formed watery vapour, whilst a large quantity of nitrogen had been set free from the air. But if the combustion had not been perfect, there was formed, in addition to carbonic acid, another still more poisonous gas, called carbonic oxide; and the common-sense deduction from these facts was that gas-stoves should be provided with flues to carry off the waste products of combustion into a chimney. It should scarcely be necessary to add that where a stove was substituted for a grate, as a means of heating an apartment, there should be retained the open chimney, or other means of proper ventilation which the open fireplace usually ensured.

The amount of light obtained by the combustion of coal gas varied according to the construction of the burner employed. The same gas which gave a poor, yellow, smoky flame when burned with a "rat-tail," was brilliantly white when a union jet was used, still brighter with a common Argand, better still with a Sugg's Argand, while in the latest street-lamps introduced in Paris, of which several were under observation in Glasgow, a perfection seemed to have been reached that rivalled the electric light. The production of heat, which, as a force, was identical with light, was quite as much influenced by the form of the burner employed; and as the phenomena of light required to be considered with reference to the luminous rays, chemical rays, coloured rays, &c., so did the phenomena of heat require to be considered with reference to dark rays, visible rays, and other components or characteristics. Thus, the several properties through which heat was communicated—namely, conduction, convection, and radiation—had each their special value and appropriate use, and ought to be carefully studied so as best to ensure the maximum intensity of each property, as well separately as in combinations. A kettle over the fire was boiled partly by convected heat contained in the diffuse mass of flame and smoke ascending the chimney, and partly by radiant heat emitted by the solid incandescent coal underneath; but a leg of mutton placed in front of the same fire received no heat whatever from convection, but was roasted exclusively by radiant heat emitted chiefly from the red-hot coal, only a very small proportion of radiant heat being emitted by the flame and smoke. By accurate observers it had been determined that about three-fourths of the heat from an open fire was convected heat, nearly all of which passed up the chimney, leaving only a fourth to be utilized as radiant heat. When coal gas was used as fuel, and the ordinary jets for lighting purposes were employed, the convected heat which was generated amounted to 84 per cent., or five-sixths of the whole, and only 16 per cent., or about one-sixth, was given out as radiant heat. When the Bunsen burner in any of its forms was employed, the heat generated was almost entirely that of convection, about 6 per cent. only consisting of radiant heat. The difference in the proportion of radiant and of convected heat emitted by the same gas by a mere change in the method of combustion depended on the presence of solid carbonaceous particles in the luminous flame. This question had been worked out by Professor Tyndall, and the results were recorded in his "Contributions to Molecular Physics in the Domain of Radiant Heat." Using an apparatus of sensitive precision, he found the radiation from the luminous gas-flame was fully two and a half times that from the non-luminous flame. The degree of force—not the degrees of temperature—in the luminous flame was 30, and the radiation fell to a force of only 12 the instant the flame became non-luminous. But by introducing solid matter the radiation originating in the non-luminous flame became so intense that a spiral of platinum plunged in the former brought up the index to a force equal to 200. In other words, there was instantly generated an amount of radiant heat more than six times that obtained from the luminous gas-flame, and more than thirty times that of the non-luminous flame. "It is mainly," says Tyndall, "by convection that the hydrogen flame disperses its heat; though its temperature is higher, its sparsely scattered molecules are not able to cope in radiant energy with the solid carbon of the luminous flame. The same is true for the flame of a Bunsen burner. The moment the air (which destroys the solid carbon particles) mingles with the gas-flame, the radiation falls considerably. Conversely, a gush of radiant heat accompanies the shutting out of the air, which deprives the gas-flame of its luminosity. When, therefore, we introduce a platinum wire into a hydrogen flame, or carbon particles [or platinum or various other solids] into a Bunsen flame, we obtain not only waves of a new period, but also convert a large portion of the heat of convection into the heat of radiation."

To obtain in a practical form the means of converting the heat of convection into the heat of radiation was the chief aim of the author's efforts for the improvement of gas-stoves, and the following is a short description of the method by which he accomplishes his object. He employs in gas heating-stoves a burner consisting of a group of hollow perforated tubes of fire-clay, supplied internally with a mixture of gas and air, which, passing through the perforations, burns on the outer surface. These fire-clay tubes, called "atmopyres," are enclosed in a case or chamber which prevents free access of air to their exteriors, where combustion is completed; but by means of perforations a small quantity of air is admitted, which ascends within and between the tubes, and ensures complete combustion, so as to cause the fire-clay tubes to become brightly incandescent. Thus only the smallest practicable excess of unconsumed air is permitted to mix with the products of combustion. These products are led to a chimney by means of a flue of peculiar construction, and in this flue they are detained until they have parted with all their available heat. Other channels or ducts lead currents of pure air along the heated walls of the flue channel, and the air so warmed is allowed to re-enter the room in which the stove is used. The walls of the air channels or ducts, and

generally the casings of the stove, present an extensive surface (obtained by duplications of the casings) to take up the heat from the products of combustion traversing the flue channel, and consequently these surfaces do not become overheated. The air entering the stove is caused to pass into it at or near the top, and thus a supply free from dust is ensured, and draughts along the floor of the room are avoided. The warm air issuing from the stove is caused to pass over water contained in a trough so formed that by filling it more or less, the surface of water exposed to the warm air may be varied. Lastly, not to dwell on too many points, provision is made by which the risk of explosion is entirely obviated. Dr. Adams stated that the limited time at his disposal would not admit of a detailed account being given of the arrangements by which the exact consumption of gas necessary to produce the full efficiency of the stove was regulated with automatic precision, and by which the quantity of air necessary for perfect combustion was also supplied efficiently and automatically. On the last head, however, he remarked that air was admitted to the combustion chamber by small apertures of carefully-regulated size and fixed number, corresponding to the designed supply of gas; that the air was projected in fine jets; and that it was so diffused that all, or nearly all was brought into actual contact with the gas fuel, and in the right proportion.

Knowing that an enormous amount of the heat produced by gas combustion, whatever the method employed, consisted of, or rather was lodged in the molecules of the gases or vapours forming the waste products, Dr. Adams deprecated the common practice of letting them go at large into the atmosphere, or sending them by the shortest cut up the chimney. But as a portion of the waste products consisted of water in the condition of vapour, which, at a temperature under 212° Fahr., would condense and trickle down as water; and as another portion consisted of carbonic acid, which, at the same temperature, was more than half again heavier than air, and would not ascend the chimney unless in a heated and expanded condition, there was a necessity that he should let some of the heat go. As the result of numerous practical experiments, he had determined that the waste products should be passed into the chimney at a temperature not under 212° Fahr. and not above 250° Fahr., and nearer the latter than the former temperature. The average temperature under his arrangements exceeded 240° Fahr. But the waste products had an initial temperature exceeding 2000° Fahr.; and, in order to extract from them all the heat that was desirable, he caused them to traverse a flue of peculiar construction—a flue *sui generis*, being of great length, consisting of superimposed horizontal chambers, communicating with each other by means of contracted openings, and the walls of the flue being fitted with baffle plates. Each of these peculiarities had a separate action, and exerted a marked influence, and the combined result was to cause the waste products to travel slowly, at a mean temperature, and to force the gaseous molecules into individual contact with the walls of the flue, which was absolutely necessary before they could impart their contained heat.

The heat transmitted by conduction through the flue walls to the outer surfaces of the flue was also diffused by conduction over a large surface area of duplicate casings. The pure air led over that great surface was warmed to the temperature obtained under the most approved systems of warming by hot water or steam pipes, although, when desired, the heat may be greatly increased. Thus, a stove of ordinary construction had, it might be assumed, an external heating surface of 16 square feet. A stove of the same size externally, but made to the author's design, had, in addition to the external surface, an internal surface of 26 feet, making a total of 42 square feet, which was a surface equal to 42 lineal feet of a 4-inch hot steam-pipe.

One of the serious drawbacks which caused Dr. Adams to lay aside his conception of a gas-stove many years ago, and which he failed to overcome at the time, was the danger of accidents by explosions. Such accidents occasionally took place with ordinary stoves, on the incautious application of a light some little time after the gas had been turned on, or had otherwise been escaping and forming an explosive mixture of gas and air within the stove; but the construction of the Adams heating-stove was such as to make an accident from that cause an impossibility. The entire "motor force" of the stove, consisting of the furnace chamber with all the subsidiary fittings for the admission and regulation of air, &c., was attached to a closely-fitting drawer or tray, in the base of the stove, capable of sliding out and in. When the tray was withdrawn, as would always be unavoidable for lighting purposes, air was at the same time freely admitted and the stove was instantly ventilated, and any mixture of gas and air accidentally present within the stove was deprived of its explosive properties. Although a considerable interval might have elapsed between the turning on of the gas and the application of a light, no explosion could occur. These arrangements ensured—(1) that the stove was efficiently ventilated and free from an explosive accumulation of gas and air before a light could possibly be applied; (2) that the gas could only be ignited in the unconfined air of the apartment, openly, and therefore safely; and (3) that the entire "motor," with its subsidiary mechanical arrangements and connections, was freely exposed to observation on every occasion the stove was used, and thus any defective condition of the gas-fittings or other working parts could be instantly recognized and, if need be, remedied.

Several modifications of the construction of this hot-air stove had been designed by the learned author of the paper; and the one which was exhibited was a plain working model. It was for the manufacturers to employ artistic devices for the outward forms, and to construct smaller or larger sizes to meet popular requirements. As the "motor force" was of the exceptional power of which he intended to give evidence, it was capable of being applied to a variety of uses for which high temperatures were required, such as cooking-stoves, laundry and tailors stoves, conservatories, bakers ovens, and, in short, nearly all the purposes to which coal itself was usually applied.

Dr. Adams remarked that it had been pressed upon him to discuss the important question of cooking, and to give some description of the modifications of stoves which he had designed in this connection; but this was a matter that must be reserved for special and for fuller consideration than could then be given. Hitherto he had been treating of the best method of generating heat within a stove by the combustion of coal gas, and of the best method of distributing that heat outside the stove. For cooking and analogous uses the principles of construction differed entirely. The objects he had aimed at in cooking-stoves were—(1) to prevent the loss of heat outside the stove; (2) to ensure a more effective use of convected heat than hitherto; (3) to utilize the properties of pure radiant heat in a degree to no previously existing gas-stove could make pretensions; and (4) to devise cooking utensils specially for the gas-stoves, or at least more suitable than any in ordinary use. That there was scope for improvements might be inferred from one illustration having reference to the conditions under which cooking operations were generally performed, and which would show that there was more matter for consideration in the subject than was dreamt of in the philosophy of stove manufacturers in general. At the gas apparatus exhibition in Greenock, he remarked, Mr. Stewart, M.P., while heartily desirous of aiding the movement, stated that "from what he had experienced of food cooked by gas, there was always a something left behind which one would rather have been without." Some light might be thrown upon the cause of that peculiar undesirable

"something" if the arrangements made by the best stove-makers were examined. In roasting meat, the burners were placed at the bottom of the oven, and the joint was suspended above; and then, in the words of the usual advertisement, the meat "is completely enveloped in an atmosphere of heated air," the joints when "cooked have very much the same appearance as those done before an open fire, but they lose rather less in weight, are plump, and full of gravy," &c.; and, finally, it was stated that "in the roasting of a 6-lb. joint there is burned 30 cubic feet of gas." But, the author asked, was the meat roasted? Was it not rather what might be called "gassed"? It was not an atmosphere of heated air that enveloped the meat, but an atmosphere of hot waste gases, watery vapour, tar, and other impurities, the products of gas combustion. Might not the watery vapour alone have a share in producing that peculiar "something"? The combustion of 80 cubic feet of gas of average composition generated 2 lbs. avoirdupois of pure water in the shape of water vapour, and it was therefore easy to understand why the meat did not lose so much weight in the "gassing" process. It was already surrounded by a watery atmosphere, which lessened evaporation. If the meat had been roasted before a clear fire, and a pan holding 2 lbs. of water had been boiled and evaporated into steam underneath the joint, the two processes would have been perfectly analogous, with the exception that in the "gassing" process there was mixed with the watery vapour some 200 or 300 cubic feet of the waste products of gas combustion. Such facts were worthy of being pondered over, and so the author would leave them.

He then proceeded to give some evidence of the efficiency of his hot-air stove. If, he said, he simply confined himself to a bald statement that so many units of heat were utilized in the combustion of so much gas, many persons would be but little the wiser. To appraise the statement, it was necessary to know the alleged value of the units, and to have some standard or data for comparison. An English unit of heat was that amount of heat which would raise the temperature of 1 lb. of water 1° at 32° Fahr. But that standard was not conveniently applicable to the purpose of determining the calorific force of a gas-stove. There was required a different formula, and in each case intricate calculations were necessary according as the air was delivered warm, say, above 212° Fahr., or below that temperature. The specific heat of air, its weight per lb. at every degree of temperature, the elastic force of the moisture it contained, and so on, formed so many factors, making it necessary that tables and formulae of an extensive and complicated character should be at one's elbow, and that a competent head should direct the calculations. The author's chemical friends were satisfied that the unit which he adopted, although wanting in strict scientific accuracy, was, nevertheless, perfectly fair in determining approximate values, and for purposes of comparison. He ascertained, by the use of an ordinary thermometer, the temperature of the warm air delivered, and he ascertained, by the use of a delicate anemometer, the quantity of air that entered the stove to be warmed; then he multiplied the one by the other, and called the product "units of heat." Thus, 1000 cubic feet of air might be assumed to enter the stove at a temperature of 40° Fahr., and leave it at 240° Fahr. Then, deducting the initial temperature—40° Fahr.—he multiplied the two factors:—1000 x 200 = 200,000. If the amount of gas burned was, say, 10 cubic feet, he would divide the product by 10, which gave a quotient of 20,000, and he said that 1 cubic foot of gas had yielded 20,000 units of heat. The method was simple, and easy to be practised by persons of ordinary intelligence. Its defect was chiefly with temperatures under 212° Fahr., for then much heat was rendered latent, and practically lost in converting the aqueous vapour into steam, and the rate of expansion of moist air—and air was always moist—under 212° Fahr. was enormously greater than in the case of dry air. But it was of greater importance to determine how far the units of heat produced the desired result. It was the manner in which the force was localized that gave the true measure of force in its relation to the subject under consideration, and the author therefore placed little value in a parade of units of heat, unless associated with a statement of the effects produced in the desired direction. He then went on to show that, in any point of view, whether in the number of heat units generated, or in the production of the heating result desired, there was obtained in his hot-air stove a development of motor force in gas-stoves not hitherto appreciated. That was best done, he said, by comparison. He selected the best hot-air stove which he had tested, or that had been publicly tested, so far as he knew. That to which he referred had had much attention directed to it a few months ago, as it was tested, at the instance of the manufacturer, by Mr. Joshua Horton, of Glasgow, a gentleman who was well known to have made gas matters a specialty. The result of his tests caused Mr. Horton to abandon in despair a gas-stove which he had himself contrived, and to express to Dr. Adams his opinion that he also should give up. That stove was also tested by Mr. J. L. Bruce, architect, of Glasgow, whose special knowledge of all things pertaining to the subject was well known. That gentleman had certified that, with the exception of one of the author's early rough working-models, he had not seen a gas-stove at all equal to that which was referred to. The certification and tests of those gentlemen—excluding reference to the Adams stove, which was not then open to public inspection—had been made public by the manufacturer as testimonials of merit, and the author's reference to such public facts was, therefore, legitimate. He had afterwards, in conjunction with Mr. Bruce and Mr. Harvie (a gentleman of large experience as a maker of stoves), also tested that stove. The tests were frequently repeated, and the experimenters were all practically agreed as to the results. Mr. Bruce only differed in his mode of expressing them. He preferred the use of elaborate and complicated formulae, difficult of application, but admittedly more scientific, and yet open to fallacies from their liability to be applied under conditions for which they were not suitable. But substantially, the conclusions arrived at in the experiments were in accord. Selecting the chief items from an elaborate series of results, the author presented them in the form of a table which would be easily understood by the members:—

	Square Feet of Heating Surface.	Units of Heat utilized per Cubic Foot of Gas.	Temperature of Air warmed above Initial Heat.	Cubic Feet of Air warmed per Cubic Foot of Gas.	Temperature of Waste Products.
No. 1 stove, presumably best in market, burning 10½ cubic feet of gas per hour . . .	15	3,658	62° Fahr.	59	170° Fahr.
Ditto, burning 15½ cubic feet . . .	15	6,396	102° "	48	200° "
No. 2 stove, Dr. Adams's new model, burning 1½ cubic feet of gas per hour . . .	42	51,300	180° "	285	244° "

Proceeding to refer to the table, Dr. Adams said that the units of heat utilized by radiation and contact of air from the external surfaces of the two stoves were not calculated; but as No. 2 had 3 feet of additional external surface, and a much higher temperature, any mode of calculation would show a very large addition due to that stove. Similar tests made with

cooking-stoves constructed to his design, and contrasted with others, showed a similar ratio of results. It would be asked, he said, how he accounted for the vast difference shown in the table. He replied that the explanation should suggest itself to the members when he reminded them of two conditions of which he had already treated—first, the mode in which the heat when generated was distributed; and secondly, the quality or character of the heat. They would recollect that a Bunsen flame was composed of a current of gaseous molecules, which would only give up their heat to a stove if the walls were made big enough, or the flues long enough. That principle had not been sufficiently understood, and the rule had been to let the current of molecules escape into the atmosphere or up the chimney as speedily as possible. The heat contained in those molecules was further wasted, or destroyed for practical use, by being mixed up with, and diluted through the admission of an unnecessary quantity of cold air. With those defects removed, he had transferred the same form of burner employed in No. 1 stove to No. 2 stove, when there was effected instant and great improvement. The heat utilized was 21,000 units per cubic foot of gas, and 183 cubic feet of pure air were heated to 115° Fahr. above the initial temperature for every cubic foot of gas. That great difference and excess over No. 1 stove were fairly attributable, therefore, to the altered construction of the stove, irrespective of the burner, because in both cases the same burner was employed. But the Bunsen burner had defects in its application to a hot-air stove which he had been unable to overcome. It was liable to "strike back," run down, and burn with a smoky flame, &c. Further, it was liable to be suddenly extinguished by "blow-downs" in the chimney, or by sudden strong currents caused by the opening or slamming-to of a door, &c. He had, therefore, satisfied himself that for a hot-air stove the Bunsen burner was not generally suitable. The same stove when fitted with the new combination chamber showed an enormous increase of heating force over the Bunsen; and here again he would remind the members that the character or quality of the heat generated in the new combination chamber differed very greatly in the proportions of convected and radiant heat from those generated by a Bunsen burner. Instead of a trifling percentage of radiant heat, there was produced a substantially large proportion of the most intense energy. The fire-clay burners became white hot, and the walls of the combustion chamber became red hot. That heat was not, and could not be carried off, in currents, but was instantly distributed in straight lines. Instead of being diffused through a loose cloudy current of vapour, it was concentrated and localized in a solid compact reservoir kept fully supplied, and from which the radiant heat was drawn off through the absorbing walls of the furnace chamber, from which it was communicated to the walls of the pure air chamber, which were continually being bathed by large streams of fresh air receiving heat through actual contact; and the air thus warmed was rapidly delivered by the wide vomitories of the stove. He would only further contrast the Bunsen with the "atmopyre" burner, by pointing out that the former—like an ordinary gas-jet—was a mere mechanical outlet for delivering the fuel. It was in no sense a source of heat in itself, and was only effective in the production of convected heat; but the "atmopyre" in itself became a source of heat, and was effective in the production of radiant as well as of convected heat. The new combination burner did not "strike back," and could not be extinguished except by shutting off the gas; and even then, so intense was the heat, that for several minutes after the gas was shut off, it would re-ignite when turned on.

In conclusion, Dr. Adams desired to say that it was only the chemist friends who had, at different stages of his investigation, aided him with their corroborative counsels, who could adequately appreciate the laborious details involved in giving practical form to theoretical conceptions; and to Mr. L. Mayer, of the Tharsis Company, to Dr. Wallace, to Professor Dittmar, to Mr. Tatlock, City Analyst, and others, he owed much obligation. To Mr. Harvie, who made his first stove 25 years ago, as well as the working model then exhibited, he referred such persons as might wish to have a closer and more leisurely inspection and more detailed information.

An interesting discussion followed the reading of the paper, the first speaker in which was

Dr. W. WALLACE, who said there were three requisites in a really good gas-stove—first, the products of combustion must be conducted away into a chimney or flue; secondly, the smallest possible quantity of air consistent with perfect combustion should be admitted, for the very obvious reason that the greater the proportion of air used in burning the gas, the greater would be the amount of heat carried up the chimney; thirdly, the products of combustion should be cooled down before passing off from the stove, so as not to leave in them any more heat than was necessary to cause a sufficient draught and prevent the condensation of moisture. He considered that Dr. Adams's apparatus fulfilled those conditions more completely than any other stove he had seen, and he had no doubt it would come largely into use for the heating of apartments. In one thing, however, he differed from Dr. Adams. The use of water at the top of the stove, to render the air more humid, he considered to be quite unnecessary. A gas-stove did not "dry the air" any more than an open fire did; and the air of inhabited rooms warmed by open fire-grates was seldom, if ever, found to be unpleasantly or unhealthily dry. Of course, those who did not wish moist air had only to omit filling with water the trough running round the top of the stove, and thus the provision for moistening the air was no objection whatever to the stove itself. He had to congratulate Dr. Adams upon his having brought to perfection an apparatus of great public utility.

Professor W. DITTMAR, F.R.S.E., of Anderson's College, remarked that Dr. Adams's stove, to say the least of it, was founded throughout on sound scientific thought, and this, taking gas-stoves as gas-stoves, was giving it high praise. To select a set of "atmopyres" for the generation of the heat was the happiest choice that could have been made. The "atmopyre" offered this great advantage, amongst others, that it retained within itself, and thus localized at the right place, a considerable portion of the heat, which, in the case of a Bunsen burner, for instance, would get wholly diffused throughout, and be carried along with the large stream of gases and vapours resulting from the combustion of the coal gas employed in the stove; but in Dr. Adams's stove a considerable percentage of the heat necessarily retained by the combustion gases was coaxed out of them, and utilized by means of the system of circuitous canals through which they had to travel before they were allowed to reach the chimney, the heat abstracted assuming the form of a stream of pure hot air. Dr. Adams had so arranged matters that those gases reached the chimney with a temperature of 250° Fahr., for this reason, amongst others—namely, that the gases must be kept above 212° Fahr., at any rate, so as to prevent the condensation of the steam. In his (Professor Dittmar's) opinion this was a great mistake. The steam in the combustion gases being largely diluted with nitrogen, carbonic acid, and unconsumed oxygen, was at a tension of a mere fraction of one atmosphere, and consequently would stand refrigeration to a much lower temperature than 212° Fahr. It would condense only when cooled down below the temperature at which water boiled under the pressure of that fraction of an atmosphere. There was one other point on which he could not quite endorse the views of Dr. Adams. He

referred to the Doctor's method for measuring the useful heat furnished by a gas-stove. He (Professor Dittmar) believed in the old established unit of heat; and the correct mode of measuring the utilized heat was, in his opinion, to determine the volume of combustion gases going into the chimney per unit of gas consumed, then to calculate from their temperature and composition the number of units of heat which they carried away with them, and to deduct that quantity from the total number of units of heat produced by the combustion of a unit of gas. If it had not been determined directly, that quantity could be calculated only from a sufficiently complete analysis of the gas.

Mr. HARVIE, in reference to the high temperature of the escaping gases, stated that the high temperature of 250° Fahr. was necessary for the production of a sufficient draught.

After some remarks by Mr. W. P. Buchan, sanitary engineer, Mr. John Mayer, F.C.S., and Mr. G. W. Muir, coalmaster,

Mr. J. HAY, heating engineer, thanked Dr. Adams for having recognized in a healthy way the need for having a chimney in connection with gas-stoves for the discharge of the products of combustion, seeing that amongst them there were the usual poisonous gases. This was the more welcome, considering that for many years past there had been a constant succession of inventions in gas-stoves, in which the chief recommendation was that there was no smell, the combustion being so complete, forgetting all the while that the carbonic acid gas, being thus the more pure, was the more deadly. At all times there was an objection to the use of gas-stoves on account of the high cost, the estimated difference of cost being for gas six times that of common coal. Referring to the construction of the particular stove under consideration, he said that the combustion of the gas was well secured by the construction of the burner used by Dr. Adams; and in reference to some remarks on the subject of the high temperature of the gases discharged into the chimney, he said there was a distinct necessity for such a high temperature being maintained, because, if the gases entered the chimney at a low temperature, they were liable, by being further cooled, to lose their ascending power. In illustration of which he cited the experience gained many years ago in the use of the original Arnott stove, in which the heat was so thoroughly exhausted by the stove itself that the combustion often came to a standstill from the absence of sufficient power in the chimney. He quite thought the stove would have been much improved in its efficiency if the air to be heated were introduced into it at the lowest possible level, instead of descending from a high level, and still more if the air were drawn direct from the outer atmosphere.

Professor DITTMAR again rose and directed attention to a point which, obvious as it was, had been left entirely unnoticed by other speakers who had dealt with the expediency or otherwise of impregnating the hot air furnished by the stove with water. He said that the absolute quantity of vapour of water contained in a given quantity of air was, of course, as had been correctly remarked by Dr. Wallace, absolutely independent of temperature; but it stood different to that which was meant when one spoke of the relative moistness of an atmosphere—namely, with the ratio of the water actually present to the maximum amount of water which could be present at the respective temperature. That ratio *did* get less when the temperature increased, and, consequently, Dr. Adams, who made provision for moistening the hot air issuing from it, was right, in principle, at any rate.

Dr. ADAMS replied. He said he had already explained that his method of estimating units of heat was only designed for the use of individuals who could not obtain or use the customary scientific formulæ. His suggested method gave fairly approximate values for the practical purposes of ordinary comparison. As to the high temperature at which the waste products were passed into the chimney, he considered this absolutely necessary in order to give them the requisite ascensional force. The late Dr. Andrew Ure, F.R.S., had pointed out that in slow-combustion stoves—which he designated "poison-vomiting coffers"—there was regurgitation of carbonic oxide and acid into the apartments from the chimney; and as the result of practical investigation made under Government instructions, he had reported that 300° Fahr. should be the minimum temperature. As to the provision made for supplying moisture, he (Dr. Adams) remarked that it could be used or not at pleasure. But it should be borne in mind that in this country about 80 per cent. of the amount of water necessary to saturate air was necessary for a healthy atmosphere. Air at 60° Fahr. contained about double the amount of moisture that could be held by air at 40° Fahr. But if air at 40° Fahr. was suddenly raised to 60° Fahr. it could not obtain the healthy amount of moisture unless through an artificial supply; indeed, the dry condition of a stove-heated room was one of the chief objections to the use of stoves. Moreover, for medical uses it was often requisite to have, and medical men were put to great shifts to obtain an extra moist atmosphere, as in some forms of asthma, in croup, &c.; while in other ailments, as bronchitis, some diseases of the larynx, and certain stages of consumption, a dry atmosphere was an important and much-desired therapeutic agent. If moisture were needed, his (Dr. Adams's) mode of supplying it was an improvement on ordinary methods, and it could be adopted or let alone at pleasure. Taking the supply of air from an upper stratum of the atmosphere was, in his opinion, a great improvement. If taken from the level of the floor there was caused a rush of "cold-footbath" currents of air, together with a cold floor, both of which were held to be hurtful by all sanitary authorities. There was also the fact that the interior of the stove did not get cooled, nor did the burners become choked up with any dust carried along the floor level. He also replied to Mr. Buchan in respect of the cost of the gaseous as compared with ordinary fuel. He said it was unnecessary to keep the stove burning continuously or at its full power, and it could be regulated quite as easily as an ordinary jet of gas for illuminating purposes.

A number of the members subsequently inspected the stove which Dr. Adams had in actual operation, and were much pleased with the arrangements for securing complete combustion of the gas used, and for getting an abundance of pure air sufficiently heated and moistened to distribute through an apartment.

PARIS GAS COMPANY.

At the Annual General Meeting of the above Company, held in Paris on the 25th of March, the usual report on the Company's operations for the year ending Dec. 31, 1879, was presented by the Board of Direction. It stated that further progress had been made in the consumption of gas over the previous year, but that the increase would have been greater had not the excessively cold weather which prevailed during the month of December caused considerable disturbance in the commerce and industry of Paris. The past severe winter was productive of very great difficulties for the Company, and although, during the month referred to, they were able to keep all their stations well supplied with raw material, maintain their plant in good working order, and discharge faithfully all the obligations imposed upon them, it had been done at great sacrifice, which had made a sensible diminution in the profits realized in the previous month. Of course the Company could have somewhat mitigated the effects of this state of things by raising the price of their coke; but the Directors bore in mind that as this combustible had come into such general use, and was the only heating material

employed by the most necessitous classes, it was unadvisable to impose a fresh cause of suffering upon that portion of the population which was most directly affected by the rising in price of articles necessary to life. The report then proceeded to give a detailed account of the Company's working during the year 1879, under the usual headings, as follows:—

GENERAL REVIEW OF THE COMPANY'S OPERATIONS.

Consumption of Gas.—During the year 1879 the Company sent out for consumption a volume of gas equal to 218,813,875 cubic metres (7724½ million cubic feet), being 6,864,358 cubic metres (242,312,000 cubic feet) more than in 1878. During the year 1868, which was one following an Exhibition year, the consumption of gas increased to the extent of only 2,228,049 cubic metres (78,650,000 cubic feet).

The day consumption of gas, which takes place between the time for extinguishing and the time for re-lighting the public lamps, figures to the extent of 53,539,638 cubic metres (1890 million cubic feet), or 24½ per cent., in the above total consumption, and exceeds by 4,862,035 cubic metres (171,630,000 cubic feet) the corresponding amount in the year 1878. This day consumption, which is due principally to the use of gas for industrial and domestic purposes, has latterly made considerable progress. For example, in the four years 1875-9 it increased by 20 million cubic metres (706 million cubic feet), while previously it had taken ten years—namely, from 1865 to 1875—to increase by a like amount.

Receipts for Gas.—The receipts from the sale of gas, which in 1878 amounted to 54,025,229 frs. (£2,161,009), in 1879 reached the sum of 55,619,588 frs. (£2,224,783). These receipts may be apportioned as follows between the two great divisions of the Company's area of supply:—

	Francs.	Sterling.
In Paris and its environs	52,000,886	£2,080,035
In the outskirts beyond the fortifications	3,618,702	144,748
Total	55,619,588	£2,224,783

Consumers.—The number of consumers on the 31st of December last was 139,230, exceeding by 7796 the number at the corresponding date in 1878. This is the first time in the Company's history that the number of fresh consumers has in a single year attained so high a figure.

Public Lighting.—The number of public lamps in use on the 31st of December, 1879, was—

In Paris and its environs	39,086
In the outskirts	7,046

Total 46,132

exceeding by 1128 the number in operation on Dec. 31, 1878. During that year the number increased by 2518.

House Services.*—The number of house services laid on during the year 1879 increased to 1253, being 123 more than in the previous year, thus bringing up the total number in use on Dec. 31, 1879, to 12,913, distributed over 10,660 houses. Of these 1253 new services, 978 were fixed for the supply of apartments of which the occupants were willing to contract at once for a supply of gas to at least three burners, and 275 were laid on upon the application of landlords, who undertook, at their own expense, to fit up a minimum of three burners in three apartments. These 12,913 house services, exclusive of the branch-pipes, fittings, meters, &c., which are subject to a special payment, cost 7,726,875 frs. (£309,075), which is equivalent to an average cost, 598 frs. (£23 18s. 6d.) per service.

The receipts arising from the sale of gas consumed by means of these services in the year 1879 amounted to 8,229,106 frs. (£329,164), showing an increase of 747,390 frs. (£29,893), or 10 per cent., on the analogous receipts for the preceding year, which amounted to 7,481,776 frs. (£299,271).

With regard to the number of consumers supplied from house services, which, on Dec. 31, 1878, stood at 35,032, on the same date in 1879 it had reached 39,788, representing more than one-fourth of the total number of consumers.

Principal Results of Working.—The following table gives the quantity of gas manufactured from Jan. 1, 1856, to Dec. 31, 1879, the total of which is 3048½ million cubic metres (107,612 million cubic feet). It shows that during the first 23 years of the Company's working, the annual consumption of gas has more than quintupled, and that the average annual increase, far from diminishing, tends, on the contrary, to grow larger in a very notable proportion. In fact, an examination of the table shows that the average increase in consumption per annum, which, during the first 14 years of the Company's concession, did not exceed 7,460,000 cubic metres (263,338,000 cubic feet), has, during the 7 years which have just passed, reached 10,106,000 cubic metres (356,741,000 cubic feet), which is higher than the preceding figure by 35 per cent.

Year.	Annual Consumption. Cubic Metres. (1 c. m. = 35·317 c. ft.)	Annual Increase. Cubic Metres. (1 c. m. = 35·317 c. ft.)	Annual Dividends. Francs.
1855 . . .	40,774,400	—	—
1856 . . .	47,335,475	6,561,075	40·00
1857 . . .	56,042,640	8,707,165	45·00
1858 . . .	62,159,300	6,116,660	50·00
1859 . . .	67,628,116	5,468,816	60·00
1860 . . .	75,518,922	7,890,806	70·00
1861 . . .	84,230,676	8,711,754	70·00
1862 . . .	93,076,220	8,845,544	85·00
1863 . . .	100,833,258	7,757,038	95·00
1864 . . .	109,610,003	8,776,745	105·00
1865 . . .	116,171,727	6,561,727	105·00
1866 . . .	122,334,605	6,162,878	110·00
1867 . . .	136,569,762	14,235,157	115·00
1868 . . .	138,797,811	2,228,049	120·00
1869 . . .	145,199,424	6,401,613	102·00
1870 . . .	114,476,909	30,722,520 dec.	40·50
1871 . . .	87,481,346	26,995,558	32·50
1872 . . .	147,668,331	60,186,985	51·00
1873 . . .	154,397,118	6,728,787	52·50
1874 . . .	160,652,202	6,255,084	55·00
1875 . . .	175,938,244	15,286,042	60·00
1876 . . .	189,209,789	13,271,545	62·00
1877 . . .	191,197,228	1,987,439	62·00
1878 . . .	211,949,517	20,752,289	65·00
1879 . . .	218,813,875	6,864,358	65·50

Manufacturing Power.—The manufacturing power of the Company's works, which, on Dec. 31, 1878, was 236½ million cubic metres (8348½ million cubic feet), including that of the reserve plant intended to meet cases of accident, or any unexpected increase in the consumption, has varied but little. It has only been increased to the extent of 2½ million cubic metres (88½ million cubic feet), which brings the total to 239 million cubic metres (8436½ million cubic feet). At the close of the current year, when the works in progress at the Clichy station are completed, the manufacturing power of the Company's plant will be raised to 261 million cubic metres

(9213½ million cubic feet), which, after deducting the ordinary 10 per cent. for reserve, will give every security for the supply of gas next winter.

Canalization.—During the past year the Company's mains have been increased by 23,425 metres, apportioned as follows:—

	Metres.	Yards.
In Paris and its environs	13,684	14,962
In the outskirts	9,741	10,650
Total	23,425	25,612

Consequently, the total length of mains laid under the public roadways has been increased to 1,829,037 metres, apportioned as follows:—

	Metres.	Yards.
In Paris and its environs	1,289,549	1,409,907
In the outskirts	539,488	589,841
Total	1,829,037	1,999,748

These extensions of mains have, as usual, been made either at the request of the Municipal Authorities, or in compliance with the terms of agreements, though in some cases the work has been initiated by the Company, with the view of meeting demands for a further supply of light, or to improve the general condition of the network of mains.

EXPENSES OF FIRST ESTABLISHMENT.

It was announced last year that the Company's stations had reached the limit of their productive power, and that in order to satisfy the growing requirements of consumption it was necessary to construct entirely new works, which the Directors proposed to erect at Clichy, on a site between the River Seine and the Western of France Railway. During the past year, therefore, the Directors have confined themselves to the completion of the work absolutely necessary in the original works, and have concentrated all their efforts upon the new ones, which they expect to start working next winter. When this station is finished, it will produce annually 75 million cubic metres (2647½ million cubic feet) of gas, which will correspond to one-third of the Company's total production.

The total amount expended on works of first establishment increased last year to 5,601,602 frs. (£224,064), apportioned as follows:—

Purchase of Land.

	Francs.	Sterling.
For enlargement of coke shed	70,000	£2,800
For enlargement of coal stores	123,500	4,940
Legal and other incidental expenses	31,891	1,270
	225,399	£9,016
Less value of land sold	147,266	5,890
Total	78,133	£3,126

Works and Plant at the Company's Stations.

	Francs.	Sterling.
La Villette	421,511	£16,860
Les Ternes	89,725	3,589
Passy	40,062	1,602
Vaugirard	124,772	4,991
Ivry	180,633	7,515
St. Mandé	33,746	1,350
St. Denis	25,514	1,021
Boulogne (Paris)	18,275	731
Maisons-Alfort	33,455	1,338
Clichy	1,760,019	70,401
Tar-works (La Villette)	136,471	5,459
Chemical-works (Ivry)	21,093	844
Miscellaneous	83,658	3,316
Total	2,976,934	£119,077

Mains, Services, Fittings, &c.

	Francs.	Sterling.
Extension of mains	594,892	£23,796
House services	802,745	32,110
Pipes and fittings	386,692	15,468
Meters	333,001	13,320
Vehicles	250,614	10,024
Tools and material	57,887	2,315
Miscellaneous	120,704	4,828
Total	2,546,535	£101,861

Total expenses of first establishment 5,601,602 . . £224,064

The general position of the account of expenses of first establishment may be thus stated:—

	Francs.	Sterling.
Amount expended to Dec. 31, 1878	175,280,203	£7,011,208
Ditto during 1879	5,601,602	224,064

Total on Dec. 31, 1879 180,881,805 . . £7,235,272

To meet which there is a capital of—

In shares	84,000,000 frs.	
In bonds	111,745,739	
	195,745,739*	7,829,829

Balance in favour of the Company 14,863,934 . . £594,557

Loan of 1878.—The works intended to be carried out with the money authorized to be raised by loan in 1878, for the purpose of increasing the annual producing power of the Company's stations from 228½ million cubic metres (8066 million cubic feet) to 261 million cubic metres (9213½ million cubic feet), inclusive of the necessary reserve plant, were estimated to cost 25,885,291 frs., apportioned as follows:—

	Francs.	Sterling.
Purchase of land, extension of works, plant, &c.	12,150,000	£486,000
Mains, services, fittings, meters, &c.	12,450,000	498,000
Tools and materials, office expenses, &c.	1,285,291	51,412
Total	25,885,291	£1,035,412

The expenses incurred during the years 1878-79 amount to the sum of 11,021,357 frs., apportioned thus:—

	Francs.	Sterling.
Purchase of land, extension of works, plant, &c.	6,086,008	£243,440
Mains, services, fittings, meters, &c.	4,211,606	168,464
Tools and materials, office expenses, &c.	723,743	28,950
Total	11,021,357	£440,854

* These house services, called *conduites montantes*, are pipes carried from the bottom to the top of the buildings, for the supply of flats and separate apartments, as in Scotland.

* It follows from an examination of the balance-sheet that, out of a capital of 195,745,739 frs., there had been paid off, on Dec. 31, 1879, in shares, 9,429,250 frs.; in bonds, 9,960,757 frs.—total, 19,390,007 frs.—leaving 176,355,732 frs. to be redeemed.

Consequently, on the 31st of December last there remained a balance unexpended of 14,863,934 frs., apportioned as follows:—

	Francs.	Sterling.
Purchase of land, extension of works, plant, &c.	6,063,992	£242,560
Mains, services, fittings, meters, &c.	8,238,394	329,536
Tools and materials, office expenses, &c.	561,548	22,461
Total	14,863,934	£594,557

The total amount authorized to be raised by loan was 26,600,000 frs. (£1,064,000), and the difference between this sum and the estimated expenditure—viz., 714,709 frs.—has been applied in liquidation of expenses incurred previously to, and remaining unpaid on Dec. 31, 1877. The foregoing comparison between the estimated expenses and those actually incurred in the course of the past two years shows that the outlay has been well within the contemplated limits.

WORKING ACCOUNT FOR THE YEAR 1879.

EXPENDITURE.

	Francs.	Sterling.
Value of gas in store on Jan. 1, 1879	21,767	£870
<i>Materials used in Manufacture.</i>		
Coals carbonized.	18,110,842	£724,433
Coke and tar for heating purposes	3,616,146	144,646
	21,726,988	£869,079

Manufacturing Charges.

Salaries and wages	2,576,086	£103,043
Maintenance of works and plant	1,581,170	63,247
Incidental expenses of distillation	1,033,976	41,359
Purifying material	295,400	11,816
General expenses	76,394	3,056
	5,563,026	£222,521

Cost of Distribution.

Salaries of Engineers and Officers	1,112,715	£44,509
Repair and maintenance of mains and service-pipes	665,825	26,633
Allowances, premiums, &c.	20,127	806
Printing and advertising	141,211	5,648
Miscellaneous.	54,705	2,188
	1,994,593	£79,784

General Management.

Board of Direction and Executive Committee.	150,000	£6,000
Salaries	814,877	32,595
Office and other expenses	170,287	6,812
Service, accidents, relief, &c.	164,743	6,590
Law and other charges	20,319	813
Rents and insurances	165,239	6,609
Interest on loans	5,317,075	212,683
Loan redemption-fund	1,728,000	69,120
Share ditto	1,389,500	55,580
Cost of experiments, &c.	128,993	5,160
Pension-fund	85,500	3,420
Provident-fund	111,467	4,458
	10,246,000	£409,840

Municipal Charges.

Tax of 2 c. per cubic metre of gas.	3,804,342	£152,174
Rating of subsoil	200,000	8,000
Lighting, extinguishing, and maintenance of public lamps	519,752	20,790
	4,524,094	£180,964

State Charges.

Taxes.	543,808	£21,752
Stamps	124,113	4,965
Subsidy to Control Department	6,000	240
	673,921	£26,957

Total Expenditure 44,750,389 . . £1,790,015

REVENUE.

Produce of the sale of gas	55,619,588	£2,224,783
Value of gas in store on Jan. 1, 1880	15,591	624
Retort coke	12,611,732	504,469
Furnace coke	455,948	18,238
Tar	2,609,600	104,384
Ammoniacal liquor.	366,228	14,649
Rent of meters on hire	1,200,547	48,022
Rent of fittings, &c., on hire	1,172,301	46,892
Fire-bricks	209,841	8,394
Chemical products	1,153,596	46,144
Sundry works	169,016	6,761
Interests and discounts	644,505	25,780

Total Revenue 76,228,493 . . £3,049,140

Balance in favour of revenue, being profit made during 1879	31,478,104	£1,259,124
Add balance of profit from 1878	91,412	3,656
	31,569,516	£1,262,780
Deduct reserve to meet claims outstanding on Dec. 31, 1879.	169,516	6,780
Balance, being profit available for distribution.	31,400,000	£1,256,000
Deduct for share dividend	12,400,000	496,000
Balance divisible equally between the Municipality of Paris and the Gas Company	19,000,000	£760,000

The total amount available for distribution among the Shareholders is, therefore, as follows:—

	Francs.	Sterling.
Dividend, as per above account	12,400,000	£496,000
Moiety of balance, ditto	9,500,000	380,000
Seventh payment by the Municipality, in partial reimbursement of working expenses.	50,000	2,000
Balance of profit to the credit of Shareholders	64,673	2,587
Total	22,014,673	£880,587

Deduct 1 fr. per share for special reserve-fund, authorized at the general meeting on March 23, 1875 336,000 . . 13,440

Balance 21,678,673 . . £867,147
Deduct interim dividend of 12 frs. 50 c. per share paid in October last 3,798,013 . . 151,921

Balance 17,880,660 . . £715,226
Deduct final dividend of 53 frs., making a total dividend for the year of 65 frs. 50 c. per share (250 frs.) 17,808,000 . . 712,320

Net balance to carry forward.. . . . 72,660 . . £2,906

PROVIDENT AND OTHER FUNDS.

Provident-Fund.—The object of this fund is to ensure to such of the Company's servants who, through sickness or accident, may be temporarily unable to discharge their duties, the medicine and medical attendance they may require; to provide them with funds during their illness; to defray the expenses of their interment in the event of their death; and to temporarily assist the widows and children of those who have died while in the Company's service. The fund is maintained by a deduction of 1 per cent. from the salaries of those who benefit by it, with the addition of an equal total amount provided by the Company. There are 20 medical gentlemen and 60 chemists upon the medical staff supported by the provident-fund.

During the year 1879 the medical staff visited 1390 patients, as well as attended 25,574 consultations. The medical fees, medicine, and other expenses in the year 1879 amounted to 228,819 frs. The account of the fund stands thus:—

	Francs.	Sterling.
<i>Receipts.</i>		
One per cent. deducted from salaries, &c.	111,467	£4,459
Equal amount given by the Company	111,467	4,459
Interest and sundry receipts	6,490	259
Total	229,424	£9,177

	Francs.	Sterling.
<i>Expenditure.</i>		
Medical fees, medicine, &c., as above	228,819	£9,153
Excess of receipts.	605	£24

In 1878 the receipts exceeded the expenses by 4605 frs. (£184). On the 31st of December last this fund possessed 65 of the Company's fully-paid bonds, which had cost 33,042 frs. (£1322), and a cash balance of 5489 frs. (£219); thus bringing up to 38,531 frs. (£1541) the balance standing to the credit of the fund.

Pension-Fund.—This fund was instituted in 1858 for the purpose of pensioning off those officers of the Company who, having reached the age of 55, and given 25 years good service, might become incapable of discharging their duties. The capital required to maintain this fund consists of contributions from several of the Directors, who are desirous of assisting so useful an institution, and of an annual grant from the Company, the interest being capitalized. The officers do not contribute in any way whatsoever. As this fund cannot be drawn upon until the year 1881, the Company have, up to the present time, out of their funds granted various sums of money by way of periodical assistance, or as pensions to those old officers who, by their labour and devotion to the Company's interests, have merited such consideration.

The various sums from time to time placed to the credit of this fund amounted on Dec. 31, 1879, to 1,906,966 frs. (£76,279), represented by 20 of the Company's shares, 3910 of their bonds, partially paid up, 400 three per cent. bonds of the Eastern and Western of France Railways, costing altogether 1,895,619 frs. (£75,825), and by a balance in hand of 11,347 frs. (£454). The previous deduction of 4500 frs. (£180) made each year from the amount regularly set apart for this fund, for the purpose of granting pensions to, or temporarily assisting the Company's workmen and servants, under the circumstances indicated above, has for a long time been found quite insufficient. The Company have, therefore, had to supplement it by a grant of 69,950 frs. (£2798), thus forming a total of 74,450 frs. (£2978). In 1878 this subsidiary grant amounted to 68,963 frs. (£2758).

Savings-Fund.—This fund, which is of comparatively recent date, was instituted with the object of engendering thrifty habits in the Company's servants, by affording them facilities for putting away, without expense or loss of time, whatever they might be able to save each month out of their earnings. From the date of its formation up to the 31st of December last—a period of 3½ years—3109 accounts have been opened. The balance-sheet stands thus:—

	Francs.	Sterling.
Amount received on deposit	602,108	£24,084
Out of this sum there has been repaid—		
In cash to 2114 depositors, some of whom have left the Company's service	261,808	frs.
In vouchers to 201 depositors whose payments exceeded 500 frs.	117,590	„
	379,398	15,176

Balance in hand on Dec. 31, 1879 222,710 . . £8,908

Special Reserve-Fund.—This fund, which consists of a levy of 1 fr. per share per annum, was authorized by the Shareholders at the general meeting in March, 1875, for the purpose of providing a sum to compensate for the share of the undertaking that will be claimed by the Municipality at the end of the Company's concession. It stood as follows on Dec. 31, 1879:—

	Francs.	Sterling.
Amount paid into fund	2,016,000	£80,640
Interest	261,084	10,443
Value on Dec. 31, 1889, of the seven annuities due from the City of Paris, payment deferred till 1888	1,713,046	68,522
Total	3,990,130	£159,605

The first two amounts are represented by 3095 of the Company's fully paid-up bonds, by 2481 bonds on which 250 frs. have been paid, and by a balance in hand of 210,409 frs. (£8416). All these bonds having to be held by the Company and repaid at par, they constitute in reality a value of 2,167,750 frs. (£86,710), which exceeds by 101,075 frs. (£4043) their purchase price, thus bringing the actual total of the special reserve-fund up to 4,091,205 frs. (£163,648).

COALS, RESIDUAL PRODUCTS, ETC.

Coals.—During the year 1879 the price of coal dropped to below that of preceding years. The Company profited by this decrease to renew upon satisfactory terms those of their contracts which were about to expire, and also to enter into fresh ones.

Retort Coke.—The sum realized by the Company's coke business, which in 1878 amounted to 13,585,445 frs. (£543,418), reached 12,611,732 frs. (£504,469) only in 1879. The reason of this decline was the exceptionally mild weather prevailing during the winters of the years anterior to 1879, which prevented the Company disposing of the whole of the coke produced at their several stations. The result was that the stock accumulated to such unusual proportions that ground had to be hired for the purpose of stacking the coke which encumbered the works. On Jan. 1, 1879, the quantity of coke in store was over 8½ million bushels, and there was then a daily production, after deducting the quantity employed in heating the ovens, of nearly 110,000 bushels. Under the circumstances, therefore, the Company were compelled to reduce their price, and adopt other measures in order to prevent an increase of their stock. Furthermore, the heavy snowstorms of December last tended to complicate matters, and entailed expenses which could not possibly be avoided. However, as soon as traffic was re-established the Directors did their utmost to make up for any shortcomings which had been occasioned by the severe weather, and the activity they displayed was such that by the end of January their stock of coke was exhausted, leaving at their disposal only the quantity made each day. From Dec. 1, 1879, to the 10th of February last—a period of 72 days—the Company sent out a total quantity of nearly 11½ million bushels of coke, being a daily average of 155,100 bushels. These figures need no comment.

Another cause of the diminution in the amount earned by the coke business was the depreciation in the value of this residual resulting from long stacking, and a consequent large production of dust. The Directors have ascertained, however, that the loss thus arising, when spread over the whole of the coke sold by the Company since the year 1871, does not amount to 10 per cent. They had, nevertheless, for some time given this matter considerable attention, and eventually determined on converting the coke dust into compressed fuel by the aid of pitch, and the result has been the production of a combustible material having a heating power about equal to that of coke itself. The Company's compressed fuel works, which have been in operation since 1873, have turned out 98,738 tons of this material, which have realized a profit of 1,481,000 frs. (£59,240). This amount would have been larger if the falling off in the demand for coke for several years had not interfered with the development of this new manufacture, by preventing the employment of compressed fuel for the heating of the retorts, except under the penalty of still further encumbering the works with coke. However, now that the stores are empty, the Directors reckon upon converting into compressed fuel a great part of the coke dust, and they hope thus to find some compensation for the unexpected misfortunes of last December.

Tar and Ammoniacal Liquor.—The quantity of tar and ammoniacal liquor resulting from the manufacture of gas at the several stations now exceeds 110,000 tons, and in order to ensure the sale of these residuals the Company are obliged to convert them into commercial products suitable for various requirements. Thus, in distilling tar, there are obtained pitch, which, mixed with breeze, is employed in making blocks of fuel suitable for heating locomotive boilers; heavy oils, used for the preservation of timber; and light oils, from which are extracted benzine, and the essences serving as bases for the preparation of colouring materials. By the treatment of the ammoniacal liquor there are produced sulphate of ammonia and other matters, which, either for agricultural purposes or for the manufacture of soda, find an easy and advantageous market.

The receipts arising from the treatment of the tar and ammoniacal liquor, the secondary products of which are sold at prices varying to a very considerable extent from time to time, amounted on Dec. 31, 1879, to 3,763,196 frs., divided as follows:—

	Francs.	Sterling.
Tar	2,609,600	£104,334
Ammoniacal liquor	1,153,596	46,144
Total	3,763,196	£150,528

This exceeds by 501,105 frs. (£20,044) the amount produced in 1878. In the previous year (1877) the contrary was the case; the produce of this branch of the Company's business was then 512,799 frs. (£20,512) below that of the preceding year.

Heating Appliances.—The number of appliances for heating by coke sold by the Company in 1879 was 2824, being 532 in excess of the number sold in the preceding year. This brings up to 49,619 the total number of these appliances which have been sent out of the Company's works, and nearly the whole of which are in use in Paris.

Gas-Engines.—During the year 1879 the Company sold 9 vertical engines on Otto and Langen's principle, and 82 horizontal Otto engines. In 1878 only 30 of the latter engines were manufactured and offered for sale by the Company. The quantity of gas consumed annually by the gas-engines at work in Paris may be estimated at 1,200,000 cubic mètres (42½ million cubic feet). The public are beginning to appreciate the advantages, for minor manufacturing operations, offered by these simple engines, which are so easy to work, so readily transportable, and, above all, so economical where intermittent power only is required.

[The report next dwells at some length on the action recently taken by some of the Syndical Chambers of Paris to obtain a reduction in the price of gas. The matter has already been referred to in the JOURNAL, and is at present under the consideration of a Commission appointed by the Minister of the Interior, on the requisition of the Municipal Council. The Company stand upon the rights accorded to them in their treaties with the City—treaties which, for the past 24 years, have been most faithfully carried out—and these rights cannot, they maintain, be set aside or modified without the consent of, and some compensation being made to the Shareholders.]

IMPROVED PUBLIC LIGHTING.

In announcing, at the last general meeting of the Company, that some trials of an improved system of public lighting were about to be made, at the request of the Municipal Administration, in the Rue du Quatre Septembre, in the Place de la République, and in one of the pavilions of the Halles Centrales, the Directors added this remark: "These trials will demonstrate that gas, when burned in sufficient quantity in appliances suitably placed, is capable of producing a much more powerful concentrated illumination than is generally supposed; that its light is quite as susceptible of multiplication as of division; and that, for large as well as for small consumers, lighting by gas still remains *par excellence* the most

practical and economic system of illumination." The public are now thoroughly satisfied of the possibility of obtaining, with gas, centres of light quite as intense as those obtained by means of the electric lamps in the Avenue de l'Opéra. The brilliancy, whiteness, and steadiness of the flame burning in the Company's new lamps in the Rue du Quatre Septembre excited general surprise. It was specially remarked that there was an absence of shadows around the vehicles in motion; and persons who were the least familiar with the subject of public lighting were able to form a correct idea of the difference between a rational system of illumination, conforming to scientific principles, and a system in which are employed very intense light centres, placed at some distance one from another, and presenting alternations of light and shadow which are so much the more marked in proportion as the space between the lamps and the brilliancy of the light are greater. In the Rue du Quatre Septembre the Company proposed to show that, at equal cost, gas affords a considerably better light than electricity. In the Place de la République they wished to prove that, with equal illumination, gas is less costly than the electric light. This they have done. Henceforth, whenever powerful luminous centres are deemed necessary, the use of gas for the purpose of obtaining them will be attended with the advantages of simplicity, adaptability, and cheapness. In conclusion, the Directors hope that the Shareholders will be gratified by the success of these experiments, and continue to share the confidence which the future of the undertaking inspires in each member of the Board.

ROCHDALE CORPORATION SEWAGE AND WATER WORKS.

LOCAL GOVERNMENT BOARD INQUIRY.

On Saturday, the 10th inst., Mr. C. NEALE DALTON, one of the Inspectors of the Local Government Board, held an inquiry at the Town Hall, Rochdale, as to an application made by the Rochdale Corporation to the Board to partially amend, by Provisional Order, the Rochdale Water-Works Acts of 1847 and 1866, and the Rochdale Improvement Acts of 1853, 1872, and 1875, so as (among other things) to extend the powers of the Corporation in relation to the disposal of the sewage of the borough; to enable them to borrow further money for water-works purposes, and for the construction of sewers; and to postpone the time prescribed for the commencement of a sinking-fund for redeeming annuities created, and the repayment of money borrowed for water-works purposes.

Mr. LERESCHE (instructed by Mr. Z. Mellor, the Town Clerk of Rochdale) in opening the case on behalf of the Corporation, said the 88th section of the Rochdale Improvement Act, 1853, incorporated the Towns Improvement Clauses Act, and there was thus provision for the Corporation carrying sewage upon land, and for constructing works for the manufacture of manure. In the first instance the Local Government Board thought there was also power for the treatment of sewage for sale by means of irrigation and filtration; but as it was thought the words in the Acts of 1847 and 1853 were not sufficient to enable them to acquire lands for this purpose, it was suggested that they should obtain a Provisional Order.

The Inspector said there would be no difficulty in extending the Acts to enable the Corporation to acquire and work a sewage farm as desired. It would be necessary to draft a clause for the prevention of nuisances.

Mr. LERESCHE said this should be done, and explained that the power to acquire lands was desired in regard to land outside the borough; for, while the proposed sewage farm or works were inside the borough, they would have to go through some land just outside, in order to convey the sewage to the farm. He then turned to the main point of the inquiry, which was as to increased borrowing powers for water-works purposes, and an extension of time before the Corporation were required to provide a sinking-fund for the repayment of borrowed money. He explained in detail that the Rochdale Water-Works were originally the undertaking of a private Company, whose interests were purchased by the Corporation under the Rochdale Water-Works Act of 1866, the Corporation obtaining power to borrow £200,000 for water-works purposes. In 1872 they had power to borrow a further £100,000 for like purposes, and in 1875 a still further power to borrow £200,000, making a total sum of £500,000.

The Inspector: Plus the standing annuities to the Shareholders of the old Company, which amount to—

Mr. LERESCHE said £180,000. The whole of the sums the Corporation had power to borrow had been borrowed, and now they wanted an extension of powers to enable them to complete the works. The execution of the works, in which very great and entirely unforeseen difficulties had been encountered, had been delayed, and they were now in this condition, with regard to the unfinished portion, that what money had already been expended upon them was unremunerative, and the works were useless until the Corporation were able to have them completed. They had arrived at the point when they must spend more money in order to make what they had already spent practically available.

Mr. C. HAWKESLEY explained that the last observation of the learned Counsel only related to one reservoir.

The Inspector: As to the others, the several sums are being repaid. Are they all to be repaid by 100th parts, with the sinking-fund postponed until 1884?

Mr. LERESCHE: Yes.

The Town Clerk: And we want the commencement of the sinking-fund to be postponed a further ten years.

The Inspector: Have you any other powers under your local Acts enabling you to pay off your debt by any other means except by a sinking-fund?

The Town Clerk: No.

Mr. LERESCHE: That accounts for the double application. We now want more money to complete uncompleted works, and power to postpone the date for the creation of the sinking-fund. We have no money to complete works, and we are not receiving any revenue from the water-works, so we cannot provide a sinking-fund. Therefore, we have to make two applications—one to give us more money, and the other to postpone the time for creating a sinking-fund.

The Town Clerk: There ought not to be any sinking-fund at all required. The works will last for all time when they are completed, and posterity will then inherit a valuable undertaking.

The Inspector: I can understand that you want more money; but what I want to know, in addition, is, how much more you do want, and what effect your proposed expenditure will have upon your works. How far will your proposed further expenditure go to improve your property, and make your works of permanent value?

Mr. LERESCHE: We want £75,000.

Alderman SHAWCROSS: That is the sum necessary to complete the work. We have already had to levy a rate upon the ratepayers to cover a deficiency on the revenue account of the water-works.

Mr. LERESCHE: That deficiency is equal to about a 9d. rate.

Mr. C. HAWKESLEY, C.E., was then called in support of the application, and, in answer to Mr. LERESCHE, said his firm had been Engineers in connection with these works since the formation of the old Company. In the construction of the new reservoirs at Cowm Brook and Spring Mill unusual difficulties had arisen. There were also three old reservoirs of the Company still in use. One of the new reservoirs, that at Cowm, was

completed, and the other was in course of construction. Especial difficulties had been encountered at Cowm, the Engineers having had to go through 75 feet of quicksand. The cost of the two reservoirs up to the present time had been £348,000, including lands and compensation. Then there had been other sums expended in increased pipe lines and interest on the unremunerative works, making the whole expenditure £499,300. It would still require £75,000 to do the work immediately required. He produced an estimate of the several works representing this sum. The Cowm Brook reservoir had been brought into use, and was partially supplying the town with water, together with the old reservoirs; but the increase of population was necessitating the further supply which the completion of the Spring Mill reservoir would provide. The population was a growing one, and the demand had now nearly reached the limit of supply afforded by the present available sources. It was necessary to complete the Spring Mill reservoir without unnecessary delay. There had been already spent a sum of £121,631 upon this reservoir, and it was not yet in a state to enable water to be impounded. The difficulties that had been met with here consisted in the great depth to which they had been forced to carry the puddle trench beyond what they had calculated. They would require £35,000 to complete the works on this reservoir according to their calculations, and until it was completed the previous expenditure would be unremunerative. The water available from the Spring Mill reservoir would be 485,000 gallons per diem, so that not to complete the works would be to throw that yield away. The quantity available from the Cowm reservoir was 529,000 gallons per diem. In the sum of £121,000 mentioned in the estimate was included an item of £19,600 for interest on the cost of the works during construction, because the interest on that cost until the works were completed had to be paid out of capital in the usual manner.

The INSPECTOR said of course it was fair to say that until the works were completed they were losing the interest on £140,000 expended.

Alderman SHAWCROSS: Not only so, but the works cannot be made available.

The INSPECTOR: It would be right to say that until you get these works completed you are paralyzed. Do you say that your sinking-fund is to be paid out of the revenue derived from the water-works?

Alderman SHAWCROSS: Yes; or out of the rates, if the revenue is not sufficient.

The INSPECTOR: Is your application under this head to obviate the necessity of your providing any sinking-fund at all?

The TOWN CLERK said that was not their intention, but if he were asked his private opinion he should say that no sinking-fund ought to be provided, because it was a tax on the present for future generations.

Mr. LERESCHE: Mr. Hawksley, have you not found that in some cases Parliament has extended the time for providing a sinking-fund for such works as these?

Mr. Hawksley said he had. In reply to further questions, he said the Cowm reservoir was completed with the exception of one or two small details, and was yielding a large supply of water to the town—not to the full extent of its capacity, because the demands of the town and district did not yet put it to that test. But the demand was getting pretty near the extent of the supply from the present sources, including Cowm and excluding Spring Mill, which, as he had stated, was not brought into use. The Corporation supplied water for manufacturing purposes, but not to a great extent yet, though it was gradually increasing. He expected that the Spring Mill reservoir would be completed in the course of the ensuing year—1881. Estimating the supply at 15 gallons per diem when Spring Mill reservoir was completed, they would be able to supply a population of 133,000 people, with a proportionally increased demand for manufacturing purposes. The population now being supplied was about 100,000. Every house in the borough was not obliged to use the Corporation water, but the Corporation supplied large populations outside the borough, in some directions to the confines of the old parish of Rochdale. In one direction the parish extended to Todmorden, and they supplied water almost to the top of the hill separating this from the Todmorden Valley watershed.

The INSPECTOR: My note is that in 1881 you would have an excess of 485,000 gallons per diem above your actual demand.

Mr. Hawksley, in reply to Mr. LERESCHE, said he considered it a very reasonable request that the time for creating the sinking-fund should be extended until 1894. This sinking-fund principle pressed very hardly upon the present generation, by compelling them to provide a free water supply to the population of the future; and if the works had remained in the hands of the old Company, there would have been no sinking-fund created, and the debt would have remained a debt for ever, which, in works of this character, appeared to him to be proper. But Parliament had thought otherwise, and established the principle of providing such a fund in connection with all works executed by public authorities.

The INSPECTOR: Have you anything to say with reference to the permanence of the works?

Mr. Hawksley: Only that they are constructed in the most substantial manner. No expense or means have been spared to secure their permanence. The works in this case are, I should say, everlasting, and will require but a comparatively small outlay for repairs.

The INSPECTOR: It seems to me that they would be adequate in capacity to meet any increased demand for the next 40 years.

Alderman SHAWCROSS: You must take into account the manufacturing demand, which is likely to increase in much greater ratio than the population demand.

Mr. Hawksley: If it had not been for the bad trade, more water would have been required for manufacturing purposes already. With the revival of trade both the population and manufacturing works will increase rapidly. There is no limitation of supply; there is stringent suppression of waste, and the supply per head per diem is under 14 gallons, including the supply for manufactures. Under Mr. Rofe (the Manager of the water-works), it is only between 11 and 12 gallons per head per diem. Although these works were authorized to be constructed in 1866, such difficulties have arisen that some of the works have only recently been completed, and therefore the Corporation are only just realizing a portion of that benefit they would sooner have derived if the works had been completed earlier. This has some weight in enforcing the reasonable demand for delay in providing the sinking-fund. In addition to the rates charged for water, the town has to make up a deficiency of £9000 per annum on these works, and that sum will be increased when the Spring Mill reservoir is completed, and that expenditure falls upon revenue instead of upon capital, as at present.

Alderman SHAWCROSS: The moment the Spring Mill reservoir is completed we shall have £6000 a year more to pay.

Mr. LERESCHE: That will be equivalent to another 6d. rate.

Mr. HEDLEY: And with the present rate of 9d. to make up the deficiency of £9000, that will equal a water-rate of 15d. in the pound altogether.

Alderman SHAWCROSS: And when the sinking-fund comes into operation it will put another £5000 or £6000 upon that deficiency.

Mr. LERESCHE said the rates were only paid by the inhabitants within the borough, while outside the borough many thousands of people were supplied with water who did not bear any portion of the rates which the borough ratepayers bore in addition to the charges made for water.

The INSPECTOR: But do you not charge a higher price to consumers outside the borough?

Mr. Rofe put in a list of charges, giving a negative answer to this question.

The INSPECTOR then asked if there were any other matters to be laid before him, and no response being made, he said he should consider the inquiry closed. There would not be much time now to prepare for the Provisional Order which the Corporation would require, and in regard to the sinking-fund, he thought it would be well to have introduced into it the clauses of the Local Loans Act.

The inquiry then terminated.

SINGAPORE GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held at the City Terminus Hotel, London, on Tuesday last—H. P. STEPHENSON, Esq., in the chair.

The SECRETARY and ENGINEER (Mr. Robert King) read the notice convening the meeting, and the following report was taken as read:—

The Directors have to report continued progress in the lighting of Singapore, for particulars of which they refer to the report annexed, from their Engineer and Manager (Mr. E. J. Wells), dated Feb. 9, 1880.

The Directors going out of office by rotation are Messrs. Robert Stannard Foreman and Henry Palfrey Stephenson; and these gentlemen, being eligible, offer themselves for re-election. The present Auditors (Messrs. William Thomas Morrison and Alfred Williams) retire from office according to the articles; and, being eligible, offer themselves for re-election.

The balance-sheet to Dec. 31, 1879, appended to this report, shows the financial position of the Company. The Directors have written off for depreciation of works and plant, and off the expenses of first establishment, as per balance-sheet, at the rate of 1 per cent. per annum, and £109 for depreciation of fittings. The profit for the half year, after writing off these sums, amounts to £2474 19s. 6d., which together with £816 6s., the unappropriated profit of the preceding half year, makes the available balance £3291 5s. 6d. Out of this sum the Directors recommend the declaration of a dividend at the rate of 7½ per cent. per annum, less income-tax, on the preference capital, and at the rate of 8 per cent. per annum, less income-tax, on the ordinary capital; the balance of £848 16s. 10d. to be carried forward to the profit of the succeeding half year.

Report of the Engineer and Manager.

Gas-Works, Singapore, Feb. 9, 1880.

Gentlemen,—I had the honour to forward you, by the Brindisi mail of the 3rd inst., the several statements, banker's voucher, and balance-sheets, showing the working for the half year ending Dec. 31, 1879. I hope you will regard the accounts that are submitted as satisfactory, and that they will be found correct. As all the accounts are fully detailed, as usual, it is unnecessary for me to go into figures with the exception of one or two important points.

The loss by exchange for the half year has been £789 13s. 6d., on £4350 remitted, and the whole of this loss has been charged to revenue account. The average rate during the half year has been 3s. 9½d. per dollar. It may have been remarked that, notwithstanding our increased gas-rental, the profits increase very slowly. The following figures will, I think, clearly show the cause of this:—Taking the last seven years, the loss by exchange has been—1873, £132; 1874, £140; 1875, £692; 1876, £771; 1877, £1001; 1878, £1411; and 1879, £1825; the last year showing a loss on account of exchange of nearly 11 per cent. of our total receipts.

In the retort-house, Nos. 6 and 7 benches of retorts have been re-set with 7 oval retorts in each, and are ready for use when required. No. 4 bench is being re-set with 3 oval and 4 D retorts, which I had in stock, and have utilized.

In the purifying department all is working satisfactorily. The gas has been kept free from impurities, and its illuminating power fully up to the standard, and the supply has been equal to the demand; the efficiency of the works and plant generally being fully maintained.

An extension of mains for 8 new public lamps has been carried out in Neil Road, and a 5-inch main has been laid in Scott's Road, in place of the 3-inch main laid originally, which was not large enough to supply the Club and European houses in that district. A re-arrangement of the mains supplying the Fort has had to be made in consequence of the meter being removed to allow of the erection of the new flagstaff.

The Campong Malacca district is being rapidly built upon, and extensions of mains will soon be necessary. The Teluk Ayer Bay reclamation has been commenced. This will form a continuation of College Quay to the Tanjong Pagar Dock, and will form quite a new town when completed.

The unaccounted-for gas during the half year has amounted to 12 per cent. This includes the consumption on the works.

During the half year the new Exchange and Club and the Masonic Lodge have been lighted up satisfactorily. The new flagstaff has also been fitted up for the harbour light with two of Sugg's 50-candle burners and with reflectors. The light given is clear and bright, and is visible upwards of 20 miles. There have been 28 buildings fitted up with 556 lights, making a total of 652 houses in which gas was consumed on Jan. 1, 1880. 13 additional lamps have been ordered to be erected by the Commissioners in districts where mains are already laid, and one public bathing-place is also to be lighted, and the fitting up is in progress. The two Sugg's lamps mentioned in my last report arrived safely, and were erected in prominent places. They give general satisfaction.

I regret to have to report the serious illness of my assistant in this department. He has been unable to attend to his duties for more than a month past, and the medical men entertain serious doubts of his recovery.

I have lately tried some Takisima (Japan) coal, and have found it a very good coal for the production of gas and coke. Five hundred tons of this coal have been purchased.

You will observe that the stock in hand has been reduced by £1497 during the half year, and I hope it may be further reduced in the future.

(Signed) E. J. WELLS, Manager.

Dr.	Balance-Sheet, Dec. 31, 1879.	Cr.
Capital—		
2,000 preference shares, £5		£15,544 17 6
paid	£10,000 0 0	76 5 0
10,597 ordinary shares, £5		£15,621 2 6
paid	52,985 0 0	227 14 6
Debiture bonds.	350 0 0	
Sundry creditors	435 17 9	£15,393 8 0
Insurance reserve-fund.	215 11 6	1,118 2 8
Profit and loss.	3,291 5 6	

The CHAIRMAN, in moving—"That the report, with the balance-sheet attached thereto, be received, adopted, and entered on the minutes," said he did not know that it was necessary at this meeting to go through all the items of the accounts, but the Shareholders had the usual form before them, and he should be very happy to answer any question that might occur to any one present. As they saw, they were in a rather better position than on former occasions. They were in a sufficiently good position to induce the Directors to declare an improved dividend, and looking to the fact that there was £800 odd of undivided profits carried forward, after the usual writings off, they might, if the proceeds from profits fell short, be able to keep up the dividend out of the balance carried forward. There was only one other matter he had to call attention to, and that was the extensions that were going on in the town of Singapore. Their Engineer and Manager at Singapore had sent them a plan, which showed that a considerable amount of building was going to take place on what they called the new Campong Malacca. This was, in fact, nearly carried out, and they were going to erect new lamps, and would thus get a considerable number of private lights in addition. The Teluk Ayer Bay reclamation was only just commencing, and this practically was the building of an annex to the town of Singapore. A new quay wall was going to be made, and a certain amount of land would be reclaimed from the sea. The Shareholders would observe on the map the new streets that were going to be made, and the Company would get a considerable addition to their private lights from this source. There was also to be a new road made to the Tanjong Pagar Dock, and altogether, to his mind, things looked exceedingly satisfactory as regarded future progress in Singapore.

Mr. R. S. FOREMAN seconded the motion, and it was carried unanimously.

On the motion of the CHAIRMAN, seconded by Mr. FOREMAN, the dividends recommended in the report were declared.

Mr. ALFRED WILLIAMS then moved, and Mr. ROBERT RICE seconded the re-election of the retiring Directors, Mr. R. S. Foreman and Mr. H. P. Stephenson, and the motion was carried unanimously.

Mr. FOREMAN having expressed his thanks for the continued confidence of the Shareholders in his colleagues and himself,

Mr. H. W. SMITH proposed, and Mr. JOSEPH MANWARING seconded the re-election of the retiring Auditors, Mr. William T. Morrison and Mr. Alfred Williams, and the motion was carried unanimously.

The CHAIRMAN then moved the usual vote of thanks to the Company's Engineer and Manager, and to the Local Committee at Singapore. He said as the Company progressed year by year—they did not progress very rapidly, but they did progress, he hoped, to the satisfaction of all the Shareholders—they were more impressed with the fact that they had a most excellent Manager at Singapore. When he looked at some other foreign Companies, many of them wrecked through the incompetency, and others through the dishonesty of their Managers, he congratulated this Company that for so long a period they had had the services of Mr. Wells.

Mr. WILLIAMS seconded the motion, which was carried unanimously.

Mr. MORRISON then returned thanks for the re-election of the Auditors, who, he said, were delighted at the steady progress of the Company. He moved a vote of thanks to the Chairman and Directors for their very able administration of the affairs of the Company.

Mr. RICE seconded the motion, and it was carried unanimously.

The CHAIRMAN expressed the acknowledgments of his colleagues and himself at the compliment. He said that they had now what he might call a steady task before them. They tried to make as much profit as they could, and they did not divide profit unless they had made it. If the Directors made profits, the Shareholders would receive dividends; but if they did not make any, there would not be any dividends. He hoped if bad times came on them the Directors would be honest enough to come before the Shareholders and state that they had not made sufficient to pay a dividend.

Mr. RICE then moved a vote of thanks to the Engineer and Secretary, saying that Mr. King had occupied his position for some years, and the Shareholders had found him ready on all occasions to afford them any explanation they required.

Mr. MANWARING seconded the motion, and

The CHAIRMAN, in putting it, said he could quite endorse what had been said of Mr. King.

The resolution was carried.

Mr. KING briefly returned thanks, and the proceedings terminated.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of this district continues very dull, and all descriptions of round coal are both low in price and bad to move. As a rule, the orders coming to hand are not sufficient to keep the pits going more than three to four days a week, and at many of the collieries heavy stocks are held. It is difficult to say in which class of round coal the depression is most felt. Of course, there is considerably less demand for house-fire coals. Best coals are now moving off very slowly, and although it is chiefly in the lower qualities that the consumption has fallen off, this is only partially met by the slightly improved demand for common round coals for steam and forge purposes. The result is that both best and common round coals are plentiful in the market, and there is every probability, as I have pointed out in previous reports, that gas coal consumers will be able to cover their requirements on very favourable terms. There are still but few inquiries coming to hand, and these are scarcely sufficient to fairly test the market. Indeed, so far as I can ascertain, there are at present really no fixed prices; sellers, although not caring to commit themselves to any very long forward deliveries, not feeling themselves strong enough, in the face of the competition in the market, to hold out firmly for any stated figure. It does not, however, seem likely that ordinary Lancashire gas coals will fetch more than about 6s. per ton, and good Arley gas coals more than 7s. 6d. per ton at the pit. So far as ordinary quotations are concerned, they may be given about as under:—Best Wigan Arley, 8s. to 8s. 6d. per ton; common sorts and Pemberton four-feet, 6s. to 6s. 6d.; and common round coal, 5s. to 5s. 6d. per ton at the pit. Engine classes of fuel continue firm, owing to the scarcity of slack, and the average prices now being obtained at the pit are about 4s. to 4s. 6d. for good burgy, 3s. 6d. to 4s. for best slack, and 2s. 6d. to 3s. per ton for common sorts.

There has been rather more coal going away for shipment, for low prices have, as a rule, to be accepted to effect sales.

In the iron trade of this district there has been something pretty nearly approaching a panic during the past week, and prices have gone down so rapidly, without any indication that the downward movement would be arrested, that speculative holders of iron have taken alarm, and in many cases there has been an endeavour to force sales of second-hand lots at almost any figure. Lancashire makers of pig iron, finding it hopeless to attempt to meet the market in its present condition, have practically withdrawn their quotations; but they are open to offers, and local pig iron delivered into the Manchester district could now be bought at about 60s. per ton, less 2½ per cent. Finished iron is also weaker, and although very few of the makers are as yet under the necessity of pressing for

orders, lower prices would be taken. Bars delivered into the Manchester district could now be bought at from £7 12s. 6d. to £8 per ton, and other descriptions of finished iron in proportion.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The best gas collieries in the county of Durham are very well employed in the shipments of coals, sold under contract, to the larger ports in the Baltic. This business is likely to be active until the end of June. Gas coals have likewise been shipped to the Italian ports of the Mediterranean and to the Black Sea. Gas coals have likewise been in request for the nearer ports of Europe, especially for Norway, Sweden, Denmark, and the North of France. The price of gas coals is unaltered. In the present circumstances of the iron, chemical, and other local industries in the county of Durham, it is found very difficult to uphold the price of most descriptions of coals. Latest quotations are therefore nominal. Second and inferior gas coals are bad to sell, and the price of coke is lower. The same observation applies to steam coals as to gas. The best steam collieries maintain a nominal quotation, but regulate the price and sales by discounts. Manufacturing coals keep in fair demand from the local factories. A little more money has had to be paid for special sorts upon the contracts which have been made for the second half of 1880.

Coasting shipping freights show very low quotations. Sailing vessels, to load gas coals for the English Channel ports and for the North of France, experience much difficulty in entering upon charters which will pay. The supply of coasting tonnage was much in excess of the requirement of trade last week. Several small sailing ships were unable to find freights. Coasting rates are about 3d. per ton down.

The collapse of prices in the Cleveland iron district is materially affecting trade all round. In the North of England general business is very flat and dull. Prices cannot be upheld. The chemical market is especially disappointing this spring. It shows that there has been over-speculation. Several middle men are likely to lose pretty heavily upon the chemicals they bought for April delivery. The only article which showed an advance last week was bleaching powder. There was a rise of half-a-crown a ton upon it. Other chemicals were, if anything, lower in price than they were the week before, with a wretchedly poor demand. The prospects of the trade further on are not good either. The shipments of fire-clay goods and fire-bricks continue to be upon a large scale. There is a strong demand from the Continent. A satisfactory business in fire-bricks is also done with America. Lead and copper are not so much asked after. The latest sale of rich Spanish lead which occurred at Newcastle last week was at £16 10s. per ton. The importation of Baltic timber has commenced for the season. Like in almost every other trade, there were great expectations in January of a heavy rise of prices. These have been grievously disappointed. Some large speculative transactions took place in the trade in January. Prices were forced up for a time by operators; but the public would not buy. Many of the outsiders who bought up cargoes and tried to force the markets for their own advantage have lost considerably on the transaction.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At a meeting of the Forfar Gas Commission, held on Monday, the 19th inst., a discussion arose about the purchase of two annuities that had been offered for sale, in the course of which a desire was expressed by Mr. Craik to know where the money to purchase them was to come from. The Clerk replied that it was to come from the bank, and Bailie Laird said it was from the sinking-fund. But Mr. Craik said they had no sinking-fund, and that it was an illegal working of the Gas Act to borrow more. At a later stage of the proceedings the same gentleman further dilated on the practical non-existence of the sinking and contingent funds, and said that instead of getting additional borrowing powers from Parliament they should raise the price of gas. He, for one, would never consent to go to Parliament. The offer of the annuities was declined by a majority of votes—six against five.

At last week's meeting of the Police Commissioners of Greenock, the minutes of the Gas Committee were under consideration, and in the course of the discussion upon them, Provost Campbell said that, along with the Chamberlain, he had been looking into the financial position of the gas-works, and he feared that the probable surplus revenue, as shown to the Trust last September, would not be borne out, but that there would be a falling off in the expected surplus. He called attention to the matter in order that the Gas Committee might, if possible, economize, and so that the statement made in September as to the profits from that source might be borne out. They did not like to have a falling back in any department of revenue, and he hoped that Bailie Shankland (the Convener) and the Committee would give attention to the matter.

At their last meeting the Paisley Gas Trust resolved to accept an offer from a local firm of gas engineers for the reconstruction of the gasholder which was damaged by the great storm (the Tay Bridge storm) at the end of last year. The cost is to be about £500. It is estimated that the surplus profits for the year ending the 15th prox. will not only meet this item of outlay, but also provide £1000 for town improvement purposes, and still leave at least £1000 to the good. Certainly the gas supply undertaking of Paisley is well managed.

In connection with the late elections I may mention that the author of the Burghs Gas Supply (Scotland) Act (Sir Windham Anstruther, Bart.) has failed to secure his return to Parliament for South Lanarkshire, having been beaten by a very decisive majority by Major Hamilton, who previously represented the same division of the county in the House of Commons.

A Dundee labourer named Brown, and his family, consisting of his wife and mother-in-law, and a child three months old, narrowly escaped being poisoned by means of gas last Tuesday week. The family, who reside at James Street, Maxwelltown, Dundee, retired to rest about nine o'clock on the Monday night. At that hour no smell of gas was perceived, but about one o'clock on the following morning Brown awoke in a sort of stupor, and found the house filled with gas. He immediately roused his family, all of whom were suffering more or less from the effects of gas poisoning, and had them removed to the house of a neighbour. A gas inspector was thereafter called, and the leak, found to be in a pipe in the wall, was stopped. The family are now recovering satisfactorily.

Another narrow escape from death by inhaling coal gas has just been recorded. On Saturday week a joiner, named Robert Orr, came from the country into Selkirk, and on Sunday morning he was found in a state of utter unconsciousness, and, indeed, apparently lifeless. He is a young man, and being unaccustomed to the use of gas, he had gone to bed about ten o'clock on Saturday night, after extinguishing the gas, but leaving the stove open. Not answering to a knock at his bed-room door about eight o'clock on Sunday morning, the door was opened, and a strong smell of gas was perceived, while Orr lay in bed quite motionless. The doors and windows of the house were at once thrown open, and in a few minutes a medical gentleman was in attendance. The case seemed to be a

hopeless one, nevertheless the doctor proceeded to employ artificial respiration, but it was not till that had been done for three-quarters of an hour that signs of life became apparent. Gradually the patient so far came round as to be able to take stimulants, and in the afternoon the doctor considered him to be out of danger.

In consequence of a flood in the Clyde, the like of which, it is said, has not been known for the last forty or fifty years, the gas coal workings at Clydegrove Colliery, near Wishaw, were drowned out, the waste having been filled by the overflowing waters. The pit was sunk quite recently.

At the last meeting of the Town Council of Port Glasgow, it was reported that the new reservoir at Auchendroos, computed to contain about 120 million gallons of water, was filled to within 2 feet of its capacity. The Leperston reservoir has a capacity of about half that quantity.

A meeting of the Annan Police Commissioners was held the week before last, at which a letter was read from Messrs. Gibson and Strathearn, Edinburgh, agents to the Duke of Buccleuch, stating that his Grace was ready to enter into a friendly reference with the Commission as to certain land required by the latter in the parish of Middlebie for the construction of a reservoir. Mr. Drennan, Ayr, was appointed valuator on the part of the Commissioners. It was resolved to adopt the larger reservoir recommended by Mr. Gale, the Engineer, and 16½ acres of land will consequently be required. It was resolved, however, to intimate to the Public Works Loan Commissioners that £8000 would be required for sanitary purposes this year, £2800 for drainage, and £5200 for water.

It was reported at the last meeting of the Galashiels Town Council that there was reason to believe that the operations undertaken with the view of stopping the leakage in Knowes Dean reservoir had been successful.

A water supply scheme, estimated to cost about £5000, is about to be proceeded with for Bonhill and Jamestown, in the Vale of Leven. It is reported that the water is of such a quality that filtration will not be required.

At last Tuesday's meeting of the Greenock Water Trust the Superintendent submitted his statement of water in store. It showed the amount of water to be 446,704,864 cubic feet, or a supply sufficient for 127 days for all purposes. It was reported that the Loch Thom Extension Works had cost, up to the 1st inst., £8101 5s. 2d., and the Provost remarked that when they were completed the storage for water would be so much increased that there would never be any danger of the water supply running short, as had formerly been the case when they had a hot and dry summer.

The quarterly report on the condition of the Aberdeen Water-Works, which has just been issued, states that six important repairs to the aqueduct were made in the course of the three months, requiring the cutting off of the water in each case for some eight or nine hours; besides which there were 15 cases of minor repairs to culverts, &c. The depth of water in the Invercarnie reservoir varied during the quarter from 12 ft. 4 in. to 14 ft. On 64 days the state of the river is reported as "very clear," on 16 days as "clear," on 11 days as "brown," while during one day the river sluices had to be shut, no water being taken from the river on account of its muddy state. As usual, the consumption of water was measured for one day, when it was found that in 24 hours 4,262,890 gallons were consumed—4,055,200 gallons from the low service reservoir, and 207,690 from the high service reservoir. The inspectors of the private water supply in the city found 829 cases in the course of the quarter where it was necessary to enforce repairs.

The Chairman of the Bothwell Local Authority reported to a meeting of that body, held last Tuesday, that the gross outlay on account of the water supply scheme now in progress (including everything except the cost of the loan) was £35,335 9s. 8d., and suggested, as they did not know what changes there might be, that power should be taken to borrow £40,000. A representative of Messrs. H. Salter and Sons, financial agents, Glasgow, was present, and explained the offer of his firm to lend the money at 4½ per cent. interest, under an annuity scheme by which the whole would be repaid in 30 years. It was stated by the Chairman that every available source, including the Public Works Loan Commissioners, had been unsuccessfully applied to in the endeavour to get the money at a cheaper rate. His suggestion was agreed to.

Lately there has been a great amount of a low type of typhoid fever or diarrhoea in Perth, and a feeling arose that it was due to impurities in the public water supply. A Committee of the Water Commission had the subject under consideration, and on Tuesday last they took samples of water from the filter well at Moncrieffe Island, the reservoir at Wellshill, and a street well, all of which they forwarded to Dr. Wallace, of Glasgow, who is the Public Analyst for the city.

There was quite a run down in prices in the Glasgow pig iron market last week, and an enormous amount of business was done. The fall on Friday was 1s. 6d. per ton, making on the week a decline to the extent of 5s. 9d., or more than double the amount of the decline during the preceding week. The week closed with prices at the lowest—46s. 9d. cash, and 47s. one month for sellers, and buyers near. There is as yet no sign of the fall being arrested, and far less is there any indication of recovery. The most utter hopelessness prevails, and holders are clearing out on all hands. The price is now very low, and there is no doubt that investments in iron will ultimately pay handsomely. A number of large losses have lately been incurred, rumours putting some of them down at £10,000, at the least. It is feared on some hands that the depression will be overdone.

The Glasgow coal market continues to be dull. Orders are scarce for all descriptions, excepting for steam coal, which is a little more in demand. Prices rule low.

THE annual meeting of the Association of Municipal and Sanitary Engineers will be held at Leeds on the 27th, 28th, and 29th of next month.

AYLSHAM GAS COMPANY, LIMITED.—The Directors of this Company have just declared a dividend of 5 per cent. and a bonus of 5s. per (£10) share.

CARMARTHEN WATER SUPPLY.—The Carmarthen Town Council last Tuesday rejected several proposed schemes of water supply by gravitation, and resolved upon an extended pumping system, similar to that which has been in use by them during the last 12 years.

THE WATER SYSTEM OF NEW YORK.—According to the *Scientific American*, the Department of Public Works has during the past four years added to the Croton water service 70 miles of distributing-pipes, making the present extent of pipes 480 miles. The Croton aqueduct supplies 95 million gallons a day. The elevated railroads consume over half a million gallons daily.

WOKINGHAM WATER SUPPLY.—On Wednesday last the boring by the Wokingham Water Company reached a stratum of chalk at a depth of 340 feet from the surface, thus placing beyond doubt that an abundant supply of pure water will soon be available for the inhabitants of the town and of the large district embraced in the Company's scheme, which includes Binfield, Barkham, Sandhurst, Bracknell and neighbourhood.

SALES OF GAS AND WATER SHARES.—Last Tuesday £250 of stock in the South Shields Gas Company was sold by auction in lots of £10 each, and realized prices ranging from £13 10s. to £15 per lot. At Grantham last

week 20 shares in the Local Water-Works Company were sold by auction (the dividends accruing due in June next being included), at the following prices:—15 at £21 12s. 6d.; 2 at £21 15s.; 2 at £21 17s. 6d.; and 1 at £22.

MINSTER (THANET) GAS COMPANY, LIMITED.—The annual meeting of this Company was held on Thursday, the 15th inst.—Mr. D. Swinford in the chair. The Company was established in 1863 with a capital of £1500. They are, however, in a very flourishing condition, and have declared a dividend of 7 per cent. for the past year, with a balance to carry forward. The price of the gas will be reduced to 5s. per 1000 feet next quarter. Votes of thanks to the Chairman, to the Secretary (Mr. R. Bubb), who has held office since the establishment of the Company, and to the Auditor were passed.

WAVERLEY ASSOCIATION OF GAS MANAGERS.—The ordinary half-yearly meeting of this Association was held at Melrose last week. A financial statement was laid before the members, and, it being favourable, was unanimously approved of; after which it was resolved to hold the next meeting at Berwick-on-Tweed on the second Wednesday of September. Mr. Hall, of Berwick, was unanimously appointed President for the year. The burner question was then taken up and discussed, and, in connection therewith, Mr. David Young, of Dalkeith works, made some beautiful and interesting experiments with several new burners constructed for special purposes. These were much admired and highly approved of. The members, of whom there was a large number present, and their friends afterwards adjourned to the Crown Hotel for dinner, and spent a few hours agreeably together.

BOLTON CORPORATION WATER SUPPLY.—The *Bolton Chronicle* says: "It is gratifying to be able to announce that an arrangement is likely to be come to whereby nothing more will be heard of the arbitration case, *Hoare v. The Bolton Corporation*, which has been pending for several years, and the hearing of which was to have been resumed on Tuesday, the 27th inst. (to-day), before the sole Arbitrator, Mr. Staveley Hill, Q.C., at the Surveyors Institute, Great George Street, Westminster. The matter in dispute, it will be remembered, was the value of certain lands near Chapeltown, and adjoining Wayoh and Bradshaw Brooks, taken for the purposes of the Corporation Water-Works. Mr. John Cross, on behalf of F. R. Hoare, Esq., the owner, valued the land and the minerals at £26,200; but the Corporation disputed the existence of minerals under the land, alleging that there is a 'fault' which extends over the whole of it, and that therefore the land is not worth more than £500. The last sittings were held in February and April of 1873. The question happily is now in train for settlement without further expense."

ST. HELEN'S CORPORATION WATER SUPPLY.—A special meeting of the St. Helen's Water Committee was held last Wednesday, to consider what should be the amount of the water-rate for this year. The Borough Treasurer (Mr. Johnson) submitted the statement of receipts and expenditure for the year ending March 25 last. The income from house supply was £5151; meter supply, £5831; meter-rents, £242; and a number of minor items made the total income £12,035. The arrears were £2404, while at March, 1879, they were £1692. The expenditure for the year was made up of the following items:—Working expenses, £10,933; sinking-fund, £2040; public works loan account, £617—total, £13,591, leaving a deficiency of £843. The working expenses were upwards of £830 less than in the previous year, and this although in the year just ended there was an extraordinary expenditure of £446. During a desultory conversation as to the financial position of the Committee it transpired that during the past year there has been a considerable diminution in the quantity of water consumed by the manufacturers; and had it not been for a remarkable reduction in the working expenses, the deficiency would necessarily have been much greater than it proves to be. It also transpired that the consumption of water by manufacturers is now on the increase, 87 million gallons having passed through the meters in March, 1880, as compared with 69 million gallons in March, 1879. The main point for the consideration of the Committee was the question whether the water-rate should be increased to cover the deficiency, or whether they should trust to an increased consumption of water taking place during the current year. It was ultimately resolved that there be no change upon the water-rates charged last year, which were 4½ per cent. on the gross rental of houses, and 5d. and 1-7th of a penny on water supplied by meter to works, &c.

Register of Patents.

APPLICATIONS FOR LETTERS PATENT.

- 1509.—KESSELER, C., Berlin, "Improved arrangements of gas-flues for steam-boilers, evaporating pans, and the like." A communication. April 13, 1880.
- 1512.—HILLS, W. A., Saltney, Flint, "The utilization of alkali waste, gas lime, or other forms of lime, for the production of tri-calcic and di-calcic phosphates." April 13, 1880.
- 1528.—HADDAN, H. J., Westminster, "Improvements in apparatus for lighting and extinguishing gas-flames." A communication. April 14, 1880.
- 1537.—MORGAN-BROWN, W., Southampton Buildings, London, "Improvements in fluid-meters." A communication. April 15, 1880.
- 1539.—LIDDLE, E., Preston, Lancs., "Improvements in apparatus for lighting and heating by gas, applicable in part for igniting fuel to produce coal or other fires." April 15, 1880.
- 1545.—SUGG, W. T., Westminster, "Improvements in gas burners and lanterns." April 15, 1880.
- 1546.—VALE, J. H., Hamburg, Germany, "Improvements in apparatus for enriching gas by admixture of hydrocarbon vapour." April 15, 1880.
- 1567.—ENGEL, F. H. F., Hamburg, Germany, "Improvements in automatic apparatus for lighting, regulating, and extinguishing gas-burners." A communication. April 16, 1880.
- 1582.—FILER, A. E., Mildmay Park, London, "Improvements in gas-burners." April 17, 1880.
- 1594.—QUESNEL, L., Paris, "Improvements in gas soldering irons." April 19, 1880.
- 1629.—BUCKLAND, C., Swansea, South Wales, "Improvements in taps or cocks for water and other liquid." April 21, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 4222.—JOY, A. A., Chancery Lane, London, "Improvements in apparatus for regulating the flow of gas or other fluids." Oct. 18, 1879.
- 4337.—KING, C. W., St. Swithin's Lane, and CLIFF, A., Chancery Lane, London, "Improvements in and connected with engines actuated by the explosion or combustion of a mixture of combustible gas or vapour and air." Oct. 24, 1879.
- 4377.—BUTCHER, J. J., Gateshead, Durham, "Improvements in gas motor engines." Oct. 27, 1879.
- 4396.—PURSELL, J. R., Blackfriars Road, London, "An improved arrangement of apparatus for moving tramcars and other like vehicles by gas-engine power." Oct. 29, 1879.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 4, 1880.

Circular to Gas Companies.

SOME years ago, when Mr. Chamberlain, M.P., was explaining to the Birmingham Town Council the terms of purchase of the Birmingham Gas and Water Companies undertakings, and the probable results of the bargain, he made his statement in so lucid a manner that we ventured to prophesy that whenever a Radical Government came into office he might possibly be Chancellor of the Exchequer. Our prophecy has only been half fulfilled. Mr. Chamberlain has entered the Liberal Cabinet, though not as Chancellor of the Exchequer. He is President of the Board of Trade—a fact which we recommend Gas Companies to notice. Mr. Chamberlain's proclivities are altogether antagonistic to the interests of Gas and Water Companies. He believes—and we are certain that he is conscientious in his opinions—that gas and water undertakings should not any longer remain in the hands of commercial bodies, but should pass as quickly as possible into the possession of Local Authorities. He has a few other crotchets, one of which is that when a Local Authority contracts a debt it should remain a charge upon all posterity; but perhaps being a year or two in-office with colleagues who advocate sinking-funds will bring him round to the opinion that a debt incurred should be wiped out as quickly as circumstances will admit. If we take the case of Birmingham, it is quite certain that the ratepayers will be benefited by every reduction in the charges for interest. Supposing the whole debt wiped out, the Corporation would remain in possession of the undertakings, and be practically free from further charges on the undertakings, unless they contracted fresh debts. They would necessarily do so, and therefore a continuous responsibility would be entailed. This certainly ought to satisfy Mr. Chamberlain. He has practically a permanent debt to meet, but of a kind for which he has no respect. He would borrow a large sum and expend it; borrow more, and add to the debt, and so forth; but we may take it that an inevitable day of reckoning must arrive. There is a class of advanced political economists, to which, we believe, Mr. Gladstone belongs, who would hasten to pay off the National Debt while the full supply of coal is to be obtained. When the payment of that Debt is considered, we may just as well look to minor matters, and inquire how the debts of Local Authorities are to be discharged. A Local Authority with a gas and water undertaking is in a very convenient position to assume a state of solvency; but with constantly accumulating charges, it seems perfectly clear that such a condition of things cannot long exist, unless the debts be gradually reduced, as they must be, by means of a sinking-fund.

Mr. Edison, it would seem, has not gone to California to

extract gold from poor quartz any too soon for his reputation as an electric light inventor. Our readers will see in another column an abstract of a report from Professors Morton, Mayer, and Thomas, which clearly demonstrates that the horseshoe lamp is a striking failure when compared with gas. One of these lamps actuated by $1\frac{1}{2}$ -horse power and the Brush or Siemens machine fails to give a regular light of more than ten candles. Gas of a known quality consumed at the rate of five feet per hour, produced a light which cast the Edison horseshoe into the shade. The expenditure of coal for the production of $1\frac{1}{2}$ -horse power is fixed at five pounds per hour. Now, one pound of gas coal will produce five feet of gas, besides a large quantity of coke and other residuals. Leaving residuals out of consideration, five pounds of gas coal are equal in light-producing power to five pounds of steam coal. Thus we arrive at a knowledge of the fact that equal quantities of coal are considered equivalent in illuminating results. The reporters from whom we quote are perfectly satisfied that the advantage of illuminating power and low charges, therefore, decidedly lies with gas. We believe it will always be found so. We await, with much interest, reports from some of our public authorities; but we believe, as we say, it will be found that gas can fairly compete, in illuminating power and cost, with electricity.

The Lancaster Corporation are still hesitating to complete the purchase of the undertaking of the Gas Company who have up to this time supplied their limits. Their hesitation seems to be the result of some small meanness existing in the Council. When the Company parted with their undertaking, it was well known that their storage room wanted enlarging, and it was estimated that from £10,000 to £15,000 would be required for the excavation of tanks and the erection of additional gasholders. It seems perfectly certain that the extensions are urgently required; but the Town Council hesitate to commence the necessary erections, and some members now grumble that the purchase-money was ever agreed to be paid. It is quite true that the works may not, at the present moment, be adequate to supply the wants of a dark winter's day; but if an expenditure of £10,000 would have made the then plant adequate for the requirements of the borough, it would simply have amounted to this, that the Corporation would simply have had to pay £15,000 more. Now the Corporation have the opportunity of completing the works themselves, and so of saving a considerable sum; but they will not see it. However, the business, we take it, is settled. Lancaster has a gas undertaking, and under proper management it will prove highly remunerative. It paid the Gas Company well, and there is no reason why, when enlarged, it should not pay the Corporation better; and we have no doubt the ratepayers, if they can only secure good management, will soon rejoice over the success of their gas-works.

The sixth half-yearly meeting of the North of England Association of Gas Managers was held at Newcastle-on-Tyne on the 24th ult., and the principal business done was to pay a visit to the Jarro works of the South Shields Gas Company, in order to see Mr. Warner's apparatus for retort drawing and charging in operation. The apparatus was exhibited and described by its inventor, and it was shown that the best effects resulted from its use. Our readers who have not seen it in actual working will be able to judge of its merits from the description and drawings we give to-day.

The eighth annual general meeting of the West of Scotland Association of Gas Managers was held at Hamilton on Thursday last, under the presidency of Mr. R. Mitchell, of Coatbridge, and we are sorry to see that a proposition for the amalgamation of this Association with the North British Association of Gas Managers has fallen through. We will not say that there can be too many Gas Managers Associations; but we feel satisfied that a few concentrated ones are best adapted to promote the interests of the science of gas-making. The President delivered an interesting address, in which he mentioned that since the electric light dawned on the world, Gas Managers had been more than ever active in their endeavour to cheapen the price of gas to the consumer. It is somewhat curious to see a Gas Manager acknowledging a debt of gratitude to the electric "scare;" but it was very properly done by Mr. Mitchell. The fact is, the electric light has stirred up Managers to find improved systems, first as to the setting of retorts, and then as to the application of heat. Siemens's regenerative furnace has come to be looked on with more favour. We shall probably find it brought into frequent use. The new systems of drawing and charging retorts by machinery are calculated to save much labour, and consequently much cost to Gas Companies; and we look for very favourable results from the use of these apparatuses. Mr.

Niven promises a simplified table, which will enable Gas Managers to reduce gases to uniform temperatures and pressures without any tedious calculation. We did not know that tedious calculations were required; but if any simplification can be effected, by all means let us have it.

Those students of the Institution of Civil Engineers who accepted the invitation conveyed to them by Mr. G. Livesey, M.I.C.E., to visit the works of the South Metropolitan Gas Company, to which a brief allusion was made in last week's JOURNAL, are not likely, we think, to regret the two hours they spent in so doing. Under the personal guidance of their host and his brother, Mr. F. Livesey, the party of gentlemen who assembled at the works in the Old Kent Road last Friday afternoon were afforded an opportunity of witnessing the process of gas-making under the best possible conditions. The various details in connection with the production, purification, and storage of coal gas, which has now come to be regarded as one of the necessities of life, were concisely explained as each branch of the entire process came under notice. Of course the centre of attraction was the extensive gasholder-tank which is now in course of construction on the works, and of which a few particulars are given in another column, and it must have been gratifying to all connected with this undertaking to witness the great interest displayed in it. It is not to be supposed that the information acquired last Friday will be immediately or specially serviceable to all the gentlemen who then accompanied Mr. Livesey round the works; but it will, nevertheless, be to that gentleman's credit that he afforded the students of the important Institution of which he is a member, an opportunity of making themselves more closely acquainted with the particular branch of industry and civil engineering in which he has distinguished himself.

Water and Sanitary Notes.

THE representatives of the London Local Authorities were busy last week in considering the Water Supply of the Metropolis. The Vestry delegates held a meeting on Friday, at which a few members of Parliament assisted, when it was resolved to apply to the Government for advice and assistance in the matter. Sir R. Cross's Bill was unanimously condemned, but there seemed a general consensus of opinion that something might be effected, if only the new Government would now take the initiative. Should the Government take it earnestly in hand, and should the measure they propose meet with the approval of a strong Committee, doubtless something may be done. We are at the beginning of May, and it will be another fortnight before Parliament settles into working order. Thus it is scarcely possible that any progress can be made with a Metropolitan Water Bill. There is, as we have said before, a great deal to be urged in favour of Sir R. Cross's Bill, and perhaps the best thing Mr. Gladstone could do would be to take it as it now stands and send it to a Committee; as this would save a world of trouble, and the work would only have to be done over again next year, as, in any case, it is certain to be. We do not discern a unanimity of feeling on the part of the Vestry delegates, further than going to the Government for advice and assistance. No one member seems to have an idea of what will be required when the Water Companies are bought up. The valuations made by Sir R. Cross's assessors fairly represent the water undertakings as they stand, and as they will be twelve years hence. Thus we have a valuation by eminent actuaries as to the present and prospective value of these undertakings. The growth of the Metropolis, although somewhat irregular, is steady. We know perfectly well to what extent the Water Companies will be required to extend their supplies; but the question to-day is in what way they should be compelled to limit their charges for the supply of water. A Suspensory Act is talked of, which would take away from the Companies the power to add to their rates on the re-valuation of Metropolitan house property. Suspensory Acts are not unknown, but this, we believe, is the first which is proposed to step in between Water Companies and the exercise of their legitimate rights. Of course, many opinions will be entertained as to the duty of the Government under the circumstances. There are enthusiasts who would drive them forward in a headlong course, which could only end in a signal defeat.

That Mr. Fawcett should be a member of the Government at this conjuncture is an ominous fact. How far, now that he occupies an official position, he will be inclined or induced to push on with the schemes with which he first took up, is

extremely doubtful. We rather think he will find in his official duties at the Post Office, small as they may be, sufficient to divert his attention from all assaults on the Water Companies. He would, perhaps, be prepared, but he has now a ready excuse—the matter is out of his hands, and must be passed over to the whole Cabinet. We can hardly suppose that Mr. Gladstone has any decided views on the subject, and we may feel satisfied that Sir W. Harcourt will have no views at all. Thus, then, the matter remains. The reconsideration of the Water Question must be relegated to a Committee of the House of Commons. But who is to prepare the Bill for their consideration? We have many times suggested that Sir R. Cross's Bill may properly form a convenient basis for new legislation. We are perfectly aware that while it meets the views of the Water Companies, it does not altogether suit the ideas of the ratepayers; but there are always two parties to a bargain—the one is a seller, the other is a buyer—and each one wants his own terms.

The Metropolitan Board of Works have, we will not say made a *fiasco*, but they have entirely failed to appreciate the exigencies of the situation. Like the Vestry delegates, they have resolved on going to the Government for assistance and advice upon the Water Question, and this we can only hope they will obtain. When we say this we must not be considered to express any opinion as to the policy of the proceeding. We should prefer to see some more independent course followed. If ever the Metropolis is to have full and perfect control over its own water supply, it must be effected through the unaided exertions of a strong Municipality. Mr. Chamberlain never thought of applying to the Government for advice and assistance when engaged in the purchase of the Birmingham gas and water undertakings. He went straight to the point, met the Companies, and soon arranged terms with them. Doubtless, if Mr. Chamberlain were at the Home Office, instead of at the Board of Trade, he would soon come to an arrangement with the Metropolitan Water Companies. We must wait, however, a few weeks, to see what turn events will take. The question will probably be brought forward in some shape or other at a very early date, and we shall then have Mr. Gladstone's views of the matter. In the meantime, it is very curious to notice how very little enthusiasm is shown on the subject by the general public. The agitation is confined within very narrow limits, and perhaps if left alone the matter would soon be forgotten.

The Corporation of Exeter have decided on furnishing a constant supply of water in the city, but they are going cautiously to work—introducing it into one district at a time, to see how it answers, and whether the ratepayers can be trusted with the necessary fittings. Of course there is a great deal of talk about regulations, and some members of the Council evidently consider that some of those prepared by the Water Committee are too stringent. For instance, it was seriously proposed that a consumer should not be allowed to turn off the stopcock outside his house, if the pipe within the house had burst, without the previous sanction of the Water Committee. This was thought "too good," and the Council rejected it. Nevertheless, it will be found highly necessary to have somewhat stringent regulations if the water is to be supplied at any considerable pressure.

It cannot be said that all sewage farms are unprofitable. There is, for instance, one of 207 acres at West Derby, which has produced a profit of £230 in the six years during which it has been worked. Of course it will be said that sewage farms are not primarily intended to produce profits; so long as the sewage is got rid of, and no harm is done, it is considered all well. Still, it is a grievous disappointment to many, who have been so egregiously misled by Mr. Mechi and others, to find that, after all the promises that have been made, more or less complete failure has resulted from practical working.

BRISBANE GAS COMPANY.—The report of the Directors of this Company for the six months ended Dec. 31, 1879, stated that during this period the management was carried on under circumstances of unusual difficulty and anxiety, arising from the necessity for a change in the professional management. For these reasons the erection of the South Brisbane gasholder, and the carrying out of many alterations, additions, and repairs, were delayed until the new Engineer's arrival. To meet the necessary expenditure, the Directors, after recommending that the usual dividend at the rate of 10 per cent. per annum, with bonus, be declared, considered it advisable to carry forward to next half year a larger sum than usual. It was decided to increase to 20 per cent. the discount allowed for prompt payment of accounts, to take effect from Jan. 1, 1880. The profit and loss account showed that in the period reported on £9325 was received from the sale of gas; rent, £62; licence fees, £4; balance brought forward, £41—total, £9432. There was expended in the manufacture and distribution of gas, and management, £3689; rates and taxes, £81; interest and discount, £1471. These sums, with the bad debts, amount written off for depreciation of plant, and the reserve, made a total of £6582, leaving a balance of £2850.

THE METROPOLITAN WATER WRANGLE.

MR. SELWAY'S proposition in reference to the London Water Supply, brought forward at the meeting of the Metropolitan Board on the 23rd ult., was adopted by them last Friday, after it had been so modified as to avoid all appearance of a proposal to seek for an Act of Parliament. As matters now stand, it is referred to the Works and General Purposes Committee to consider and report as to the necessity and means of improving the Water Supply of the Metropolis, by amending and regulating the powers of the existing Water Companies, by consolidating their undertakings, by providing an additional supply of pure water, or by any other means the Committee may deem desirable, with authority to confer with Her Majesty's Government thereon. The Chairman of the Board, on being interrogated by Mr. Munro, stated that in order to obtain the Indemnity Bill, he had promised, so far as he could pledge the Board, that for the future no Bill dealing with the Water Supply of the Metropolis should be introduced by the Board "without the consent of Her Majesty's Government." This final clause in Sir James Hogg's undertaking was referred to by Mr. Selway as showing the loophole through which the Board might once more get into Parliament with a water scheme; and, if we understand Mr. Selway aright, it appears that this gentleman has some hope that if a conference should take place between the Metropolitan Board and the Government, the Board may find itself in a position to deal with the Water Question by a scheme of its own.

Concurrently with the discussions at the Metropolitan Board, we have the meetings of the Vestry delegates at St. Martin's-in-the-Fields, under the chairmanship of Mr. E. J. Watherston. On Friday these local dignitaries had the benefit of the presence of several Members of Parliament; but the sole result of a discussion which lasted two hours was the adoption of a resolution—"That the delegates of the various Vestries and District Boards of the Metropolis seek an early interview with the Premier, the Home Secretary, or other Minister, to urge the passing of a Bill without delay, suspending until the end of the next session of Parliament the power of the Water Companies to augment the charges made by them respectively in the Metropolis." The delegates might, with almost equal propriety, have resolved on asking the Government to introduce a Bill restricting the Water Companies from making any addition to their dividends. As we remarked on a former occasion, the proposal is nothing less than a request that the Companies shall in many cases be compelled to base their charges on something less than the annual value of the premises to which they furnish a supply. That Mr. Torrens should advise the delegates to pass a resolution of this kind shows how little that gentleman understands a question on which he has, nevertheless, made himself prominent. Mr. Beal endeavoured to infuse a little common sense into the meeting respecting this part of the subject, but with small success. He so far succeeded as to make some gentlemen understand that the Metropolis Valuation Act of 1869 merely served to assist the Companies in ascertaining the annual value of house property, the right to charge on such a basis being quite independent of the Act in question. But the resolution of the delegates, as amended and approved by Mr. Torrens, goes to sweep away the powers conferred by the Water-Works Clauses Act of 1847, and by the special Acts of the several Companies. This is to propose a despotism pure and simple, and for the sake of vested interests in general we may well congratulate the community that there is a considerable gulf between St. Martin's and St. Stephen's.

The numerous meetings and conferences of the Vestry delegates thus end in nothing. Had these gentlemen been wise, they would have gone with Mr. Watherston and Mr. Beal in asking that the Bill of the present Sir Richard Cross should go before a Hybrid Committee, who could thoroughly investigate the measure and report upon its merits. Although the Committee could not alter the terms of the Bill, it was distinctly intended, and necessarily so, that they should inquire into the financial part of the scheme, in order to see whether it was such as Parliament ought to approve in the interests of the ratepayers. Having, as they fancy, got rid of the Bill, the delegates assembling at St. Martin's wish the Government to keep the Water Companies just where they are until some new scheme can be settled. In fact, the Companies are to be bound hand and foot, until they can be conveniently hanged. Mr. Torrens, who spoke of London as a "town," and yet as "ten towns on the banks of the Thames," declared that "the town at large" was "sick of the present system" in regard to the water supply, which had grown to the "magnitude of a public scandal." The member for Finsbury

denounced the Bill of Sir Richard Cross, together with all the laws and regulations affecting the Water Companies, as well as the Water Companies themselves. But he was determined to vote against any scheme for transferring either water or gas undertakings to a Government department. Mr. Torrens looked forward to the reconstruction of the government of London, when the water supply would be handed over to the municipal bodies thus created. The delegates cheered the proposal, but one of their number suggested that with this prospect before them it was desirable to have a Suspensory Act which should operate for a longer period than until the end of the next session. Mr. Torrens replied that this "was the usual form." We venture to think it will be something very "unusual" if Parliament passes any such Act as the one proposed. Mr. Beal was curious to know whether Mr. Torrens had any experience of such an Act being passed, unless it might be in the case of the Irish Church. Mr. Torrens was obliged to own that "the question raised by Mr. Beal was encumbered with many difficulties." Suspensory Bills had been passed by Parliament, but they were in the nature of public Bills. It might, therefore, be necessary in this instance to suspend or modify some of the rules of the House. But Mr. Torrens declared that, *volens volens*, the Government "must do it." "If there were no precedent, the Government must create a precedent, because the state of affairs in regard to this matter was itself without precedent." So the Gordian knot was cut, and the delegates were satisfied. As for Sir Richard Cross's Bill, Mr. Torrens would not ask the Government to withdraw it. Such a request would be a mistake. The Bill did not exist; this was a new Parliament. Mr. Beal rose from his seat at this statement, and inquired whether Sir Richard Cross had not obtained the passing of an Order keeping all Bills alive. Mr. Torrens explained that the Order of the House merely provided that the Bills "might be introduced," despite the Standing Orders which otherwise would block their way.

We think it well that the "wild words" of Mr. Torrens should be carefully weighed, wild as they may be. Mr. Torrens commenced by stating it as his experience that "it was much easier to say sharp things and strong things than to say wise things." Of this he appears to have furnished proof *in propria persona*. The delegates were addressed in a very different spirit by Mr. Coope, who avowed himself as a Director of a London Water Company, but who appealed to the judgment and good sense of the delegates, instead of seeking to play upon their prejudices and excite their passions. Professor Thorold Rogers acknowledged that he was not very familiar with the subject, but he objected to the terms embodied in the Water Bill, and proposed that the delegates should seek for the appointment of a Royal Commission to define a financial basis of purchase. Mr. Firth, the member for Chelsea, objected to the price which the Government Bill proposed to pay to the Companies, and founded his objection on the fact—as he put it—that the present water supply was not to be the "final one." Mr. Firth appeared to have a notion of getting a new supply, it being his contention that the water taken from the Thames was polluted with the sewage due to a population of 900,000 persons. Mr. Firth did not state on what authority he obtained this reckoning. Later in the proceedings one of the delegates complained that the sewage of Oxford contaminated the Thames, to which statement Professor Thorold Rogers took exception. We believe the Thames Conservators would differ widely from Mr. Firth concerning the extent to which town sewage enters the river above London. But the member for Chelsea wished for change, and adopted the idea of a Suspensory Bill in the interval. He also hoped for municipal institutions.

Pending the settlement of the government of London, it appears that the Water Companies are to be crystallized where they stand. "As you are" is to be the word of command, until they are ordered to march off the ground altogether. Such, at all events, is the procedure which certain gentlemen contemplate; and it will be observed that these enterprising and zealous reformers also have their eyes on the Gas Companies. It has been said that the Government Bill meant "patronage." The objection may be valid, so far as it goes; but will nobody enjoy the sweets of patronage supposing the water supply to be transferred to some great Municipal Authority? In such a case there may not be any salary to a Chairman or a Vice-Chairman, but there will be a large staff of officials, and the appointment of these will give the Municipal Authority the opportunity for an agreeable exercise of power. When we hear so much said about the interests of the ratepayers, it may be well to remember that the dignity and influence of the Local Authorities will be enhanced by the possession of the Water Supply of the

Metropolis. Whatever may be the precise value set on the property of the Water Companies, it is evidently worth many millions sterling, and we need not marvel if there is a resolute attempt to wrest such a prize out of the hands that hold it. The old revolutionary theory that private property is public robbery seems now to present itself in another form. Private property is claimed "in the name of the public," and the claimants are to fix the price.

At the Metropolitan Board on Friday last there were some amusing references to the "outside parties" who were having the audacity to meddle with this Water Question. People calling themselves representatives of Vestries and District Boards were holding meetings, conferring with Members of Parliament, and proposing to seek interviews with Cabinet Ministers. Such effrontery was felt to be insufferable. "I must protest," said Mr. Fowler, "against any body of gentlemen meeting together and calling themselves the representatives of the ratepayers." Mr. Fowler is perfectly right. As we suggested a fortnight ago, these outside gatherings are unconstitutional and schismatic. "We are the proper and only body to deal with this question," said Mr. Richardson. "The principle is this," continued that gentleman, "that the central representative body of the Metropolis should have charge of the water supply." Unfortunately people seem apt to forget their best friends. Even one of the members of the Board was disposed to doubt whether the "central representative body" of the Metropolis had any claim at all on the gratitude of his constituents. He complained that, although the Board had the power to compel the Water Companies to furnish a constant supply, they had failed to exercise that power. A memorial had been sent up from Shoreditch, the parish which he represented, asking the Board to compel the New River Company to provide a constant supply; and, after keeping the memorialists waiting for five months, the Board decided not to comply with the request. Mr. Tolhurst, who moved that the subject should be deferred for six months, remarked on the fact that nobody asked the Board to interfere with this matter. The delegates took no notice of them, and a public body which had just passed a resolution on the subject were going to seek an interview with the Prime Minister. But whatever meetings were held, or whatever agitation was got up, nobody asked the Metropolitan Board to do anything. Some little time back, said Mr. Tolhurst, the Board had gone to a great expense and taken a vast amount of trouble to deal with the Water Question, and, after all, they were "never so much as thanked for it."

On the whole, there seems to be a feeling rising at the Metropolitan Board that the Water Question is passing out of their hands in a way that is perilous alike to the *prestige* and existence of that body. The Board have done much to bring on the present crisis, and having sown the wind they have reaped the whirlwind. Their policy was to let the water supply drift to the bad, in the hope that then the entire charge of it would be taken from the Companies and handed over to them. This policy has entirely failed to benefit the Board, but it has precipitated the question, and that in a very awkward form. On all hands it is now said that something must be done. It is a new, and startling thing to find members of the Metropolitan Board acknowledging that, as at present constituted, the Board are not competent to take charge of the water supply. The task would be too onerous, and the labour too great. Mr. Selway has faith in the Board, but he so far feels the pressure of public opinion as to say, "If the Board is not large enough or wise enough for the purpose, let it be made a larger and more clever Board." Other members speak more boldly still, and every member apparently feels that if the Board be not in a position to be entrusted with the water supply, it ought to be placed in that position. There is, doubtless, truth in this view of the case. The Board, as "the central representative body," ought to possess the confidence of the public and of the Government, and ought to be naturally and inevitably looked to as the centre of authority for dealing with such a question as the supply of water to London. It will be a remarkable fact if the Water Question, after being in some degree connected with a change in the *personnel* of the Imperial Government, should be the immediate cause of a radical reform in the local government of the Metropolis. Already the pressure of this question has practically converted some members of the Metropolitan Board to the persuasion that a change in the constitution of that body is necessary. To remain unaltered is standing rigid amid the storm, when safety is to be obtained by submission. If anything can hasten the advent of a new government for London, it is this very critical question of the water supply. The Vestry dele-

gates virtually demand that the Water Companies shall continue to exist until London is reformed. Happy delegates, who are willing to be swept away, so that they may but know that the Water Companies will follow next!

EFFLUVIUM NUISANCES.*

The greater part of this Blue-book, to which general reference was made in the last number of the JOURNAL, consists, as was then stated, of a highly interesting report by Dr. Ballard on effluvium nuisances, such report forming the third and concluding portion of his account of the inquiry into this matter upon which he has been engaged, not without intermissions, since November, 1875. "In former portions"—we quote from the general introductory remarks of the Medical Officer—"industrial processes that are concerned with animals, animal substances, and with vegetable substances, have been considered; and in the present portion an account is given of various offensive processes, wherein mineral substances are principally concerned, and of others wherein materials of mixed origin—animal, vegetable, and mineral—are dealt with. The governing idea of the inquiry has been to study 'effluvium nuisances' in their relation to the health of the community; and thus their influence within workplaces upon persons voluntarily subjecting themselves to such nuisance has been studied chiefly as it might throw light on the nature or circumstances of the influence which the nuisance could exert upon the outside community. In the course of Dr. Ballard's inquiry, some 70 different kinds of businesses, represented by 850 separate trade establishments in various parts of the United Kingdom, have been investigated; and it is probable that few offensive trades of any importance have been omitted. In the account of them considerable technical accuracy has been secured, through the willing and active co-operation of manufacturers."

The object of Dr. Ballard's inquiry has been twofold—first, "to learn the extent to which the public health is injured by one or another offensive trade or trade process, under one or another condition; and, secondly, to ascertain in what measure, and under what circumstances, nuisance and injury to health can be avoided."

In the study of the former problem, it has been impracticable to specify by a numerical method the absolute amount of sickness or mortality actually due to proximity to offensive trade establishments, there being no reliable data by which the effects of such establishments can be distinguished from those arising from other causes, and Dr. Ballard has consequently been compelled to rely upon his experience as a physician and sanitary observer, and upon the testimony of other duly qualified professional men, as to the interpretation which may rationally be put upon the health-rate of a particular district. Dr. Ballard's conclusions upon this subject, resting as they do on a broad basis of careful observation by one whose opportunities have been altogether exceptional, are of great value, as adding materially to our previous knowledge, and forming a good point of departure for further investigation.

The general result may be thus expressed: There are, first, a variety of influences upon health, due to certain trade processes, which are not only offensive, but are concerned with definably infectious or poisonous materials in quantity, and are consequently infectious or poisonous to workers or neighbours. As an illustration of trade processes dangerous from their dealing with infectious matter, we may instance the treatment of house refuse; while processes which give off poisonous gases or vapours, such as the arsenical vapours from galvanizing works, or the emanations from limekilns, fall into the second category. Leaving these two sorts of offensive businesses, in which the nuisance is accompanied by a major evil influence, the bulk of Dr. Ballard's report deals with trades and trade processes in which mere offence is the predominant feature. In these he recognizes several kinds of influence upon health:—(1) The effect of stink, merely as stink—an influence of common character attaching to offensive businesses generally, independently of the nature or cause of the stink itself. This influence consists of a group of symptoms of singular constancy, representing a disturbance of digestive and circulatory functions, along with, and probably due to a number of sensory disturbances, such as loss of appetite, nausea, sometimes actual vomiting, sometimes diarrhoea, headache, giddiness, faintness, and a general sense of depression or *malaise*. Some individuals suffer from this influence more than others, and some persons become more and others less sensitive to it with custom and time. Sickly persons are particularly liable to suffer from it, sometimes to a serious degree. (2) Then certain trade effluvia are distinguished by their exerting an acrid, irritating effect upon the surfaces of the body, particularly on the eyes, air-passages, and sometimes even on the skin. (3) Having arrived at this point, Dr. Ballard is precluded from assigning definite disease and death to the operation of the emanations from offensive trades or trade processes, by the non-existence of statistics, or rather by his inability to measure the influence of one and another disease-producing condition, the sum only of the entire effects of which is given by the statistics of mortality. He is able to trace the effect of a variety of trade processes upon comfort and ease of life, but as to the more serious effects possibly produced upon health and life by similar causes, he finds himself unable to speak definitely, for want of unmistakeable relation between observed disease and the offensive trade as its cause. Given, for example, continued respiration, in the vicinity of offensive works, of an atmosphere moderately charged with sulphuretted hydrogen, and an observed depression of general health with some nervous disturbances in persons exposed; other

* Eighth Annual Report of the Local Government Board, 1878-79. Supplement containing the Report of the Medical Officer for 1878.

circumstances, such as conditions of lodgment and diet, would have to be taken into account before the offensive gas and the failing health could be connected as cause and effect. Yet suggestions of the reality of such connection were, in this instance, not lacking, even with limited investigation. Again, the prevalence of acid vapours in certain neighbourhoods could not be distinctly affirmed to produce actual disease of the respiratory organs, although the organs appeared to suffer, and people with delicate chests were commonly observed to complain of aggravation of their sufferings. Of the popular belief that acid gases have conversely some power for good in preventing the spread of infectious disease within the range of their influence, Dr. Ballard finds no confirmatory evidence whatever. On the whole, the report tends to show that "the presence of an offensive business, though it may not rank in the infective or poisonous class, yet deserves to be rated along with, and prominent among those conditions that cause one place to be less wholesome than another place;" although, at present, it may not be possible to affirm the extent or nature of the share that the business has in the production of the total result.

"As regards the second object which the Board has sought to obtain from this inquiry—viz., to learn in what measure and by what means nuisance and injury to health from offensive businesses may be avoided—the report leads to a quite satisfactory result. It shows that by the application of such knowledge as is now at command, all or nearly all businesses that are now in a serious degree offensive may be carried on either without offence, or with such important reduction of offence as shall make it tolerable or even trivial. The means of avoiding or lessening offence are fully discussed by Dr. Ballard for the several businesses to which his inquiry has extended, and it is not the least satisfactory feature of his inquiry that it is commonly found in practice to be as much to the interest of the manufacturers as of the public that the emanations from offensive processes should be thus arrested."

Thus far we have closely followed, with some condensation, the comments of Dr. George Buchanan, the Assistant Medical Officer to the Board, who (in the absence through illness of Dr. Seaton, the Medical Officer) has summarized the results of Dr. Ballard's inquiry in his own general report; and the insight thus afforded into the nature and scope of the aforesaid inquiry, while presenting sundry considerations which should be borne in mind during the perusal of the detailed report, must at the same time arouse considerable interest in the subject of it, particularly to those whose occupation may happen to attain the somewhat doubtful honour of Dr. Ballard's attention.

It is impossible to praise too highly the care with which the inquiry has been carried out; every one of the great number of different manufactures included in its scope having been subjected to a searching examination, which has resulted in the compilation of exhaustive descriptions, elucidated wherever necessary by drawings and photographs of the minutest details of every process involved which might be considered either a cause of offence or as explaining its existence. Parenthetically we must accord a certain admiration to Dr. Ballard for the heroism with which, at the call of duty, he encountered in his own person nearly a thousand different odours, rivalling each other in vileness—not merely braving them, but wilfully stirring them up and tracing them to their sometimes obscure origin. Fortunately he does not appear to have suffered materially in health from his five years exposure to influences which he credits with considerable powers for evil, and this circumstance, if true—and there is no evidence to the contrary in the report—gives hopes for others who, if longer subjected to one or another effluvia, may be reasonably expected, under ordinary conditions, to escape such a complication of stinks as Dr. Ballard incurred during what he can scarcely remember as the pleasantest pilgrimage of his life.

Concerning the utility of Dr. Ballard's inquiry, no doubts can prevail. He has placed on record the willingness with which manufacturers and their responsible agents met his inquiries, and explained to him their methods of working, very generally supplying him with drawings and photographs, and even, in many cases, correcting the proof-sheets of his notes, in order that his descriptions and observations might be technically accurate. The result may be seen in the clearness which marks his treatment of every process he has touched, and which in many respects raises his report to the level of a dictionary of offensive trades. A catalogue of such trades having been determined upon, it was obviously of the first importance it should be as complete and accurate as possible, in order that a vast amount of popular ignorance and the prejudice of many persons who should be better informed might be set right. The existence of such perfectly unbiassed testimony as that contained in Dr. Ballard's descriptions of certain trade processes which ere now have proved bones of contention between manufacturers and the public, should be welcomed on both sides. Manufacturers prove thereby that there is no mystery in operations which they have, sometimes with good reason, refused to show to outsiders who have been actuated by hostile curiosity; and, on the other hand, the custodians of the public health are instructed in the *rationale* of proceedings which they might otherwise regard with especial jealousy. It is instructive to note that increased knowledge has, in Dr. Ballard's case, resulted, in the usual way, in the diminution of confidence in dogmatizing on the effects of most of the trade effluvia mentioned by him. His caution in alleging positive injury to health in any case is in marked contrast to the assurance which is so characteristic of ill-informed or amateur nuisance inspectors, who are generally so eager to swear that all the ills that flesh is heir to are clearly due to the malignant vapours from some particular establishment they are determined to annihilate.

Unfortunately for the preservation of unbroken harmony between manufacturers and the public, the sense of smell is particularly out

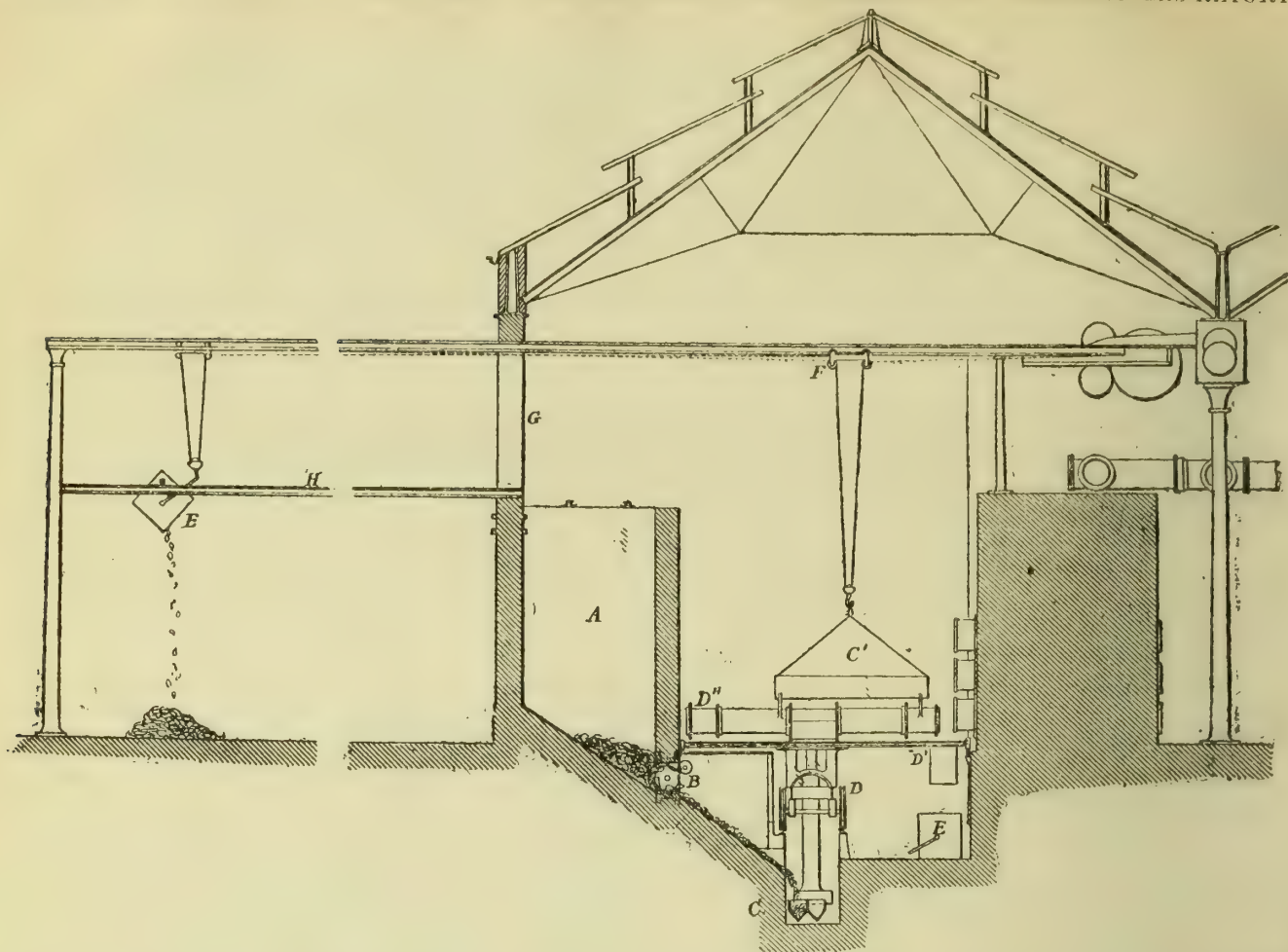
of joint with the operations of a large number of highly necessary trades. For a single pleasant odour produced in the arts there are a thousand processes with either no smell at all or a decidedly unpleasant one, frequently deserving the homely Anglo-Saxon epithet so sensibly used by Dr. Buchanan. Whenever this latter occurs to any great extent, the idea which generally arises in the public mind is that wholesale poisoning is in progress, and this is an error which Dr. Ballard is able to correct. It seems to us, however, that the possible action of certain acid fumes in aerial disinfection is undervalued by Dr. Ballard. Take, for instance, as an extreme case, the fumes of burning sulphur, or sulphurous acid vapour. This is in use as a powerful disinfectant in cases of infectious disease, and while its presence in the atmosphere of any locality would, of course, be a great nuisance, yet if its disinfecting power were exercised, according to the proportion in which it existed, on any infectious matter which might otherwise exist in the air, it seems evident that to this extent it would act beneficially, although, after all, the result of its diverse actions might be undesirable. No one at this time of day will be likely to contend that a manufacturer, for his own immediately selfish ends, has a right to render the lives of his neighbours burdensome to them, or very possibly to cut them short altogether, by diffusing horrid smells over an indefinite extent of adjoining territory, any more than he may obstruct thoroughfares or poison wells. And it is not in accordance with human nature that the initiative in restraining himself from such acts should in all cases rest with him, especially if the restriction causes him expense or inconvenience. There must be opposing forces to cause every departure from established lines. But the directing or regulating power must not be too exacting, so as to render the manufacture impossible, either by sentence of banishment, or by imposing too stringent regulations, under which it could not be carried on profitably. Carelessly-managed or old-fashioned establishments will have no sufficient excuse for their unregenerated existence if Dr. Ballard's descriptions of better-managed works should be taken note of by sufferers from unnecessary nuisance. It can be no real hardship to compel lagging manufacturers to keep pace with their more enterprising brethren in the matter of the suppression of effluvia. When all are under equal restrictions, there can be no grumbling, and if any extra outlay is involved in the prevention of nuisance, it is obviously unfair, especially in the case of manufacturers who have to compete with each other in the open market, that some should be saddled with an expense from which others are free. In this respect the accessibility of such valuable information as the report contains will be of great benefit to sanitary authorities and manufacturers, by informing them of what is being done in localities of which their knowledge might otherwise be small.

For ourselves, we are of opinion that the damage done to public health and the comfort of the community by unavoidable effluvia from trade processes is small, confined as it is, in most cases, to special districts. A noisome factory is not often established in an otherwise favoured locality. The very nature of most trades of the kind, the necessities of their supply with raw material, or the possession of facilities for the disposal of their products, and the proximity of the labouring population from which their workpeople are drawn, generally presuppose a locality in which a fresh stink of any moderate dimensions is but an addition to an already settled family. We are not denying the abstract right of the poorer classes, as fully as those above them in the social scale, to pure air and sunlight, when we express our conviction that, as a rule, in town or country, they are steeped in odours compared with which most trade effluvia are bearable. Their condition has, it is true, vastly improved of late years; but much still remains which, when finally rectified, will remove a very present difficulty. This lies in the practical impossibility of accounting for the origin of every disagreeable smell noticeable in a crowded manufacturing district, or of ascribing a low state of general health to its right cause. We have before our mind the case of a suburban district of a large northern town which is thickly covered with chemical works and every kind of vile-smelling trade which Dr. Ballard has catalogued. The sky is darkened with smoke, stenches in infinite variety assail the wayfarer as he passes along clinker-made roads fringed with steaming sheds or sooty workmen's cottages, and everything would tend to give a stranger the idea that epidemic disease would there find a suitable home. On the contrary, the drainage being good and the water supply excellent, all the superficial dirt and trade effluvia do not prevent the district from being exceptionally healthy, rejoicing in a death-rate actually lower than that of many more pleasant residential localities not far distant.

We shall find, as we proceed, that Dr. Ballard has devoted much attention to gas-works, which, of course, he classes among other offensive trades, although he does not credit them with any specially diabolical influence. As we shall, in a subsequent article, examine in detail his statements respecting them, we shall here only remark that the smoke and steam which emanate from gas-works form one count of the indictment in this case as in several others. Speaking here merely of the influence of such a species of air-pollution on public health, it seems straining a point to regard as a grave nuisance a quantity of coal smoke, which, under the worst conditions, cannot be more than the most insignificant fraction of the total amount of unconsumed carbon sent into the air from the myriad chimneys of a populous town, and which, when mixed up with other vapours in the form of a thick yellow fog, becomes probably the most noxious mixture which human beings can be compelled to breathe.

Having now considered a few of the general questions presented by the great problem embodied in this voluminous report, we will in our next notice proceed with the examination of Dr. Ballard's observations on gas-works, and the nuisances said to arise therefrom.

WARNER'S IMPROVEMENTS IN MACHINERY AND APPARATUS FOR CHARGING AND DRAWING GAS-RETORTS.



A short time since, in publishing in the *JOURNAL* an account of two visits paid to the Jarrow works of the South Shields Gas Company—the first by the Shareholders of the Company, and the second by a large party of Gas Engineers and others, the object on both occasions being to view Mr. Warner's recent improvements in machinery and apparatus for drawing and charging retorts, and for doing the work immediately in connection therewith—we gave a general description of the arrangements, and promised further details and drawings. With this week's number is issued a double page plate, showing the drawing and charging apparatus proper, while the above engraving is a cross section of a retort-house, with the arrangements for carrying out Mr. Warner's inventions in their entirety.

The improvements are based upon inventions for which letters patent were granted in 1875, and provisional protection in 1877, to Mr. W. J. Warner. The invention we now notice is designed to improve and simplify the machinery for charging and drawing retorts; and, at the same time, by mechanical means, to prepare the charge of coal for the scoop, and discharge the coke from the retort-house. The work is thus dealt with under what must be considered as three separate divisions—viz., coal-getting, or preparation of the charges for the machine; drawing and charging; and delivery of the coke from the house. We shall describe the arrangements for dealing with the work mechanically, as they are in operation at the Jarrow works of the South Shields Gas Company.

The retort-house is constructed in the usual way, with the exception of the floor, which is about 6 feet below a platform at the ordinary floor level, and has a channel about 3 feet square running parallel to the platform the whole length of the house. The width of the platform is 5 feet, and the space between it and the beds of retorts is about 10 feet. On the edges of the channel, rails are laid for the machine to run upon; and under the platform is an endless rope, by which the machine is driven. A shaft also extends the whole length of the house, which drives revolving "diggers," for drawing out the coal from the openings in the lower portion of the "coal stores," or "bunkers," built opposite the beds. Sheet-iron "buckets," or troughs, divided into two compartments, each to take a charge of coal, receive it from the diggers, down an incline to the channel in the floor. Over the centre of each bed, and carried through an opening in the side of the house to about 30 feet beyond, a pair of light H-girders are fixed, which are a part of a simple hoist. The hoist is driven by a shaft along the house above the beds, and is for raising the coal and holding it in its position for delivery to the machine, also for lifting the coke in the iron buckets into which it is drawn, carrying it from the house, and depositing it on its heap, which it does without any labour in trimming being spent upon it.

The machine for drawing and charging is carried by a quadrilateral frame, 10 feet by 3 feet, mounted on wheels. Its general features are two vertical cylinders with hollow rams, on each of which is mounted a cradle, or frame, for carrying the scoop or rake. The tools so mounted are free to turn on the rams, and, therefore, may be worked at any angle, each tool being entirely independent of

the other. The retorts are placed at equal distances along the house, and the distance from centre to centre of the rams or tools being the same, the two tools are brought in succession to each retort as the machine travels along, but with only one adjustment to each, the retorts being taken in tiers.

The above illustration shows the general arrangement of the machinery. A is the coal store or bunker from which the coal is drawn, being broken, if necessary, by revolving diggers, B, and fed into a trough-like box, or "coal-bucket," C, divided into two compartments, each having the capacity of a charge of coal, the bottoms being hinged and supported by chains. When filled, C is raised into the position C', ready to deliver the charges into the scoop when required. The whole of the charges are thus prepared at leisure, and suspended as shown. The machine, D, D', D'', is mounted on a carriage, D, and runs upon rails extending the whole length of the house. D' is a platform from which the machine is actuated. D'' represents the two tools, rake and scoop, for doing the work, as the machine, which is driven by the endless rope, travels along the house. The coke of each tier of a bed, two charges to the bucketful, is drawn into a coke-bucket, E.

After the work of drawing and charging is finished, the third portion of the work—the delivery of the coke—is proceeded with. The empty coal-buckets are lowered to C, the coke lifted, and carried from the house by hoists, F, through openings, G, in the side of the house. The coke is then delivered by the bucket being lowered upon the coke platform, H, where it is inverted, by an axle fixed to its under-side coming in contact with two light girders, discharging the coke. A 10-horse power engine drives the rope for the machine and the two shafts for working the diggers and hoists. The whole work is done from the interior of the house, and is entirely under control.

The details of the machine are shown on the separate plate of engravings; fig. 1 being the back end view, and fig. 2 the side view. It may be simply described as consisting of two tools, rake and scoop, mounted on a carriage, with the mechanical arrangements necessary for effecting the several operations of transmitting the power from the running cord to the machine, and for adjustment and work. The cord, A, as shown, runs under two pulleys, B', B'', and over one, B, between them. Power for traversing is given through B'', and transmitted by a disc and friction-wheel to a worm and worm-wheel, thence to spur gear as shown, fig. 2, under the platform. By means of its pinion and bevel gear, pulley B drives the main shaft of the machine, C, fig. 1. On each side of this main shaft, bolted to the carriage, there is a vertical cylinder, D, D', fitted with a hollow ram, E, E', in which a screw is secured by a nut below, the screw being in length somewhat in excess of the difference in height between the highest and the lowest retorts. By means of the bevel and spur gear at the lower portion of, and driven by the shaft, C, the necessary changes of motion for raising and lowering the tools to adjust them to the varying requirements of the retorts are effected; each tool having the power of independent adjustment. The power for driving the machinery for each tool is obtained by the spur-wheel from the upper part of the main shaft, C, driving the secondary

shafts, F, F, which, with the wheels, G, G, geared to each tool, are raised and lowered with the lift by the brackets, H, H, keyed on the cylindrical rams. These shafts are grooved, and work through feathered bushes, or fillbores, which revolve in their seats with the shafts. It will thus be seen that each tool has not only an independent vertical action for adjustment to the retorts, but also that the power for driving the tools is continued through the adjustment by means of the rising and falling shafts. In other words, there is the power of adjustment while the tools are at work. The spur-wheels, G, G, keyed on the shafts, drive the wheels, I, I, which are loose on the rams, and drive I', fig. 2, which drive bevel-wheels and clutches, of which J, J are the handles. The changes of motion necessary for driving, reversing, and stopping the tools are communicated to the main driving-wheels, K, K', through the intervention of the chains, as shown.

Up to this point the action of the two tools is identical. In the case of the scoop, the axial motion for turning it to deliver the charge of coal into the retort is connected with the travelling motion of the scoop; but the rake tool has an independent axial motion, which is under the control of the workman. The latter motion is obtained from the handle, J, which, besides working the clutch by a to-and-fro motion, can also be moved through a portion of a circle to give the axial motion to L, which is effected by a quadrant keyed to the handle, and a pinion, shaft, and wheel, L', which is connected with the axial shafts by a short chain, as shown in the end view. The axial shaft is square, and supported at the ends of the rake frame, M, M', at M, in a bearing in the ordinary way, while at M' the shaft is keyed to a disc working among four guide-rollers. The rake shaft which passes through the disc is attached at the rear end by an arm, N, to the axial shaft, along which it is free to travel with the crosshead of the rake, as it is drawn along the frame by the chain, which passes over pulleys at each end. In action, the rake passes over the coke, enters it upon receiving the axial motion, and upon the stroke of the rake being reversed the coke is drawn from the retorts. Each motion is independent of the other, and entirely under the control of the workman, and hence adaptable to any condition of charge. The axial motion of the scoop is given by bevel-wheels, shown in the end view, at the scoop head. One is keyed to the shaft of the scoop, and the other is keyed on one end of a cross shaft, passing through the slide, O. To the other end of this shaft is keyed a crank-arm, the pin of which passes through a link of the endless chain, P, P, for driving the scoop.

The action of the apparatus is as follows:—The arms, Q, Q, catch and guide the coal-bucket as the machine travels into its place. The charge is delivered into the scoop through the hopper, R. By the handle, J, the scoop is started; the endless scoop chain, P, P, carrying with it, by means of the crank-pin, the slide and scoop, which are supported by the slide-bars and cradle. The charge being thus driven into the retort, is deposited by the crank being carried round the fore wheel, O', half a revolution with the chain, which gives the necessary half turn to the scoop by means of the bevel-wheels. The motion being continued, the scoop is withdrawn, and returned to its place and former position by the crank-pin being carried round the rear wheel, O. The handles, T, T, are for traversing, and those beneath them for actuating the rams.

The two tools have not only the power of vertical adjustment, but they may also be moved round on the axis of the rams, and the distance between the two centres may be altered by means of a slide arrangement, attached to the head of the ram, actuated by a screw and hand-wheel as shown at U, fig. 2, immediately under the rake frame. The object aimed at by these arrangements is entire control over the adjustment of the tools, that they may be adapted to any alterations in working or setting, thus preventing any prejudicial action upon the retorts. So adaptable is the machine to varying circumstances, that the tools will work retorts with their axes either divergent or convergent. Indeed, the power of adaptability is such that two stacks may be worked face to face by this machine; a tier being taken on one side, then each tool and its cradle raised in succession to clear the other, swung round, and a tier upon the opposite side taken. With such an arrangement the coal stores may be placed parallel to the beds, behind the retorts on either or both sides of the house, and in the same or separate buildings. The coke would then be stacked beyond the coal stores, or on the opposite side of the house if only one coal store were constructed. The plan of the machinery in connection with the lift and coal feeders would be arranged to suit the altered general plan.

Though it is somewhat recapitulating, the mode of working the whole of the machinery is as follows:—The shaft or rope for driving the feeders being set in motion, a bucket is filled with two charges of coal, lifted by the hoist, and put into position in front of each bed to be charged. Assuming that the retorts have been charged, and the charges worked off, the machine has its tools adjusted by the screw lifts to the tier of retorts to be taken, and is then run into position for drawing. The drawing is done by the attendant on the drawing platform, by passing the rake into the retort over the top of the charge, giving it an axial motion, and reversing at the same time, thus pressing the rake-blade into the coke, and withdrawing any portion of the charge desired, and repeating the operation as often as is necessary for clearing the retort. The charge being drawn, the machine is moved on, and the scoop brought into position for charging. This again carries the rake into position for the next retort, as the retorts are at equal distances along the house, and the centres of the two tools are at the same distance; but if the retorts are not so set, or get out of the true in working, the slide may be used for adjustment.

In adjusting the machine for charging, the arms on the cradle and hopper are used to carry the coal-bucket into position for delivering

the charges. The attendant of the charging tool then delivers a charge into the scoop direct from the bucket, the scoop is driven into the retort, and, arriving at the full extent of its travel, receives its axial motion, then returns into its cradle, completes its one revolution, and is ready to receive the next charge, which is delivered, the bucket raised, and the machine moved to the next retort, and so on till the whole of a tier of retorts is charged.

It will be observed that, by such an arrangement of working, the time occupied by the operations of drawing and charging is reduced to a minimum, as the work in connection with these operations during their progress is reduced to the lowest possible amount. The charge of each bed is ready to be delivered into the scoop, and the coke is delivered into buckets, to be removed after the work of drawing and charging is over, or drawn into waggons under the retort-house floor, in the usual way; or the work may be done in both ways. It is evident, however, with this system of delivering the coke by overhead gear, that the labour of stacking is avoided, and that less breeze will be made. There will also be less chance of a breakdown by such a division of the work. The coal charges being made ready before the drawing and charging commences, these operations are next effected, and the coke subsequently removed.

Though the machine is shown below the floor line of the retort-house, it is obvious that the same general arrangement of machinery may be placed in suitable framing, and made to travel on or above the floor of the house.

Communicated Article.

DR. ADAMS'S GAS-STOVES.

We have received the following communication from Dr. Adams:—

The editor of a contemporary journal, in commenting on my stoves, invites me to give information on a point where doubt exists. He says, "There is one point in their construction with regard to which we desiderate information, and that is: Suppose in a room a stove of a given size is requisite to raise the temperature, say, to 60°, and that in the course of the day, changes in the weather render the full heating power of the stove unnecessary. Is there any provision for keeping it going with half the quantity of gas, so as to get a reduced number of heat units? or must the stove, as we suppose it must, continue to consume its full measure of gas, in order that the exact mixture may be obtained to secure complete combustion? If such provision has not been made, we think that some mechanical appliance might be contrived which would regulate the flow of gas and air in the desired proportions, whether the stove is working up to its full power or not."

The query and suggestion are alike shrewd and of practical importance, and it is well to have the point made clear. The conditions referred to were carefully considered by me many years back, and I devised and practically carried into effect, in an embryo stove, a solution of the problem precisely within the lines indicated. In the words of my patent, "the object is effected by providing the general air-inlet opening with valves or discs, self-regulating under the pressure of the inflowing air, or capable of being adapted to a desirable fixed area."

But although provision has been made for the contingency suggested, there is in the stove, as now constructed, no practical need for a special contrivance which necessarily complicates and increases the cost of the apparatus. The object is sufficiently and almost as perfectly attained by the peculiar construction of the air-inlets and of the flues. The velocity of the air entering the furnace chamber to support combustion undergoes acceleration or retardation in a ratio with the heat of the chamber, and this again is influenced by an increase or diminution in the supply of gas. The openings which admit the due proportion of air to the furnace chamber are regulated in accordance with the estimated supply of gas, and the supply of gas is under the regulation of an efficient gas-governor. On leaving the furnace chamber, the hot waste products of combustion pass through a series of contracted uptake openings communicating with the superimposed horizontal chambers of which the flue is constructed. The hot gaseous products thus pass, not in a continuous, smooth current, as in ordinary stoves, but in abrupt gradations from one chamber to another; and the volume of the hot vapours thus undergoes a series of alternate expansions and contractions, which influence still further the mean velocity of the current. The result is that the stove when in use is always in efficient action, and when the full heating power is not desired, the heat may be diminished precisely as the light of a gas-jet is increased or diminished at pleasure. The case suggested by the editor is illustrated daily in the use of the stove which warms my own study. Thus, on the morning of the day on which I write, the temperature of the room was 45° Fahr. Within two hours after lighting the stove the temperature of the room had risen to 62° Fahr. The gas consumption during this period was 15 cubic feet per hour, that being the intended full power of this particular stove. I then turned down the gas to the extent that I guessed would be sufficient, and the temperature of the room throughout the day, and until the late hour at which I am writing, has remained at 59° to 60° Fahr. I find that the gas consumption is at present 10 feet per hour. The convenience has, therefore, been all that I desire, and practically meets all that has been suggested as desirable.

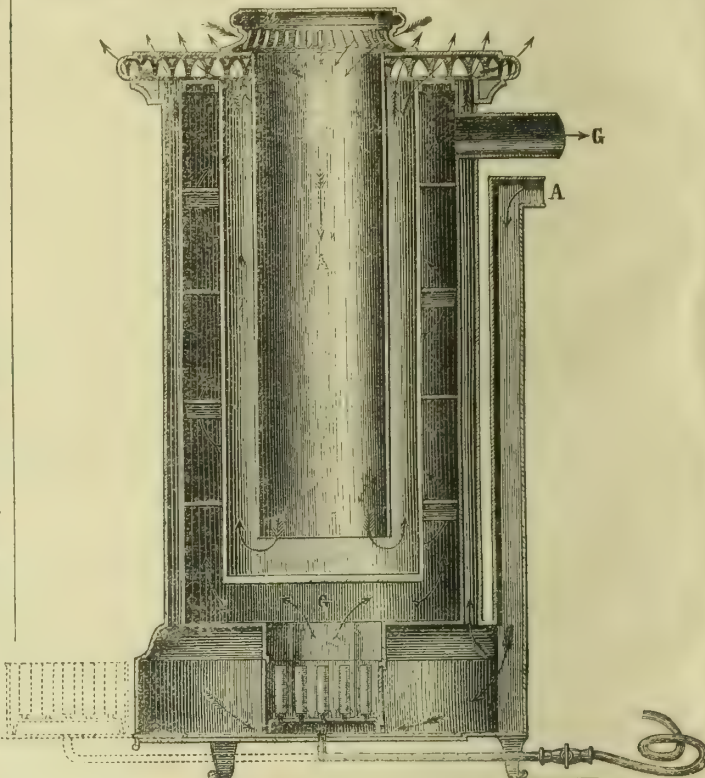
In this connection it is worthy of mention that neither with the ordinary grate nor with an American stove grate could I previously get the room comfortably heated, owing to its exceptionally faulty construction. It so overhangs an open court-yard that the floor is exposed to the cold outer air; it has two thin outside walls, and

there are 72 square feet of window glass. A room more difficult to warm could, therefore, scarcely be contrived. It is 16 feet by 13 feet and 12 feet in height, with a cubical capacity, in round figures, of 2500 cubic feet. A ventilator (with which every stove-heated room should be provided) keeps the air-supply fresh. The chimney is so dominated by neighbouring buildings, and is otherwise so faulty, that before the fire of a coal grate or coal stove could be got fairly alight there was encountered, frequently for an hour or more, a dense atmosphere of pungent smoke, and a persevering course of trimming attendance was necessary. It happened, indeed, very frequently that rather than suffer the discomfort to myself, and damage of books and instruments, caused by the smoke, the dirt, and dust of coal and ashes, &c., I preferred to shiver in a great-coat and railway rug while occupying the room. Now, in the worst conditions of wind and weather there is only occupied a second—or, on rare exceptions, when first lighted during gusty weather, one or two minutes—to set the stove in full action, and thereafter the room becomes warmed at an average rate of 10° per hour. A room of similar size, but free from the exceptional difficulties referred to, would be efficiently warmed by a stove of half the size and power, such as I recently had constructed.

The open fire has special advantages, which are so great that it will ever remain a favourite in this country, and hold its ground for domestic use against the inducements of the most perfect conditions that the most perfect stove can ensure. But at times an open fire is impracticable, or inconvenient, or non-efficient, and in such conditions comfort, convenience, and economy may, nevertheless, be all attainable through the use of a good gas-stove. That which I employ burns on an average—when in full use—15 cubic feet of gas per hour, and with that supply it discharges from the pure air vomitories more than 4000 cubic feet of air per hour, warmed about 180° Fahr. above the temperature at which the air entered the stove. If desired, a much higher temperature may be obtained, but that is the warmth aimed at in the most approved methods of heating by the use of steam-pipes. Hot-water pipes supply warmed air of a much lower temperature, and, if desired, that temperature may also be provided. Under all circumstances, it must be borne in mind that in addition to this large discharge of heated air from the interior of the stove, there is also given out heat by radiation and contact of air from the exterior surface, precisely in the manner of the best stoves of ordinary construction.

The accompanying drawing, taken from my paper in the *Transactions of the Glasgow Philosophical Society*, shows in section the chief peculiarities of one modification of a hot-air stove, for house apartments, school-rooms, warehouses, conservatories, &c. The hot gaseous current formed by the ignited gas is shown by arrows traversing the series of chambers and contracted openings to its final exit by the flue leading into the chimney, and indicated by the letter G. The course of the pure air which enters the stove in order to be warmed is indicated by feathered arrows. One supply enters by a pipe at the back of the stove, indicated by the letter A, and the stream of air is seen to enter the air chamber at the base of the stove, and to give off a small and regulated supply

to the furnace chamber for combustion of the gas. The main stream is seen to pass upwards between the outer duplicate casings of the stove, and to be discharged at the top. Another supply enters at the summit of the stove, and, following the course of the descending arrows, becomes reversed at the bottom of the hanging central tube, and ascends, passing out at the top. The dotted lines at the base of the drawing represent the arrangement for preventing explosions. The entire furnace chamber is drawn out on a sliding tray or drawer, and until that is done the gas is inaccessible. When the furnace chamber has been drawn out to light the stove there enters at the same instant a large body of air, which thoroughly ventilates and frees the stove from any explosive accumulation that under any circumstances may have formed (but which under any circumstances could scarcely ever form in this stove, because it is continually traversed with a current of air, whether in action or out of action). The gas, therefore, can only be ignited openly in the unconfined air of the apartment, when it is no more liable to explosion than that of an ordinary gaselier.



Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

PUMPING GAS AT BECKTON.

SIR,—The publication in your JOURNAL of April 20 of an account of our pumping arrangements here has drawn forth a letter from Mr. King, and one from Messrs. Gwynne and Co., in which they lead your readers to infer that the idea and arrangement of our pumping machinery has been copied from that fixed at Liverpool.

I beg to say, as far as I am concerned, that I have not seen the machinery they refer to, and their letters were the first intimation I had that anything of a similar character existed at any other works. If it should turn out that the two arrangements are identical, it only goes to prove the old saying that "there is nothing new under the sun."

The Gaslight and Coke Company,
Beckton, North Woolwich, April 30, 1880.

G. C. TREWBY.

THE BRAY LANTERN AND BURNER, AND MR. SUGG.—We have received a letter from Mr. Bray, in reference to Mr. Sugg's communication published last week; but it is accompanied by a sketch which there is not time to have engraved for insertion in to-day's issue.

Legal Intelligence.

HIGH COURT OF JUSTICE—EXCHEQUER DIVISION.

THURSDAY, APRIL 22.

(Before the Lord Chief Baron and a Special Jury.)

HUMBER v. THE TOPSHAM, WOODBURY, AND LYMESTONE WATER-WORKS COMPANY.

This action was brought to recover the balance of a sum of money, claimed by the plaintiff for work done by him, as a Civil Engineer, for the defendants. The defendants denied their liability, alleging that plaintiff never was employed by them to do the work claimed for; and they maintained that, in the event of their being found liable, the sum of £175, already paid by them, was sufficient for the work actually done.

Mr. BOMPAS, Q.C., and Mr. NAMBYTH appeared for the plaintiff; Mr. CHARLES, Q.C., and Mr. EDWIN JONES for the defendants.

Mr. BOMPAS, in opening the case, said the plaintiff, Mr. W. Humber, was a well-known Civil Engineer who had devoted himself especially to the subject of water-works, and he (Mr. Bompas) believed the plaintiff was acknowledged to be one of the chief authorities upon this branch of civil engineering in the country. The action was brought by the plaintiff to recover the ordinary payment of a civil engineer as Engineer for some water-works which were started by the defendant Company. The Company was formed in 1868, and in that year they

obtained an Act of Incorporation. They failed for some time to carry out their undertaking; but in 1871 they commenced making their works in the neighbourhood of Exeter, and these works were carried out to a considerable extent entirely under the superintendence of the plaintiff, whom they appointed their Engineer for that purpose. The contractors unfortunately failed to fulfil their contract, and when the works were partly completed they were stopped. Efforts were made to obtain other contractors to complete them, but owing to the depression of trade the matter was postponed for a time, though in due course the works would no doubt be completed. The defendant from time to time asked for payment on account, although he did not feel himself entitled to be paid such a sum as an engineer would be entitled to when the works were finished. The defendants making no apparent effort to complete the undertaking, plaintiff sent in his claim for commission, and there was a letter sent to him by the defendants, denying all liability. The present action was therefore brought to decide whether the plaintiff was entitled to be paid for his work or not. The grounds of defence set up by the defendants were that the plaintiff never did the work; but this was merely formal. There was no doubt that Mr. Humber prepared elaborate plans for the water-works, and that he superintended the carrying out of the works, and, as far as they went, they were half completed. He went down constantly from London to Exeter for the purpose of superintending them. There was a large mass of correspondence between the plaintiff and the defendants as to the way in which the work was to be carried out. The defendants further alleged that although they employed the plaintiff, and although he must have done the work, they never entered into a contract under seal. This defence, he was happy to say, was in this case a wholly futile and idle one, because the Company was incorporated by an Act of Parliament which, by express terms, was to include the clauses of the Companies Clauses Consolidation Act, and one of these clauses provided that the Company should be able to enter into contracts in the same way as any ordinary individual. The defendants also set up another defence, which he would not say was never justifiable, but upon which judges and juries looked with some suspicion—namely, the Statute of Limitations. The defendants, in effect, said, "You have let years go by without pressing us for payment, and as soon as you hear we dispute your liability you bring this action; and we say these works were commenced and carried on for the most part some six years ago." This was quite true. The appointment of the plaintiff as Engineer took place some six years ago; it was true that the greater part of the work for which he charged was done before the middle of 1872, and the action was brought in June, 1878; but the Statute of Limitations provided that the action must be brought within six years after the cause of action had arisen. The question that had to be asked in every case was when the cause of action arose. The plaintiff was suing for compensation for service, and the question was when the money that was being sued for became due. The plaintiff was appointed the Engineer to superintend the erection of these works, and, according to the custom of engineers, he was to be paid for his work when his work was completed. So far from his work being at an end in 1872, he (the learned Counsel) would show, from a series of letters and resolutions by the Directors of the Company, that the plaintiff was called upon

to do certain work down to the end of 1876. It was not because the contractors failed to carry out their contract, and throw up the works for a time, that therefore the Directors threw up the work. On the contrary, they wished to get some other contractor to carry it on, and until the works were abandoned, or until the Directors told their Engineer that they did not want him to act any longer, he had no right to say, "I have completed my work, and have a right to demand payment." It was quite true that in these cases an engineer asked for payment on account. In 1872 and 1873, Mr. Humber wrote asking the defendants for a cheque for £100 on account. They gave him a cheque for a small amount; and in 1873 and 1875 they said in one case they were short of cash, and in the second case did not give any definite answer. Until the plaintiff was dismissed, or the works were given up in 1876 or 1878, he (the learned Counsel) apprehended that the plaintiff had no right to demand payment of his commission, and that therefore, so far as the Statute of Limitations applied, there had not been one year—certainly not more than two years—that had elapsed from the time the plaintiff had to bring the action. He therefore submitted that the defence was invalid. Another defence was that in the month of April, 1870, the plaintiff proposed to the defendants that he should be appointed by them their Engineer in making and erecting certain works upon the terms that the plaintiff should obtain persons to become subscribers, and that he should not make any charge in the event of subscribers not being obtained. The plaintiff was not suing for anything that happened in 1870. In 1871 the project was revived, and the question was what took place in 1871. Why the defendants should take the trouble to state that certain proposals were made in 1870, he did not understand. The defendants also said that in 1871 an agreement was entered into between the plaintiff and the Secretary of the Company. It was agreed that the plaintiff was to procure persons to contract with the defendants for the construction of the water-works, that the plaintiff was to be the Engineer, that he was to procure 100 shares to be subscribed for, and was to take 15 shares himself. They said that it was a term of the agreement that it was to be confirmed by the Board of Directors, and if the terms were not complied with, the agreement was to be null and void. The agreement was not confirmed by the Board of Directors; and, being null and void, he would ask what it had to do with the rights of the parties. Another counter-claim made by the defendants against the plaintiff was that he should pay £3000 because he had broken this null and void agreement; but as the plaintiff agreed that it was null and void, he (the learned Counsel) could not see the validity of the defendants' claim. The defendants also said that the £175 which had been paid was enough to satisfy the claim of the plaintiff. He would be able to show, however, that 5 per cent. was the usual commission to be paid on a contract, if it was in London, whilst in farther-off districts it was 6 per cent., and that was what the plaintiff claimed; therefore the defence, as far as he could see, was an idle one. The question resolved itself into whether or not the plaintiff had been employed by the defendants to do their work. He supposed his learned friend would say that although it was true the plaintiff did this work, he did it on the understanding that he should not be paid for it unless they chose to pay him; but that was not a very probable defence, to begin with. Letters and minutes would be produced to show that the plaintiff was actually appointed the defendants' Engineer, and that all the work was done by him in the usual way as their Engineer. The Company was originally started in 1868; but they found great difficulty in getting their funds subscribed, and in carrying out their works. Time went on until 1870, when a Mr. Smith, of Bristol, wrote to Mr. Humber and asked if he could give any aid in the matter. In getting a contractor for any works of this kind, a great deal depended upon who was the engineer. In the first place, the contractor had usually to take some of the shares in the company as part payment of the works executed by him; and the contractor would think twice before he took shares in a company which might be so badly engineered that it would not answer, and where he might not be able to sell the shares when the work was completed. Another reason why the contractor would consider as to who was the engineer, was because the engineer had to decide all questions between the contractors and the company as to the way in which the works would be carried out; and it was of great importance that the engineer should be a man in whom, in point of character and ability, the contractor could thoroughly trust. The defendants, therefore, called in Mr. Humber's assistance. Mr. Humber told them he did not think there would be much difficulty, if he were appointed, in finding some contractor who would carry out the contracts. As to the question of raising capital, he thought if he was allowed to look out for a Secretary to the Company, he could find some gentleman who would agree to take a certain number of shares. It was suggested that a Mr. Tomlinson would be the Secretary; but he finally declined. Then Mr. Humber had to go away to a very large work he was undertaking in Russia, and the whole matter fell through. In the autumn of 1870 he came back again, and wrote to Messrs. Gidley and Head, Solicitors, of Exeter, asking if anything more had been done in regard to the water-works. He was answered that there had not been, and was asked if any steps could be taken to carry out the works. It required a good deal of time for a busy man like Mr. Humber to go about and find a contractor to undertake a matter of this kind, and to find people to back it up by taking some of the shares. It was not likely that Mr. Humber would undertake all this, unless he knew what position things would assume in the end. On the other hand, the Directors not unnaturally wanted to see their way in the matter. A correspondence took place, which was the expression of the two parties as to what was fair and right, and, therefore, the various proposals beforehand were not strictly evidence. What took place afterwards was always understood. On the 14th of February, 1871, Mr. Humber and the Secretary of the Company, Mr. Serena, entered into an agreement to show upon what footing Mr. Humber was to set to work and try to find some contractor who was willing to undertake the works, and authorizing him (Mr. Serena), if he could, to place more shares on being given the position of Secretary, so as to have a certain amount of control in the transaction of the business of the Company. This agreement was the one which both parties agreed was null and void. It was dated Feb. 14, 1871, and it provided that Mr. Humber was to find a proper and responsible contractor or contractors, who would enter into a reasonable, fair, and proper contract for the construction of the water-works as far as related to Woodbury and Topsham, including the laying of pipes and all proper material and labour, &c., such contractor or contractors to receive for the work £2000 in debentures of the Company, £500 in ordinary paid-up shares, and the balance in cash. Mr. Humber was to be employed as Engineer to the Company for the purposes of this contract and the works incidental thereto, on the usual terms. It was further provided that Mr. Humber should procure persons to take 100 shares of the Company in addition to the 50 to be subscribed for by proper and responsible contractors, to enable them to carry on the business, and that Mr. Humber was to take 15 shares himself. There was also a proviso that he was to nominate a Secretary, and the Company were to ratify the nomination. Whether that part of the agreement was legal or not, he was not sure; because he doubted whether the Directors had a right beforehand to appoint a person to nominate their Secretary. The agreement concluded that it was to be confirmed by the Board

of Directors, by Mr. Humber, and by the contractor or contractors; but if such conditions were not complied with, the agreement should be null and void. Mr. Humber succeeded in finding a contractor, and also a gentleman who undertook to place the 100 shares on his appointment as Secretary; but finally, the latter part of the agreement was not carried out, and the Secretary was not appointed; but the former part of the agreement was carried out. He (the learned Counsel) quite agreed that if the whole of the agreement was not carried out the Directors were not bound to carry out any part of it; but Mr. Humber found a contractor to do the work under the terms of the agreement. The Directors were satisfied with the contractor and the terms, and they therefore entered into a contract with Messrs. Hassell for completing the works. On April 19, 1871, Mr. J. Sampson, jun., wrote to the plaintiff, saying that he would undertake to place the 100 shares if the Company would appoint him the Secretary, providing that, supposing he failed to place the shares, the Directors would either return him the deposits on those he had placed, or appoint him Secretary notwithstanding that he had not placed the entire number. He was thereupon conditionally appointed, and his name subsequently appeared in the prospectuses; but it was understood that the appointment was not to be ratified unless he could place a reasonable number of shares. It seemed so probable that he could place the shares that the Directors thought they might safely go on; and accordingly on the 8th of June, 1871, a contract was entered into by the contractors, and it was, he thought, actually sealed by the Company two or three days later. It provided that the contractors should execute the works according to the specification, and that, until the Company should otherwise determine, Mr. William Humber should be their Engineer for the purposes of the contract. The agreement also provided for arbitration, and there was a final clause to the effect that the Company's Engineer or Engineers for the time being should, according to the specifications of works, certify, on the first of every month, while the works were proceeding, by writing, for the work done, that he should make every such certificate in duplicate, and deliver one part thereof to the contractors, and the other to the Engineer for the time being, &c. Then there was a proviso that the payments should be made on these certificates at the rate of 1-13th in shares, 4-13ths in debentures, and 8-13ths in cash, and another that the Company's Engineer or Engineers should be referees or arbitrators in all matters relating to the plans and drawings, and as to the sufficiency of works contracted for, or any part thereof. The Company appointed Mr. Humber as their Engineer, with the large powers given by this agreement, and instructions were given him to go down and witness the contractors sign the contract, and it was signed in Mr. Humber's presence shortly afterwards. On Aug. 10, 1871, Mr. Sampson was written to, asking him to give the names of the persons with whom his shares were placed. Mr. Sampson replied that the gentleman who had agreed to take them was dying, and that he was unable to place the shares. The Directors thereupon cancelled his appointment as Secretary. In the latter half of 1871, Mr. Humber was going down continually under the contract, watching the works, and was giving month by month, as Engineer, certificates of the work done, and the payments to the contractors were duly made under them. No suggestion was made, and could not have been made, that Mr. Sampson's failing to carry out his agreement to place the shares had anything to do with the appointment made by the Company of Mr. Humber as Engineer for the works. On December 9, 1871, Mr. Humber wrote to the Directors pointing out the necessity of their having a resident engineer or clerk of the works, to ensure the several works being properly carried out. After some correspondence, he appointed a clerk of the works, and offered to send one of his assistants to aid in carrying out the works on payment of his railway expenses, and an almost nominal sum by way of remuneration. At the same time he applied for a cheque for £50 towards the expenses he had incurred. On Jan. 6, 1872, the Board took Mr. Humber's letter into consideration, and a resolution was passed referring him to the terms of his agreement, and stating that the Company required all their capital to meet the contractor's demands. Mr. Humber replied on the 8th of January, saying he could not understand the drift of the resolution, that the Directors surely could not expect him to spend money time after time, and that he ought not to be put on one side, and the contractors have the preference, seeing that he had been the main instrument in promoting the works. On the 24th of January there was a very heavy rainfall, and some portions of the sides of the reservoir that was being made slipped, and it became necessary to take immediate steps to prevent any further damage. Accordingly Mr. Humber sent instructions to Messrs. Hassell to board up the sides of the reservoir, and to do what was necessary to prevent any further slips. The Engineer decided that this was extra work, and that, under the terms of the contract, they were entitled to be paid extra. On March 25, 1872, the Directors passed a resolution that £25 in cash and fifteen £10 shares be sent to Mr. Humber without prejudice to the agreement. On the 4th of April Mr. Humber wrote acknowledging this, requesting the shares to be entered as fully paid-up, also saying he was disappointed at not receiving a cheque for a larger amount, and asking for another cheque for £25. The Directors having learned that extras for keeping up the banks of the water-works had been incurred, they passed, on the 9th of April, a resolution to the effect that they could not recognize the right of the Engineer to give orders for extra works without consulting the Board on the subject, and submitting the plans for their approval. The plaintiff said, in reply, that he would usually do so, but in a case of this kind the work would have been destroyed if he had not taken immediate steps. On April 25, 1872, the Directors passed another resolution to the effect that, having reference to the conditional agreement of Feb. 14, 1871, especially to the clause "that the said William Humber shall procure 100 of the shares of the Company, in addition to the 50 to be taken by the contractor, to be subscribed for and to be taken by proper and responsible persons, so as to enable the Company to carry out the said contract, and shall take 15 shares himself," it was resolved that Mr. Humber's attention be called to the agreement in question, which, by reason of his having failed to carry out the conditions therein contained, had not been confirmed by the Board, and asking him to explain his conduct, the Board reserving full liberty of action when such explanation should be brought before them. The Directors further said that they had performed their part of the contract, and asked the contractors to perform theirs. He (the learned Counsel) did not know what the Board meant by that resolution, because the agreement of the 14th of February was not the one which appointed Mr. Humber as their Engineer. He had not found the shares, and he had not nominated the Secretary, and the agreement was not confirmed, and was, as far as he knew, waste paper. It would be found that no shares had been taken, except five, by a Mr. Davenport. On the 14th of May the contractors wrote to Mr. Humber, and claimed to have their certificates made out, not as certificates ordinarily are, of the work that had been done, but made out separately—the work that had been done under the terms of the original specification, and the extra work; their contention, as he understood, being that they were entitled to be paid for the extra work in cash, and not partly in shares or debentures. He thought the jury would be of opinion that this was really an excuse, because the price of iron in 1872 had gone up immensely, and therefore this contract to lay iron pipes did not answer the purpose of

Messrs. Hassell so well as they expected it to do, and they were rather glad of an excuse to get out of the contract. On May 14, 1872, they wrote to Mr. Humber that as he declined to furnish them with the details of his certificate, they had stopped the works and given notice to the Company. Messrs. Hassell, therefore, stopped the works, and took away as much of their plant as they could. Thereupon the Secretary of the Company wrote on the 15th of May, and the Managing Director (Mr. Gidley) wrote to Mr. Humber saying the Directors would hold Messrs. Hassell and Co. responsible for the non-carrying out of the works. That, however, was not treated by the Company as rendering the whole scheme abortive; but they set to work in the first place to complete the works sufficiently to prevent their compulsory powers lapsing, and they also spent a sum of money in completing the reservoir so as to prevent it being injured by the weather, and laid a pipe to the nearest house in Topham so that water would be supplied to somebody. They proceeded, by a quantity of correspondence and a series of resolutions, to call upon the Engineer to take various steps with regard to the works and with regard to the contractors who had thrown up the work. There was a further correspondence as to whether the contractors were entitled to a final certificate, and Mr. Humber wrote to ask whether he should give it or not; and on May 31, 1873, the Directors passed a resolution that, under the circumstances of the contractors throwing up their contract, they were not entitled to any further certificate, and that the Engineer be directed not to give one. Mr. Humber wrote to Mr. Gidley on June 23, 1873, saying he was astonished to hear that the Company had commenced certain works without consulting with him, and that he would not be responsible for what was done, as it might jeopardize the whole works and interfere with their efficiency. It turned out that all that had been done was to lay a pipe to the nearest house to preserve their powers. Mr. Gidley wrote an apologetic letter, saying that the time for laying the pipe was too short to enable them to consult Mr. Humber in the matter. On the 18th of August the plaintiff wrote to Mr. Gidley, saying he would feel obliged by his informing him what the Company purposed doing, that the Company were largely indebted to him, and that unless an effort was shortly made to complete the works he must request a payment on account. He also pointed out that it was now twelve months since anything had been done. The Managing Director wrote on Aug. 19 to Mr. Humber, saying he would lay the letter before the next meeting of the Board, and adding that the Directors were not likely to reverse the answer they had already given to a similar application from plaintiff as to giving Messrs. Hassell a final certificate. On the 11th of December Mr. Humber wrote to Mr. Gidley again, saying he was surprised at not receiving a reply to his several letters, and that he must again beg of them to inform him what was likely to be done, with a view to complete the works so that they might be remunerative. He also asked for a cheque for £100 on account of his expenses, and added that if the Company wished it he could obtain the pipes for them on good terms, part to be paid in shares and part in cash. There was some further correspondence, and in 1874 there was a proposal by Mr. Shoplin, a contractor, to take up the works and complete them; but after three or four months negotiations, that fell through. In 1876 a Mr. Clark offered to complete one section of the works, but the Directors refused this, saying they must have the whole of the works done, or none at all. Mr. Humber began to think the time had come when the matter must be treated as abandoned, and that at any rate he was entitled, after the lapse of five or six years, to be paid the costs he had been out of pocket, and on May 18, 1878, he wrote to the Secretary enclosing his account, and asking that the same might be laid before the Directors at their next meeting. On the 30th of May he received a reply from the Directors that they denied all liability, and returning the account. They also referred the plaintiff to the letter of April 9, 1870, as well as to a communication made on April 25, 1872, at the instance of the Board. They also expressed their surprise that the plaintiff should attempt to set up any claim against the Company. This was signed by Mr. C. E. Davenport, as Honorary Secretary, who for the first time set up that Mr. Humber had no claim upon them. The defendants pleaded that the agreement entered into between the plaintiff and the Company, never having been confirmed by the Directors, was null and void. This was an outline of the case. It appeared to him that beyond all question the plaintiff had been employed as Engineer to make the plans of these works, to superintend them, to carry them out, to give certificates for them, and to arrange all matters about and concerning them, and this upon the usual terms. All the resolutions of the Directors one after another spoke of him as the Company's Engineer. The Directors wrote and gave him instructions as their Engineer, they paid on the certificates he had given as their Engineer, and it seemed to him (the learned Counsel) inconceivable that it should be doubted that he was employed by them to do the work.

The LORD CHIEF BARON: You say there is no contract between these parties in writing or otherwise about 1 per cent. or 5 or 6 per cent.; but you say that it is the usual thing; and you may perhaps contend that it is a reasonable remuneration for an engineer who acts as engineer to a company of this description?

Mr. BOMPAS: That is my contention.

The LORD CHIEF BARON suggested whether the case could not be referred to some legal arbitrator, with the assistance of an engineer.

Counsel having consulted for some time,

Mr. BOMPAS stated that his client was unwilling to undergo the expense of an arbitration.

The case was therefore allowed to proceed, and the following evidence was called:—

Mr. William Humber, examined by Mr. BOMPAS.

I am a Civil Engineer, carrying on business at 20, Abingdon Street, Westminster. I have had 40 years experience, and am the author of several works on the supply of water to towns. I have had the superintendence of large water-works abroad as well as in England. I was first introduced to Messrs. Gidley and Head in March, 1870. The Company was formed in June, 1868. Between March, 1870, and Feb. 14, 1871, I had a considerable amount of correspondence in relation to the affairs of the Company. On the 14th of February I entered into the agreement with Mr. Serena. I introduced Messrs. Hassell to the Company, and the defendants instructed me to negotiate with them as to a contract. I met several of the Directors at their office in Exeter, and received verbal instructions to prepare plans, sections, contract drawings, and quantities, and to negotiate with Messrs. Hassell for the construction of the works.

[Some discussion here took place as to whether the original agreement between Messrs. Hassell and the Company was stamped, because his lordship refused to admit a copy unless there was positive evidence that the original document was valid. Mr. Head, formerly Solicitor to the Company, was called to give evidence on the subject, and said to the best of his belief it was stamped; but this did not satisfy his lordship. Mr. Hassell, one of the parties to the agreement, offered to produce the original document for inspection. Mr. Nasmyth put in a minute of May 19, 1871, stating that letters received from Mr. Humber and Messrs. Hassell having been read, it was resolved that, Mr. Humber's estimate for contract No. 1 being £6140 by cash prices, and Messrs. Hassell's offer for the same work being £6507 14s., Mr. Humber be requested to see Messrs. Hassell, and endeavour to obtain an abatement

of their tender, and, if possible, to get the same reduced to the amount of Mr. Humber's estimate, and to write Mr. R. W. Head the result of his interview forthwith, and that, subject to the reduction being satisfactory to Mr. Humber and the Directors, the contract with Messrs. Hassell be at once entered into. Several minutes were then put in, as also the correspondence relating to them, showing the relations between Mr. Humber and the Company, and his transactions with, and instructions to Messrs. Hassell, the contractors, the purport of which has been given in the learned Counsel's opening speech.]

Examination continued: I continued to work as Engineer under the contract with Messrs. Hassell, and from time to time gave certificates of the work done by them. The first certificate is dated Oct. 2, 1871, for £300, and the last certificate is dated May 8, 1872, for £255. There were in all seven certificates. [A list of the certificates was put in.] The reason I did not give any further certificates was because the contractors would not proceed with the works. They repeatedly asked me to give certificates, and they gave up the works in consequence of not being paid for extra work in cash, instead of debentures and shares. Down to the 14th of May I continued to do the work for which I have charged in the particulars.

By the LORD CHIEF BARON: I did the whole of this work at the request of the Managing Director of the Company, and the charges are fair and reasonable.

Examination continued: After the works were stopped, I negotiated for their being carried on by other contractors; but these negotiations fell through. The negotiations were also carried on at the request of the Managing Director. I applied from time to time for payment for my services.

By the LORD CHIEF BARON: From beginning to end I only received as payment £25 in cash and 15 fully paid-up £10 shares.

Examination continued: I have given the Company credit for the £175. [A list of letters was handed in from the plaintiff to the defendants, and from the defendants to the plaintiff, the first bearing date Dec. 9, 1871, and the last May 30, 1878.] The balance claimed by me is £408 13s. 3d.

The LORD CHIEF BARON asked Mr. Charles if there was any minute or resolution confirming the agreement of Feb. 14, 1871.

Mr. CHARLES said the only minute he would trouble the Court with was one dated Feb. 24, 1871, which approved of the agreement, and at a meeting of the Shareholders held on Aug. 21, 1871, at which the plaintiff was present, it was resolved that the Company should hold Mr. Humber responsible to place the 100 shares in accordance with his agreement.

Mr. BOMPAS here informed his lordship that Mr. Hassell had searched his papers for the missing original agreement, but could not find it, although it was believed to be in the safe of his solicitor, but that he would endeavour to have it by next morning.

Mr. CHARLES then produced some letters, in one of which the plaintiff wrote to Messrs. Gidley and Head saying that he was sorry to find the Directors took so little interest in the Company, as the delays were damaging to its prospects, and that he had no hesitation in stating that had the matter been settled when he met the Directors, everything would have been arranged, and some of the pipes laid before then. He had not the least doubt of placing the shares if it were done at once; but if it were delayed it would not be possible.

Cross-examined by Mr. CHARLES: I did not succeed in placing more than five shares, but the thing did not go on then. It was after the agreement of Feb., 1871, that I prepared plans and sections. I think, altogether, there were some fifty plans. [The witness was then led through several items in order to show his charges for the different services performed by him on behalf of the Company.]

In answer to the Lord Chief Baron, Mr. BOMPAS stated that £408 13s. 3d. was the amount claimed by the action.

The LORD CHIEF BARON: The question is whether, under the Statute of Limitations, you can recover £408 or £42?

Mr. BOMPAS: Yes.

FRIDAY, APRIL 23.

Mr. CHARLES produced an account sent in by the plaintiff on May 18, 1878, the various items in which amounted to the sum of £493 13s. 3d., and he was proceeding to cross-examine the witness upon it, when

The LORD CHIEF BARON asked if the parties could not agree on some sum. Assuming the Statute of Limitations would operate in favour of the defendants, what sum was the plaintiff entitled to recover?

Mr. CHARLES said matters had gone so far that he could not but lay his case before the jury. The defence was by no means confined to the Statute of Limitations.

The LORD CHIEF BARON: I know it is not; but I suppose that, sooner or later, if the plaintiff be entitled to recover anything at all, the jury will have to determine, unless you agree upon it, how much he is entitled to recover; and, as far as I can collect from the whole of the evidence in the case now, it is a sum between £400 and £500—that is, if no part of the claim be barred by the Statute of Limitations. Supposing the plaintiff, either under an express contract that he should be employed as Engineer—he having undoubtedly been employed, and having undoubtedly performed certain services as Engineer—be entitled to recover anything, either in one way or the other, under an express contract or under a quantum meruit, having done work and performed services, as far as I can understand it is either for some larger sum of £400 or £500, if the Statute of Limitations has no operation at all, or at least it is for the sum of £42. If you do not agree to that, go on.

Mr. CHARLES: I shall ask no other question on the details of the items.

Re-examined by Mr. BOMPAS: The writ in this action was first endorsed for £493 13s. 3d. Afterwards I found it ought to have been £583. One of the items—£31—is for giving notice to the landowners, and for plans showing that the pipes would go through their lands. The sum charged for the total amount of work was £2825, and not £3805. The 3 per cent. on £3805 ought to be on £2825. It ought to be £84 15s. instead of £114. The £67 10s. is actual expenses I paid out of pocket.

The LORD CHIEF BARON: Do you, as an Engineer, after 40 years experience, say that this is a fair, just, and reasonable charge?

Witness: I do. I have allowed for 15 fully paid-up shares, £150.

The LORD CHIEF BARON (to Mr. Bompas): Does the result, according to your calculation, and consequently the claim you make upon the defendants, come to this, that supposing the Statute of Limitations to operate on all the items before June 18, 1878, the result is that still, reckoning four or five sums I took down from Mr. Charles, the amount then, and the only amount that would remain, would be £42?

Mr. BOMPAS: Yes.

Mr. CHARLES: We both agree to that—the amount claimed.

Mr. BOMPAS (to witness): Where an engineer is employed to superintend works like these, when does his payment become due?

The LORD CHIEF BARON: It is according to the contract between himself and the company, for which he acts as engineer. It may be that the whole is not payable until the work is complete, upon which he charges a certain percentage. It may be that there is no specific contract at all, and that from time to time he claims and receives sums of money on account; but it depends upon the contract.

Mr. BOMPAS: Of course, if there is an express contract which depends upon it; but surely, if a person is employed generally as engineer, it is the custom?

The LORD CHIEF BARON: There is no custom on the face of the earth that applies to this case. There is no specific appointment under the seal of the Company, or under any contract between the plaintiff and the Company, that he shall, with certain remuneration, be employed as Engineer, and have the effect of creating him Engineer to the Company under that contract. There is no such contract in existence, but there is a great deal of evidence of what purports to be a contract, to which the Secretary of the Company is a party. And again, as to the contract, which has not yet been before me, but which I may assume to be in existence and bearing a sufficient stamp, it appears from the evidence over and over again that he is Engineer to the Company. *De facto*, the plaintiff was for a length of time acting as Engineer. Under those circumstances, whatever may be the evidence, unless there is something of which we have no conception, I shall direct the jury that there is no contract which specifies any particular sum, or enables them to determine upon any sum to which the plaintiff is entitled, and no special time at which those sums shall be payable. His services were to be performed by contract between the Company and the contractor, which contract was never in existence. The point of law is that, as undoubtedly the plaintiff has performed certain duties as Engineer from time to time during a long period, whether such a period is within the Statute of Limitations, and he is entitled to recover for services he has actually performed under the authority and at the instance of the Company as their Engineer.

Mr. BOMPAS was again about to put his question, when

The LORD CHIEF BARON said he could not admit it. The learned Counsel might ask the plaintiff what he had actually done as Engineer, and whether the communications with the Directors were verbal or were made in writing.

Mr. BOMPAS cited the case of *Whitehead v. Lord* (21 *Law Journal*, Excheq. 239), where a man was employed as a solicitor, and although the action might go on for six or seven or ten years, yet he was entitled to six years from the conclusion of the suit.

The LORD CHIEF BARON differed from this view.

Mr. BOMPAS said he would therefore leave the case as it was.

In answer to the LORD CHIEF BARON, witness stated that he charged 2½ per cent. on the works and ½ per cent. for his extra time going down to Exeter.

The LORD CHIEF BARON: It appears that the plaintiff never entered into a contract binding himself and the Company for any specific sum for what services he may have rendered as Engineer, except the one contract to which I have referred. That is the contract in which he says he should obtain a sum in cash, and place 100 shares. Yet, although there was no such contract in existence, he performed services as Engineer, and for the amount of those services from the time he began to act as Engineer down to the time he ceased so to act he has a perfect right to recover from the Company for his services, subject to the Statute of Limitations—that is, within six years of June 18, 1872.

Mr. William Dennis, examined by Mr. BOMPAS.

I am a Civil Engineer, and my offices are at 3, Victoria Street. I have been in practice for over 20 years, and have been Engineer to various large undertakings in water-works and railways. I have looked through the plaintiff's account, and in my opinion the charges are fair and reasonable.

Cross-examined by Mr. CHARLES: I have not seen the works in question, nor have I examined the original plans and sections of the Engineer of the Company. I have not seen the plaintiff's plans. My opinion as to the reasonableness of the plaintiff's bill depends upon the general custom of the profession.

Mr. BOMPAS: If an engineer is engaged by a company as the engineer of their works, and nothing is said by either party as to the time when his employment is to cease, would it, by the practice of engineers, be an engagement for the whole of the works, or for any shorter time?

The LORD CHIEF BARON took a note of the question, but said he must overrule it as inadmissible.

Mr. BOMPAS said that his learned friend and himself had agreed that the whole of the correspondence on both sides, and set out in the affidavit of documents, should be considered as put in, as also the minute-books, in case at any time they should be referred to.

This concluded the case for the plaintiff.

Mr. CHARLES intimated that he would call a witness previous to making his speech.

Mr. Silvanus Wm. Jenkin, examined by Mr. JONES.

I am a Member of the Institution of Civil Engineers, and carry on business at Liskeard, in Cornwall. I have had experience with respect to water-works for 20 or 25 years. I was employed as Engineer to the Topsham Water-Works Company previous to their application for parliamentary powers. I drew the plans for the purpose of the application to Parliament. After the Company had been incorporated I prepared the whole of the land plans, and all drawings and specifications for carrying out the works. I also prepared plans for the purpose of tenders being sent in for acceptance. I have recently visited the site of the reservoir at Topsham, and about a fortnight ago I inspected the work so far as it has been constructed. I did not see the works on or about May, 1872. I never saw any of them until about a fortnight since. I have not seen the works that have been executed since Mr. Humber was Engineer.

Mr. CHARLES then addressed the jury on behalf of the defendants. He asked them carefully to consider the agreement as evidence of what it was the plaintiff was appointed to do. The plaintiff was Engineer of the Company for a particular and specified purpose. He was to find the contractor, and when he had found the contractor he was to be the Engineer of the contract. He was to do a number of other things which he admittedly had not done. He found a contractor in Mr. Hassell, who entered into a contract on June 8, 1871, for the building of the water-works. That contract was entered into between the Company and Mr. Hassell; but the plaintiff was not himself a party to it. It was important to observe that the plaintiff was described as the Engineer for the purposes of that contract, and there was no doubt that he was. The work commenced, and from time to time, between the month of June, 1871, and May, 1872, some work was done, and certificates from time to time were given in the usual way by the plaintiff. The plaintiff felt himself unable to place the shares, which he supposed he could easily have done. He only succeeded in placing five shares. The consequence was that in the month of May, 1872, the contractor became dissatisfied, and a dispute had also arisen as to some extras Mr. Humber had certified for. On that account, and on account of the difficulty experienced in obtaining cash, the contractor became dissatisfied. On May 14, 1872—a date which was very material for his case—the works were stopped. Messrs. Hassell cleared off their plant, and went away altogether, and there was, so far as their contract was concerned, an end of it altogether. Their main reason for adopting such a course was, no doubt, that they could not get paid, and this was on account of the capital not having been provided. The Directors were then left with nothing but a reservoir partly or wholly completed, and from that day to this nothing

whatever had been done except the making of the reservoir good against the weather; and, in order to keep alive their parliamentary powers, the laying by the Company themselves of one pipe to a cottage in the village of Topsham. What he submitted was that whatever the employment of the plaintiff was, and whatever the terms of his remuneration were, his employment was at an end in May, 1872, because at that date the contract was finally abandoned by the contractors. On the plaintiff's own showing nothing was done at the place afterwards, except making the reservoir safe against the weather. He (Mr. Charles) would admit at once the correspondence between the parties from 1873 and 1874 up to 1878; but what was the end of it all? Just the same as the beginning. The plaintiff could not get, during those years, any other contractor to take the matter up, nor did he succeed in placing the share capital. In regard to the Statute of Limitations, he submitted that in this case it was a meritorious defence to the action. He did not blame the plaintiff for not finding the capital; but it was because he did not find it that the Company's contractor never finished the work, and went out in May, 1872. He held that the Company had as much right to complain of Mr. Humber, for not finding the capital, as Mr. Humber had to complain of them. Thus matters stood up to May, 1878, when the plaintiff presented his claim. Upon various occasions prior to May, 1872, he had pressed the Directors for payments on account, and in April, 1872, he had received a payment from the Directors, although they were greatly dissatisfied at his not having carried out his obligations under the agreement. They gave him 15 fully paid-up shares, amounting to £150, and a cheque for £25 in cash, and these shares had been credited by the Company as fully paid-up shares. From May, 1872, up to the present time the Directors had not paid the plaintiff anything, and denied their liability to pay anything in reference to the services he rendered. The plaintiff sought to recover £583 13s. 3d., giving credit to the Company for £175 paid to him in cash and shares in the month of April, 1872. This reduced the claim to £408 13s. 3d., and the jury would be the judges as to whether it was a fair and reasonable charge. Dealing with the items, he could not help suggesting that Mr. Humber, although he might not mean it, was endeavouring to recover some of them twice over. He started with a special item for surveying the site of the reservoir in February, 1871, and then gave another item for preparing 31 land plans, and for other purposes, for which he charged £81. Then came a lump sum for preparing the contract drawings, &c., 3 per cent. on the whole of the estimated contract price. Was it reasonable that a man should charge 3 per cent. on the estimated price of a contract which was not performed? The question was, what was his labour fairly worth? He had charged 3 per cent. upon the whole £7611, and then 3 per cent. more. In addition to this, there was a charge for out-of-pocket expenses. He had charged 6 per cent. upon the price of the executed works—£2825; and, in addition to this, he put other items in the beginning of his account.

The LORD CHIEF BARON: Upon the £3805, 3 per cent. would be charged twice over.

Mr. CHARLES: Yes; upon £3805 he charges 6 per cent.

The LORD CHIEF BARON: But upon the residue he charges only 3 per cent.

The LORD CHIEF BARON: Then there is the expense of journeys and assistance he required, and other matters. There is a considerable portion of it on which he charges 3 per cent., and not 6; and if he, in an ordinary way, is allowed to charge 6 per cent., it is for the jury to say why he did not charge that.

After some discussion as to the percentage charged,

The LORD CHIEF BARON said he should tell the jury that the plaintiff was not responsible for the breach of contract or the misdeeds of the contractors, and that if they left part of their work unfinished it did not affect his claim, unless by having left a portion of it unfinished they left a portion of his duties unperformed also. The whole claim was subject to the question of the Statute of Limitations.

Mr. CHARLES said his argument was that the plaintiff was superintending Messrs. Hassell's contract, and that in so far as he was superintending that contract down to the month of May, 1872, he had charged for superintendence 6 per cent. upon the works they executed; but in addition to that he had charged a sum of £62 10s. and of £30, or £100 more, in addition to his full 6 per cent. He submitted that these percentages should not be paid unless the jury were satisfied that the plaintiff had done the work which the percentages represented. The result of the whole matter was that the plaintiff had made out his bill upon two principles. Two of the items were made on the percentage principle, and the remainder were made out on the ordinary work and labour principle.

The LORD CHIEF BARON said that it involved the loss of time and labour in travelling from one place to another.

Mr. CHARLES, in conclusion, said the question was simply how much the plaintiff ought to receive for labour done both before and after the month of May, 1872.

Mr. BOMPAS having replied,

The LORD CHIEF BARON summed up the case to the jury. After dealing with the facts and figures, and explaining the bearing upon the case of the Statute of Limitations, he left it to the jury to decide what was the real arrangement between the plaintiff and the defendants; and what amount, if any, and subject to the Statute of Limitations—if they should think it was so subject—the plaintiff was entitled to.

The jury having retired, returned into court in about half an hour with a verdict for the plaintiff for £309 14s. 11d., and stating that they considered his claim had not been barred by the Statute of Limitations.

Miscellaneous News.

LARGE GASHOLDER-TANK AT THE SOUTH METROPOLITAN GAS-WORKS.

Towards the close of last year our readers were informed that tenders were invited for the construction of a large gasholder at the works of the South Metropolitan Gas Company in the Old Kent Road. The excavation of the ground and the construction of the tank for the holder have been for some time going on, and the work has made so much progress that some definite idea may now be formed of its magnitude.

The tank is 218 feet in diameter, and 55 ft. 6 in. in extreme depth, with a working depth of 54 feet. The wall of the tank is 5 feet thick at the bottom, tapering to 3 feet at the top.

The tank is being built entirely of concrete, without puddle; and the materials employed are rough clinkers, sand, and gravel obtained in the excavation, mixed with old fire-bricks from the retorts in the proportion of 7 parts to 1 of cement. The walls of both tank and cone are rendered with an inch thick of neat cement, closely trowelled.

In making the excavation, water was met at about 12 feet from the surface, and, in order to keep the working dry, six pumps have been employed—three 15-inch and three 18-inch—driven by two fixed engines of 25 and 40 horse power respectively, capable of throwing 3000 gallons

of water per minute; the sump-hole being 10 feet in the chalk, or 65 feet from the finished ground level.

The inlet and outlet pipes for the holder are each 4 feet in diameter, and have no dry wells; while, instead of the usual syphon wells, there are two 6-inch pipes rising to the level of the tank, and having in them 3-inch lifting-pumps for drawing off the water of condensation.

The holder for which this magnificent tank is being prepared will be a 3-lift one, rising 160 feet, and its working capacity will be 5,400,000 cubic feet. The constituent parts of the holder are already upon the ground, and as soon as the tank is ready for its reception—which it is believed will be by the middle of June—the work of erection will commence. The contract cost of the tank and holder, when complete, with the necessary inlet and outlet pipes, valves, &c., will be under £46,000.

The work was designed by Mr. G. Livesey, assisted by his brother (Mr. F. Livesey) and Mr. Somerville. The contractors for the tank are Messrs. T. Docwra and Son, while the erection of the gasholder has been entrusted, as our readers have already been informed, to Messrs. Ashmore and While, of Stockton-on-Tees.

THE PROPOSED GAS APPARATUS EXHIBITION IN GLASGOW.

After having been frequently spoken of during the last few months, the proposed gas apparatus exhibition for Glasgow was formally brought under the notice of the members of the Philosophical Society of Glasgow at the concluding general meeting held last Wednesday evening. Dr. W. Wallace stated that he was prepared to make a motion on behalf of the Council, but, since it might be regarded as a money vote, he proposed that the rule of the Society as to notice be suspended, in order that it might be considered at that meeting, and thus expedite the business by requiring only one other meeting to confirm it instead of two; and he moved accordingly. He also moved—"That, in the event of the exhibition-fund of 1847, now in the hands of the Corporation, being made available as a guarantee, the Society approve of the Council taking all necessary steps for holding an exhibition of gas apparatus, &c., in the autumn." The motion was seconded by Mr. John Mayer, F.C.S., who stated that, from the experience which he had acquired in connection with other gas exhibitions, he was satisfied that many firms in all parts of the kingdom were looking forward with some degree of interest to the proposed exhibition in Glasgow, at which they were specially desirous of showing off their inventions. There being no objection to the suspension of the Standing Orders, the motion was passed unanimously.

Dr. Wallace subsequently explained that the subject had been before the Council for several months, and he indicated the scope of the proposed exhibition, which, he thought, should be something more than a mere collection of cooking-stoves. If carried out in the comprehensive manner aimed at, it will most probably embrace a very complete series of apparatus and appliances illustrating the following:—(1) The manufacture, purification, and storage of gas. (2) The regulation of pressure, and the measurement of gas. (3) Photometry of gas and other sources of light. (4) Gas lighting. (5) Heating by gas—stoves for heating and cooking. (6) Gasoline machines for making gas for private houses, &c. (7) Gas and gasoline engines. (8) Lighting by candles, petroleum, and paraffin. (9) Paraffin for heating and cooking stoves. (10) Secondary products of gas manufacture—benzole, dyes, &c. (11) Electric lighting. (12) Electric communication—telegraphs, telephones, &c. (13) Water-engines and meters. (14) Ventilation and heating of public buildings and private houses.

The exhibition-fund mentioned in Dr. Wallace's motion is a sum of £1000 or £1200 accruing from an exhibition held in the winter of 1846-47, under the auspices of the Philosophical Society and the Town Council, and invested in their joint names, and only to be employed "for a similar purpose." Hitherto the Council of the Society have never been able to get the fund into their possession for any of their schemes, but it is confidently hoped that at least one-half of it may now be obtained absolutely as a guarantee-fund for the exhibition which it is proposed to hold.

EDISON'S HORSESHOE LAMP VERSUS GASLIGHT.

The last number received of the *Scientific American* contains a report, by Professor Henry Morton, Professor Alfred M. Mayer, and Mr. B. F. Thomas, on "Some Electrical Measurements of One of Mr. Edison's Horseshoe Lamps," in which they say that much has been written and said within the last few months on the subject of Mr. Edison's new horseshoe lamps, and with all the writing and saying there has been wonderfully little produced in the way of precise and reliable statement concerning the simple primary facts, a knowledge of which would give the means of estimating both the scientific and commercial status of this widely discussed invention. It was, therefore, with great pleasure that they found themselves placed in possession of one of the horseshoe lamps of recent construction; and to satisfy themselves as to the real facts of the case, they soon made a series of careful measurements and determinations. They also state that a further examination of other lamps would have been made at the same time had opportunity offered; but as a communication on this subject addressed to Mr. Edison did not evoke a reply, they were obliged to content themselves with the one lamp as a subject of experiment. They, however, remark that the behaviour of this lamp under the tests, and the agreement of its results with information otherwise obtained, convinced them that it was at least a fair specimen of the lamps of this form so far produced at Menlo Park.

After detailing their mode of determining the amount and character of the electric current needed to operate the lamp efficiently, they described their arrangements for measuring the resistance of the horseshoe while in actual use, and emitting different amounts of light; also the quantity of current flowing under the same conditions. Having done this, they had all the experimental data required for the determination of the energy transformed or expended in the lamp, expressed in foot pounds. These worked out gave 0.08 (about 1-12th) of a horse power as the energy expended in each lamp. That is, in other words, one horse power would operate 12 lamps of the same resistance, with an average of 10-candle power each, or 120-candle power in the aggregate.

The photometrical measurements were in all these cases taken with the carbon loop at right angles to the axis of the photometer; and this was, of course, much in favour of the electric lamp, for, on turning the lamp round so as to bring the carbon loop with its plane parallel with the axis of the photometer—i.e., the edge of the loop turned towards the photometer disc—the light was greatly diminished, so that it was reduced to almost one-third of what it was with the loop sideways to the photometer disc. The illuminating power, in the best position, was recorded as 15 candles; and in the worst, as 5 candles. The average or general illuminating power was, therefore, reckoned, as above, at 10 candles.

Assuming, then, that a Siemens or Brush machine were employed to generate the electric current, such a current would be obtained (as has been shown by numerous experiments) with a loss of about 40 per cent. of the mechanical energy applied to the driving pulley of the machine. To operate the 12 lamps, therefore, more than 1-horse power would have to be applied to the pulley of the machine, so that when this loss in transformation had been encountered, there should be 1-horse power of electric energy produced. This would call for 1½-horse applied to the pulley of the dynamo electric machine by the steam-engine. Now, to pro-

duce 1-horse power in a steam-engine of the best construction, about 3 lbs. of coal per hour must be burned, and therefore for 1½-horse power 5 lbs. of coal must be burned. On the other hand, 1 lb. of gas coal would produce 5 cubic feet of gas, and leave, besides, a large part of its weight in coke, to say nothing of other residuals, which would represent practically about the difference in value between "steam-making" and "gas-making" coal, so that it would not be unfair to take 5 lbs. of gas coal as the equivalent of 5 lbs. of steam coal. These 5 lbs. of gas coal, then, would yield 25 cubic feet of gas, which, if burned in five gas-burners of the best construction, would give from 20 to 22 candles each, or 100 to 110 candles in the aggregate. There would therefore be 12 Edison lamps producing 120 candles, and 5 gas-burners producing 100 to 110 candles, with an equivalent expenditure of fuel.

In respect to this result, the report concludes: "If each apparatus and system could be worked with equal facility and economy, this would, of course, show something in favour of the electric light; but when, in fact, everything in this regard is against the electric light—which demands vastly more machinery, and that of a most delicate kind; requires more skilful management; shows more liability to disarrangement and waste; and presents an utter lack of the storage capacity which secures such a vast efficiency, convenience, and economy in gas—then we see that this relatively trifling economy disappears, or ceases to have any controlling importance in the practical relations of the subject."

NORTH OF ENGLAND GAS MANAGERS ASSOCIATION.

The Sixth Half-Yearly General Meeting of this Association was held at Newcastle-on-Tyne, on Saturday, April 24. Mr. W. Ford, of Stockton-on-Tees, the President of the Association, occupied the chair. The following members were present:—Messrs. G. A. Allan, Willington; W. Allan, Stockton; J. Allen, Morpeth; W. Ashmore, Stockton; R. Brown, New Cumnock; H. T. Burrows, London; Isaac Carr, South Shields; R. Chapman, South Shields; G. T. Chinnery, Redheugh; R. Clapham, Newcastle; W. Cowley, Spennymoor; J. H. Cox, Sunderland; E. Crewdson, Middlesbrough; R. Denton, Jarrow; A. Donaldson, Edinburgh; J. Eadington, Blyth; R. Field, Bishop Auckland; W. Hardie, Newcastle; W. Hardie, jun., North Shields; G. H. Haswell, Tynemouth; J. Hepworth, Carlisle; J. W. Hepworth, Coventry; Matthew Hall, South Shields; J. T. Joliffe, Sunderland; W. Jours, South Shields; Joseph Mackay, London; Robert Main, Glasgow; Robert Moodie, Redheugh; Thomas Mossman, West Hartlepool; D. M. Nelson, Glasgow; J. Pattinson, Newcastle; J. H. Penney, South Shields; J. Robinson, South Shields; G. Rogers, Hexham; J. Rollo, Newcastle; J. A. G. Ross, Newcastle; Samuel Rutter, Brampton; C. Sellers, York; Roger Shotton, North Shields; W. Smith, Darlington; T. Trewhitt, West Hartlepool; G. Warner, South Shields; W. J. Warner, South Shields; Duncan Wemyss, South Shields; N. White, Jarrow; James Whyte, Seaham; Wm. Whyte, Jarrow; J. Woerth, Stockton; J. Wright, Stockton.

The SECRETARY (Mr. W. Hardie) having read the notice calling the meeting, the minutes of the previous meeting, which had been printed and circulated, were taken as read, and confirmed; and the accounts of the Association, which showed—after investing £139 in Newcastle and Gateshead Gas Company's stock—a balance of £43 7s. 3d. in the hands of the Treasurer, were adopted.

The following were elected Members of the Association, viz.:—

Nathan White, of Messrs. Palmer's Gas-Works, Jarrow; Wm. Cowley, Secretary of the Spennymoor and Tudhoe Gas Company.

And the following an Associate, viz.:—

Robert Woerth, of Stockton, Engineer.

Some discussion took place in reference to the days fixed in the rules for meetings.

Mr. WARNER moved that the meetings of the Association be held in the last week of April and the first week of October in each year, but that the particular days of such meetings be left to be settled by the Committee.

Mr. TREWHITT seconded the motion.

Mr. HEPWORTH moved, as an amendment, that the rules respecting the days of meeting remain as at present, with this addition—"or such other day in the same week as may be agreed upon."

Mr. Cox seconded this amendment; but, on a division being taken, Mr. Warner's motion was carried.

Mr. WARNER then referred to the great assistance he received last year, when President of the British Association of Gas Managers, from the President and Secretary of the North of England Association, to whose exertions, he said, the success of the Newcastle meeting was in no small degree due, and he took this, the first opportunity of thanking them.

The PRESIDENT acknowledged the compliment on behalf of himself and the Secretary. He then referred to the death of Mr. Irvine, the Manager of the Ripon City Gas-Works—a member of the Association. Mr. Irvine, he said, also had charge of the water-works, but unfortunately his health failed. He had great experience as a practical engineer, and was highly esteemed by all who knew him. He (the President) further stated that before he left the chair he had a pleasing duty to perform—namely, to present Mr. William Hardie, jun., with Miller's "Elements of Chemistry," being the prize awarded to him for the best paper read at their meeting last April. When he read the paper Mr. Hardie was an assistant at the Newcastle Gas-Works, but since that time he had been appointed to the management of the Tynemouth Gas-Works. He was sure all the members of the Association wished Mr. Hardie, jun., success and prosperity in his new undertaking.

Mr. HARDIE, jun., briefly returned thanks.

The CHAIRMAN announced the result of the voting for officers for next year as follows:—

President—Mr. J. H. Cox.

Vice-President—Mr. T. Trewhitt.

Committee—Messrs. J. Hepworth, C. Sellers, W. Smith, and S. Studholme.

Auditor—Mr. J. H. Penney.

Secretary—Mr. W. Hardie.

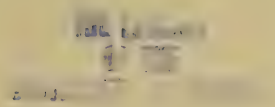
On the motion of Mr. HEPWORTH, seconded by Mr. TREWHITT, a vote of thanks was passed by acclamation to Mr. Ford for his services as President during the past year.

It was unanimously resolved that the October meeting be held in Sunderland.

This concluded the ordinary business of the meeting.

The Members and Associates then proceeded by rail to Jarrow, on a visit to the South Shields Gas Company's new works. They were met by Mr. Henderson, Mr. Robinson, and Dr. Armstrong, Directors; Mr. Warner, Engineer; and Mr. Penney, Secretary of the Company, and conducted over the works. The new stoking apparatus invented by Mr. Warner was set to work, and all present had ample opportunities of inspecting it, even to its minutest details. After having surveyed the other portion of the works, the company were invited to the purifying-house, where Mr. WARNER gave the following explanation of his invention:—

Before describing the machinery, I invite you to a brief consideration of the work of the retort-house, and to the modifying influence of machinery upon that work. By thus dealing with the matter, we may be better pre-



RAKE.

SCOOP.

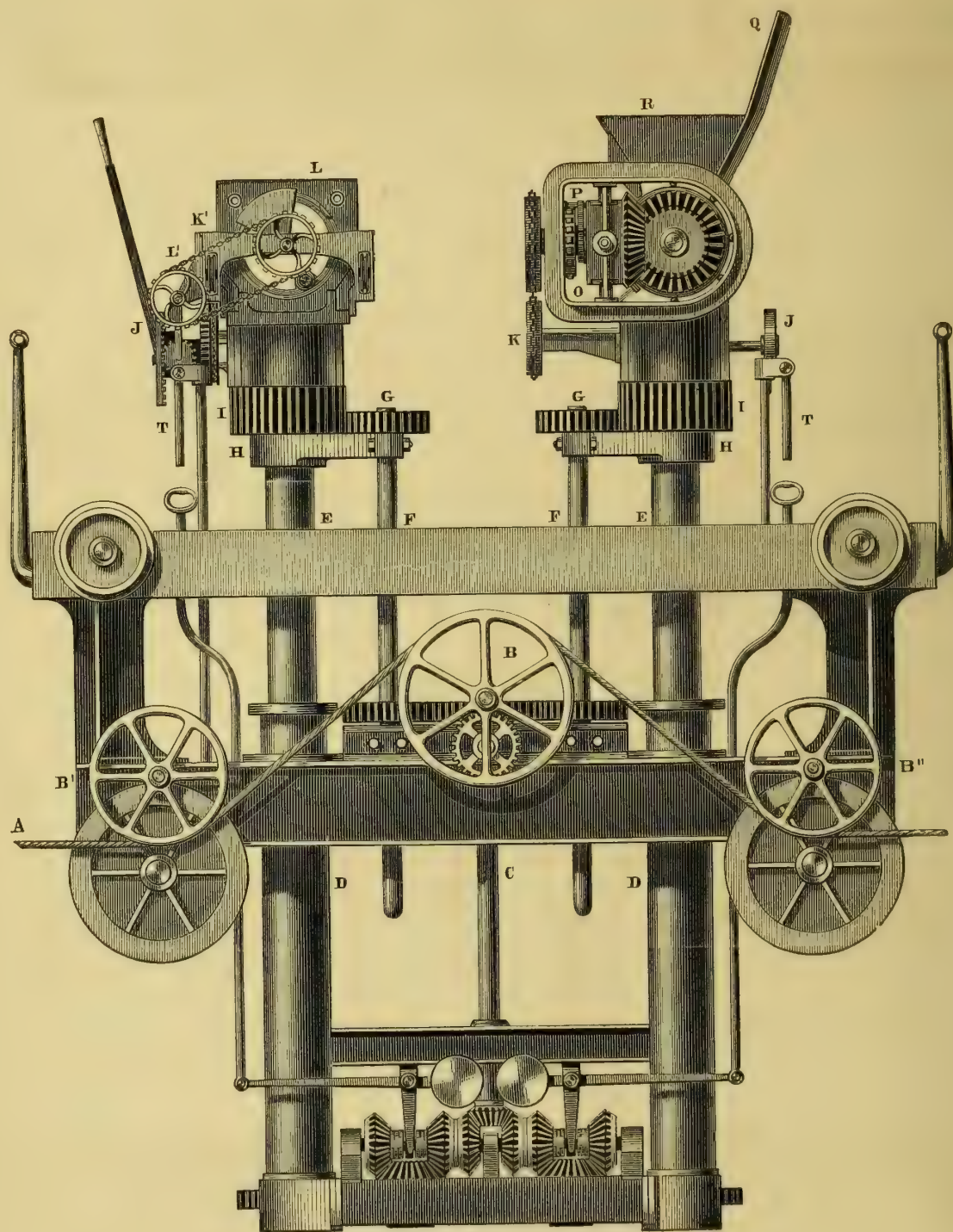


FIG. 1.—BACK END VIEW.

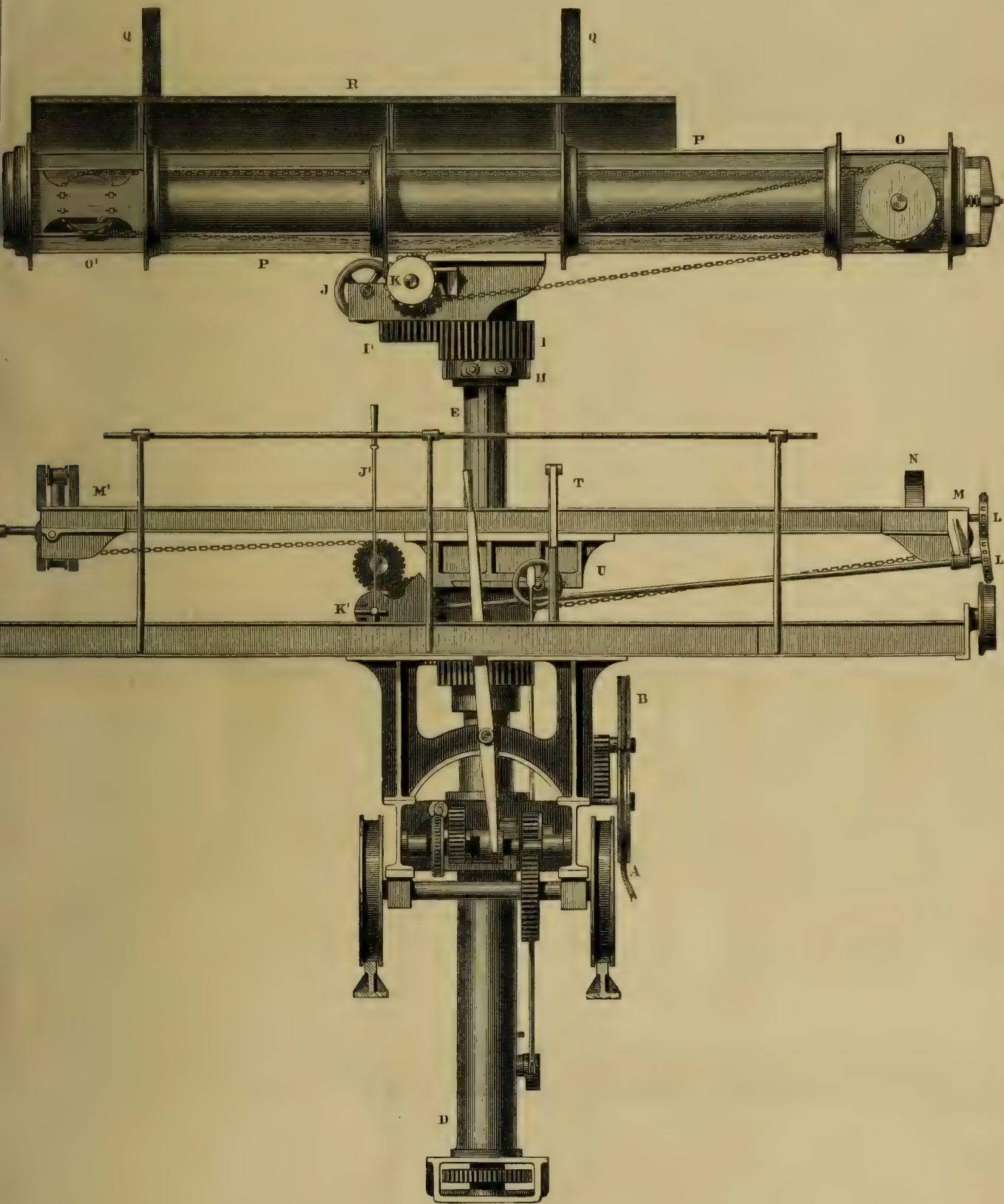


FIG. 2.—SIDE VIEW.

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pared to judge of the fitness of the several arrangements for the work, and to examine whether they are adaptable to the varying requirements of different coal, make, and retort-houses. The work usually carried on in an ordinary retort-house may be said to be included in drawing and charging, all of the operations being intermixed. Thus the retort is drawn, then left for the removal of the coke; the charge is then prepared, and the retort is returned to for charging—the whole being only several portions of one operation. With stage floors we find, of necessity, a more systematic course of working. As the coke is drawn it falls to the vaults beneath; hence the removal of the coke does not interfere with the other operation, and as the charges are more or less prepared, we find the whole work thus divided into three operations. The more these are separated, the more systematic and economical will be the work of the present mode of carbonizing. To the system of carbonizing I have given considerable thought. Years since I submitted to the Directors of the South Shields Gas Company a plan which would have entirely changed the character of our operations. Many other schemes, more or less complete, I have devised, but I have found my way back to the old plan of horizontal retorts, good heats, fair charges, and of the ordinary duration. The retorts I use—18-inch circular—are nearly the same in dimensions, and I may say are quite the same setting as those I have had in use at Shields for the past 16 years. With these retorts, Mr. Carr, the Superintendent at Shields, has been getting from 5000 to nearly 6000 cubic feet of gas per mouthpiece through the winter, 50 per cent., too, of the settings being single. I need scarcely say that this was with 6-hour charges. Probably I should not have mentioned this, but upon a visit being paid to these works a short time ago, by an Engineer of very large experience, exception was taken to the employment of circular retorts. As the tools I use for drawing and charging are but the rake and scoop, they can work any ordinary form of retort; therefore, in my case, the matter simply resolves itself into a comparison of the machinery with the ordinary labour. Indeed, in every case of investigation of this character, I think this course should be adopted—the carbonizing separated from the manipulation, unless a new principle is introduced, in which one is an essential portion of the other. The machinery for charging and drawing must be considered and judged upon its own merits, as must also the form, size, and proportion of retorts, the weight of the charge, and its duration; and all these matters can and should be kept free from any other influence affecting the quantity and quality of the gas. As the ordinary settings, or number of retorts in a bed, are limited to the height of a man, the arrangements that have been made for increasing the power of the bed by adding to its height have, of necessity, been of a limited character. In this respect, and probably in this more than in any other way, the introduction of machinery into the retort-house will exercise a considerable modifying influence upon the working. Comparisons must often be made, and not to our credit, perhaps, by those not familiar with our operations, between the height of our buildings and those of other manufactures. Doubtless the contrast is very striking, and I have no doubt a change will be brought about. Indeed, I purpose working in this direction. Considerable advantage will arise from this alteration of plant, as well as economy of working, and it will materially affect the comparative cost of machinery. For example, if the cost of machinery for working a bed of sixes is £20 per mouthpiece, a bed of twelves would be reduced, the machinery being the same, to £10 per mouthpiece. I need scarcely add that, in moderate-sized works, a modification of the chambers and flues of the settings would be necessary in most cases if such powerful beds were in action; and perhaps in beds of considerably less power such arrangements might be made with advantage, and dampers used to our profit and convenience. But, of course, in this departure from our present practice, relative proportions would have to be observed, as they are in the present settings. I am not recommending any particular number of mouthpieces to a bed, but simply indicating what I think will be one at least of the modifying effects of the introduction of machinery into the retort-house. Again, I look for a considerable alteration of the working of moderate-sized or comparatively small houses. With machinery, the labour will remain constant both summer and winter in each house, the minimum of labour being sufficient with the machinery for the maximum make. Another modification will be hastened on by this question of machinery—I allude to the gas furnace, as it will simplify the operations of heating, getting rid of the firing, and cleaning of the furnace. But this work may be done with advantage by the machinery, and I am making arrangements to do it. To return to the working, we have, then, three distinct operations—systematic preparation of the charges, drawing and charging, and delivering of coke. Let us consider them in their order. First, the preparation of the charge. Assuming the coal to be that of our locality, and unscreened, it will be necessary to break the large pieces, and then to fill the scoop, or charge the retort direct. In the latter case the operation of charging seems to be involved in that of preparation, and less comparable with machine work. In the former we fill the scoop with suitable coals, and the work is complete. In attempting this work by machinery, it will be found that not only has the coal to be broken and put into the scoop, but the machinery must be made adaptable to work a changing quantity of coal. The man with a shovel naturally adapts himself to the varying quantity, and so the machinery must act alike upon any quantity of coal. The plan which I have adopted is to draw the coal out from the bottom of the bunkers into a scoop or its substitute. The machine, which consists of a revolving shaft, with arms radiating from it, works out the coal, breaking the large pieces at the same time. With this arrangement it is thought, from an experiment made the other day, that a ton per minute can be put into charges. Secondly, charging and drawing by hand—this operation may be said to commence with the lifting of the scoop. With the machinery I prefer to consider the raising of the scoop a part of the work of preparing the charge. It is done by a simple crane and lift, and the charge is left suspended in front, and just above the retorts to be charged. I say retorts, as the scoop-substitute carries two charges of coal. It will be seen that by the use of these cranes there is an entire control over the charge and the height of the retort from the floor is not limited; also, there is absolutely a free course for the machine along the house, under the suspended charges. Thus the work is reduced to the lowest possible amount—the thrusting of the scoop into the retort. In lifting the scoop by hand, it is thrown on the mouthpiece. With the machine it slides along the cradle supporting it into the retort. The scoop thus being free to adapt itself, there can be no prejudicial action, to say the least, upon the retort. Those that you will see in action have already had a season's work. In drawing, the action is nearly the same as by hand. A rake is used, being pushed over the coke, worked into it, and the charge drawn. By hand there is no action upon the retort, the rake being free, so with the machine. By hand there is an elasticity in the operation of the tools—the scoop and rake—that is conducive to the preservation of the retorts; this elasticity, and also a freedom from shocks and violent strains, should be found in all arrangements of machinery for doing such work. In the machine you will see here, you will find, I hope, these qualities to a noticeable extent. Thirdly, the delivery of the coke. As done by hand, it is wheeled out into the yard and deposited; but other labour is required beyond this. A portion at least of the coke has to be

shovelled into the barrows, and all of it has to be more or less trimmed and stacked; or, if with stage working, it has to be filled into waggons from the vault floor. Here, then, for machinery to do the whole of the work required, the coke must be removed from the house and lifted and stacked over a large portion of space—indeed, the entire coke yard. This I do by extending the coal-crane through the sides of the house into the yard. On a previous occasion I alluded to the value of time in such work being very marked. Fixing the charging and drawing at a standard of a minute per mouthpiece, with a constant succession of work, every six or seven minutes gain or loss during the hour means a bed more or less per hour. It is, therefore, obvious that each operation should be timed to the others; that is to say, these operations should take a minute when worked at the quickest. With the arrangements here I have no doubt this will be regularly done. We can take the retorts at a minute per mouthpiece, and the charge of 2½ cwt. can be completed in about 12 seconds.

Mr. Warner's statement was received with much applause.

[In another part of to-day's issue will be found an illustrated description of the machinery.]

The members afterwards dined together at the Railway Hotel—the chair being occupied by Mr. W. FORD. In addition to those already named, the Mayor of Jarrow (Alderman Huntley) was present, and sat on the right of the Chairman.

After partaking of an excellent dinner,

The CHAIRMAN gave the usual loyal and patriotic toasts.

Mr. J. PATTINSON, of Newcastle, proposed the health of the Mayor and Corporation of Jarrow, and in doing so referred to the important duties they had to perform in looking after the comfort and health of the inhabitants.

The MAYOR of JARROW responded, and remarked that it was very fitting that he, as connected with the Corporation of Jarrow, should take part in such a gathering, for while those present, as gas managers, were directing their attention to the improvement in the manufacture of a great essential in civilized life—namely, light—the body of which he was a member were, as a Corporation, giving their best attention to promoting the health of the people; and while much had already been done in this direction, much, there was no doubt, remained to be done. As a Corporation, they were endeavouring, by enforcing sanitary measures, to stem disease and reduce the rate of death.

Mr. SELLERS, of York, said the next toast was one which he felt assured would be cordially received by every gentleman present. He had to ask them to drink to the health of the Directors of the South Shields Gas Company. They possessed many good qualities, first and foremost among which was their hospitality; for, as would be remembered by many present, about six weeks ago, when their Engineer, Mr. Warner, invited the gas managers to witness the working of his patent retort-charging apparatus, they most hospitably entertained them. In addition to the quality he had named, the Directors of the South Shields Gas Company were a very enterprising body of gentlemen, and not only so, but were also highly intelligent, and they had well displayed their intelligence by selecting Mr. Warner as their Chief Engineer and Officer. Their friend Mr. Warner had by his ability placed himself in the front in the gas world. They all admired his enthusiasm, his ability, and his industry, and he (Mr. Sellers) was sure the Directors of the South Shields Gas Company could not be served by a better officer than Mr. Warner. The Directors had shown their enterprise by endorsing and carrying out that gentleman's invention. It was very creditable to a small Company to have taken up the invention in the manner they had, and he was glad to have to acknowledge the enterprise, pluck, and courage of the Directors of the South Shields Gas Company. It had been said that the man who made two blades of grass to grow where only one grew before was a greater benefactor to humanity than he who won a battle; and he believed the next in importance to such a man was he who invented machinery to lessen human labour; and he could only hope that the invention of Mr. Warner would be crowned with success, and be generally adopted. If so, the name of Mr. Warner and the South Shields Gas Company would be handed down in the gas world for generations to come.

Mr. J. HENDERSON, of South Shields, in responding, referred to the outset to the remarks of Mr. Sellers in regard to the South Shields Gas Company being a small Company, and observed that they did not exactly look upon themselves as a small Company, though they were very much inclined to the opinion that they could not compare favourably in size with Newcastle and Sunderland, although they supplied not only two boroughs—South Shields and Jarrow—but also the Local Board of Hebburn, together with a large area in a rural district. He was sorry that the Chairman (Mr. R. Wallis) was not present with them that day; but in his absence he had, on behalf of himself and his colleagues, to return thanks for the cordial manner in which the toast had been received. He could assure them that the Directors were anxious to forward any improvement in the way of gas-making, so far as they possibly could; and the compliment they had paid Mr. Warner had not been undeserved, for by his energy, ability, and perseverance he had raised himself to a high position in the gas world. He (Mr. Henderson) then proposed "Success to the North of England Gas Managers Association." Although this was, he said, the first time he had had the pleasure of meeting the members of the Association, he hoped it would not be the last. He might remark that during the past four or five years they had had a great deal to contend with in the way—to give one instance—of the electric light; but he had no doubt that if these gentlemen, the gas engineers, would only still put their shoulders to the wheel, they would, so far as the supply of gas was concerned, be able to compete with it. In his opinion the electric light did not occupy the same position it did some months ago; and, although it might be useful for the lighting of public squares and large buildings, he did not think it would interfere with the lighting of shops and private dwellings. With reference to the invention of Mr. Warner, in addition to the saving of manual labour, it had also a humanizing effect, doing away with the most laborious work, and there was no doubt it would, in time, be generally adopted by gas companies. The great object, however, of the invention and of the inventor was to endeavour to make the manufacture of gas as cheap as it possibly could be made.

Mr. COX, of Sunderland, in responding, referred to the usefulness of the Association.

Mr. HEFORTH, of Carlisle, gave "The Health of Mr. W. J. Warner, the Engineer to the South Shields Gas Company." Mr. Warner, he said, by his ability, had fought his way into the front ranks of the gas engineering world, and had not only occupied the chair of this Association, but also that of the British Association of Gas Managers. Mr. Warner was well deserving of the position he had attained, and they admired him not only for the good qualities of his heart, but also for his inventive genius.

Mr. W. J. WARNER, on rising to respond, was received with hearty applause. He said there was often a great distance between a person's desires and his attainments, and for himself he felt that his work ought to have been greater than it had been, and that he ought to have advanced the profession with which he was so closely identified somewhat more than he had done. He was afraid his friends saw in him many good qualities to which he could not lay claim. He, however, might say that

from his youth he had endeavoured to obtain a practical knowledge of his profession, and to extend that knowledge as far as in him lay; and he might remind them that when he was a young man there was scarcely a professional paper to be had. The JOURNAL OF GAS LIGHTING only appeared once a month, and was of limited size. Now a great change had taken place in this direction, and valuable papers were published in it with great frequency. It had been his desire to strike out some method of bringing gas people more closely together, and he consulted his friend, Mr. T. G. Barlow, the then Proprietor and Editor of the JOURNAL; and in a letter which he (Mr. Warner) wrote, suggestions were made regarding the formation of a Gas Managers Association. These were subsequently acted upon; and Associations were now found in almost every part, not only of this country, but also abroad. These Associations were the means of doing much good, and by mutual consultation the members were able to arrive at something beneficial. They had been enabled to secure a considerable amount of economy in the carrying on of their works, especially in regard to unaccounted-for gas; for what was formerly 30 per cent. had now come down to 5, 6, 7, 8, or at most 10 per cent. This was one of the causes of their success. He thanked them sincerely for the enthusiasm with which they had received the toast.

The MAYOR of JARROW gave "The Health of the President of the Association," which was received with applause.

The PRESIDENT acknowledged the compliment, and in referring to the invention of Mr. Warner in the way of saving labour, said he hoped that gentleman's inventive genius would be further exerted so that additional advancement would be made in this direction. By so doing it would tend to still further reduce the price of gas, and to extend the advantages of light into every dwelling. The President then proposed "The Health of Mr. Hardie, the Honorary Secretary," who had been most indefatigable in his efforts on behalf of the Association.

Mr. HARDIE responded, and said it had always been a pleasure to him to do what he could to help on the Association. Speaking of the meeting held in Newcastle, he said it was gratifying to note how cordially they were aided by the local Companies, as well as by many gentlemen connected with the gas industry in the district.

Mr. HENDERSON then gave the health of Mr. John Pattinson, Analytical Chemist, who was well known in the North of England, not only as a scientific gentleman, but more particularly as regarded chemistry. Mr. Pattinson was connected with every Gas Company on Tyneside, and although he (Mr. Henderson) did not know what his friend Mr. Warner would say, he could only remark that the monthly visits of Mr. Pattinson were a very great relief to the Directors.

Mr. PATTINSON, in responding, said he had invariably found both managers and directors of gas companies extremely anxious to give the very best article they possibly could. With respect to sulphur, with which they had to contend, he thought he might say that it was almost conquered. They had had recently some experience in this direction at South Shields, where the sulphur suddenly rose to a very alarming extent; but he was very glad it did occur at South Shields, because he knew they had there a very excellent Engineer, and the result was that, through Mr. Warner's efforts, it was brought down far below the standard allowed by Act of Parliament. Mr. Warner not only knew how it was done, but could do it again, and also teach others to do a similar thing. With regard to the illuminating power of the gas, it had always been their desire to keep it up, and very rarely indeed had he to report that the gas was below the standard required by the Act of Parliament.

Other toasts followed, and the proceedings concluded.

WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS.

EIGHTH ANNUAL MEETING.

(FROM OUR OWN CORRESPONDENT.)

On Thursday last, the Eighth Annual General Meeting of the West of Scotland Association of Gas Managers was held at Hamilton, under the presidency of Mr. Robert Mitchell, of the Coatbridge Gas-Works. As usual, a full report of the proceedings will appear in the JOURNAL; but, in the meantime, I hasten to give a summary sketch of what took place.

The meeting was held in the Town Hall, the local arrangements having been made by Mr. John Johnstone, Manager at the Hamilton Corporation Gas-Works. There was a very large attendance of members; and amongst the gentlemen present there were Mr. Robb, of Haddington, President of the North British Association of Gas Managers; representatives both of the extraordinary and honorary members of the Association; as also of the Gas Commission of Hamilton, including Bailie Cassells, the Convener of the Gas Committee, and the much-esteemed Chief Magistrate, Provost Forrest. The President having taken the chair, the Secretary (Mr. S. Dalziel, of Kilmarnock) read the minutes of the Committee of Management for the past half year, which served as a kind of official report. These were duly confirmed, and then the office-bearers for the ensuing year were elected. Mr. Robert S. Carlow, a former Secretary of the Association, was advanced from the position of Vice-President to succeed Mr. Mitchell in the presidential chair; Mr. Dalziel was elected Vice-President; Mr. Johnstone, of Hamilton, was appointed Secretary; Mr. William Smith, of Helensburgh, was re-appointed Treasurer; and a number of other gentlemen were elected to act with them as the Executive Committee. At this stage Mr. J. M'Gilchrist, of the Dumbarton Gas-Works, brought forward his motion asking that the Committee should be instructed to revise the rules of the Association, more especially with reference to the mode of electing the Committee, and suggesting that the system which prevails in the two leading Associations of Gas Managers—the British and North British—should be adopted. The motion was seconded, briefly discussed, and unanimously adopted. Next in order, the Auditors were elected; a very encouraging financial statement from the Treasurer was submitted and agreed to; and five new members were elected. These items of the more formal business being got through,

The President proceeded to deliver his valedictory address. He pointed out that since the electric "scare" fell upon the country about two years ago, gas engineers had been more than ever diligent in research, in order to hit upon schemes designed to cheapen the price of gas to the consumer. That "scare" had exercised a material effect in bringing about various improvements, and in his opinion the time had been reached when some of the old systems of gas-making would be revolutionized. If in future gas was to be made cheaper to the consumers, a radical improvement must be wrought in the retort-house; indeed, that was the place in which changes, if they were to be of any avail, must be carried out. Mr. Mitchell subsequently dwelt at some length upon the most approved methods of building a retort-bench, the kind of retorts used, the setting of the retorts, the extent to which coal should be broken before being charged into them, the modes of heating the retorts, and more especially the application of gas-furnaces on the Siemens heat-regenerative system, and on the substitution of mechanical stokers for hand labour. On the last-mentioned topic he briefly noticed what he had seen at Manchester, where both the Foulis and West systems of stoking by machinery were in operation. The address contained many valuable practical hints, and was received with much attention and approbation, and at its close Mr. Mitchell was awarded a very hearty vote of thanks.

A long and animated discussion then took place on the proposed amal-

gamation of the West of Scotland and the North British Associations of Gas Managers. The speakers were Mr. James M'Gilchrist, Mr. D. M. Nelson, Mr. Niven, Mr. Dalziel, Mr. Adamson (Airdrie Iron-Works), Mr. Thomas Wilson (Saltcoats), Mr. Renfrew (Langbank), and the Chairman. Several proposals were submitted, but there seemed to be a general feeling that the West of Scotland Association should not sink its separate existence. The Secretary stated what had been done in the negotiations that had taken place between the representatives of the two Associations, and in the course of the discussion it was mentioned that the proposal for an amalgamation had arisen not with the West of Scotland but with the North British Association. It was eventually resolved by a large majority to let the matter drop, as there was no definite scheme contained in the overtures for amalgamation.

The first paper submitted to the meeting was one by Mr. David C. Niven, of the Dunoon Gas-Works, on "The elaborate and tedious Thermometric and Barometric Calculations relative to Coal Gas simplified." Mr. Niven began by showing the necessity for gases being reduced to like conditions, that there should be some definite unit as a standard for comparison, and that temperature and pressure were all-important factors in such conditions, and he showed that, in their construction, the thermometer and barometer implied physical laws, which had been determined by exact experiments, and could therefore be applied through definite calculation. He subsequently passed in critical review the formulae of Clegg, Wright, and others, together with the common processes of calculation for corrections of temperature and pressure, as quoted from the usual text-books. Mr. Niven gave numerous examples illustrative of his mode of carrying out the necessary calculations in regard to coal gas under the varying conditions of temperature and pressure, and they were so simple, easy, and expeditious as to indicate very evidently that he had made a decided advance over the usual tedious processes. A feeling was strongly expressed, both during the discussion upon the paper and afterwards, that Mr. Niven would confer a favour upon the members of the Association if he were to give them the benefit of his studies by preparing tables for use in photometrical operations. He was heartily thanked for his paper.

At this stage the President announced an adjournment, as the Provost of Hamilton and the Gas Committee of the Town Council had invited the members to visit and inspect the gas-works, which had lately been very much extended and improved. On arriving at the works, the members were shown over the premises by the Convener of the Gas Committee and by the Manager, and were greatly interested in what they saw. When the inspection was completed, the visitors were served with a very welcome refreshment, and they cheerfully joined the President in wishing success to the Hamilton Gas-Works and the Gas Committee. Bailie Cassells replied to the toast in an excellent little speech. Business was shortly afterwards resumed at the Town Hall.

Mr. John Mayer, F.C.S., of Glasgow, read a paper in which he gave a comprehensive statement regarding Painter's Hydrostatic Joint for Gas and Water Mains. He remarked that he could not lay claim to be regarded as a "practical" man, but as the invention had appeared to him to be one of much scientific value, and likely to be attended in use with marked advantage, both economically and otherwise, he had obtained all the information that was available regarding it, and with the permission of the executive officers of the Association he had undertaken to lay it before the members. The paper was illustrated by diagrams, and by a section of a cast-iron pipe that had actually been caulked with lead by Painter's hydrostatic method. Much interest was excited by the paper, and the author received the best thanks of the meeting for bringing the subject forward. In the course of the discussion which followed, a fear was expressed that the production of the hydrostatic joint would be as expensive as the operation of making a caulked lead joint in the ordinary way; and several members were led to speak of the cement which was in use in England for jointing gas-mains, and which had the property of expanding as it "set." One speaker urged that the cement would not be gas-tight, in confirmation of which Mr. Mayer stated that the plaster of Paris, having "set," was well known to be permeable to gases, and that it was used to demonstrate the law of osmosis and the diffusion of gases through porous septa, as was also unglazed earthenware.

Mr. William Brodie, of Paisley, subsequently read a most interesting and highly practical paper on "Gasholder Construction," in the course of which he gave many useful hints on planning gasholders of different sizes, and in using the same; and as they were the result of professional experience gained over a period of fully 30 years, he certainly placed the members under a deep debt of gratitude to him. Owing to want of time very little discussion took place on the subject of the paper; but the President conveyed to the author an expression of the heartiest thanks of the members for the instruction which they had received from him.

It had been intended by Mr. L. Monk, of Lanark, to submit a paper to the meeting on "An Improved Washer suitable for Scrubbing and Washing in Small Gas-Works;" but as one similar to that which Mr. Monk has in use is being put in operation at another works, he preferred to defer his remarks on the subject till the next meeting of the Association.

The last item on the programme of business was a report from a Committee on Mr. G. R. Hislop's system of re-burning spent gas lime. This, which was submitted by the President, was a detailed statement embodying many important data and figures; it was resolved to hold over the consideration of it until next meeting, so that the members could, in the interim, have an opportunity of studying it in print.

After a little discussion it was agreed that the next half-yearly meeting, to take place in September, should be held at Port Glasgow. Some formal votes of thanks were then passed; a very hearty one, on the motion of Mr. D. M. Nelson, being given to Mr. Mitchell, the retiring President, to which he suitably replied; and one to the Secretary, on the motion of Mr. Samuel Stewart.

The meeting then broke up, but a large number of the members subsequently sat down to dinner in the Commercial Hotel. Mr. Mitchell occupied the chair, and Mr. M'Gilchrist and Mr. Carlow were the croupiers. Amongst the guests present there were Bailie Cassells and several members of the Gas Committee, Mr. Robb, of Haddington, and other gentlemen. Various appropriate toasts were proposed and responded to, that of "Kindred Associations" being given by Mr. D. M. Nelson, and responded to by Mr. Robb, in his capacity of President-Elect of the North British Association of Gas Managers.

Alike in respect of attendance and business done, the eighth annual meeting of the West of Scotland Association was a decided success.

BRIDGWATER CORPORATION WATER SUPPLY.—On Monday last week Mr. T. Hawksley, C.E., the Engineer employed by the Bridgewater Corporation in connection with their new water-works, visited the works with the view of giving a final certificate as to their completion, at a cost which, it is believed, will reach close upon £40,000, that gentleman's estimate before the House of Commons Committee in 1877 being £32,000. The works were opened and the first supply of water was laid on in the borough about four months since, and already a large number of the inhabitants have availed themselves of it.

METROPOLIS WATER SUPPLY.

METROPOLITAN BOARD OF WORKS.

At the Meeting of the Board on Friday last—Sir J. M. Hogg, M.P., in the chair—the adjourned debate on Mr. Selway's motion in reference to the Water Supply of the Metropolis was resumed. The motion was as follows:—"That it be referred to the Works and General Purposes Committee to consider and report as to the advisability of this Board applying to Parliament for an Act to improve the Water Supply of the Metropolis, either by amending and regulating the powers of the existing Water Companies, by consolidating their undertakings, by providing an additional supply of pure water, or by any other means the Committee may deem desirable, with authority to confer with Her Majesty's Government thereon." To this Mr. Munro had, since the previous meeting of the Board, given notice to move the following amendment:—"That the question of the supply of water to the Metropolis be referred to the Works and General Purposes Committee for consideration and report, with power to confer with Her Majesty's Government thereon."

Mr. TURNER, in supporting the motion, said he considered that no question of greater or of even equal importance had been brought before the Board since its formation than that of the Water Supply of the Metropolis. It had received as much attention outside as inside the Board, and many of those who had been engaged in the sanitary arrangements of their various parishes had had its importance brought before them in a way that compelled them to give it their earnest consideration. In inspecting the various houses of the parish which he represented, he found that the condition of the water-butts in the lower class of houses, and of the cisterns in some houses of the better class, was such as to require prompt and immediate attention. It would be in the recollection of some gentlemen connected with the Board that application was made for the Board to put into operation the provisions of the Act of 1871, by which they had the power to compel the New River Company, and indeed any of the Companies, to give a constant supply of water when required. He regretted that when the Board had the authority placed in their hands for securing a constant supply, they allowed year after year to pass without taking any action in the matter. The parish which he represented sent a memorial to the Board asking that they would compel the New River Company to grant, for certain districts in the parish, a constant supply. After five months delay the Board came to the conclusion, by 23 votes to 5, not to comply with that request, and the Vestry then applied to the Local Government Board. He referred to this because he conceived that it would have been far better if the Board had taken action in the matter, and by a gradual process secured a constant supply of water for the inhabitants of London. One of the most formidable difficulties now connected with the subject arose from the immense responsibility of work which the management of the water supply would entail upon the Board. Even at present there was more work thrown upon their shoulders than they could well accomplish. But was this a reason why they should cast off their responsibility in relation to the water supply? He thought it was not. On the other hand, it might be regarded as a stimulus to them to have the constitution of the Board itself altered, and its basis broadened, so that the work might be distributed with something like equality. Representing as they did the ratepayers of London, there was no body in existence at the present time more entitled to the confidence of the inhabitants, or to whom the control of the water supply could be more properly given. That there was a pressing need for a change, everybody was prepared to admit. He supported the motion because it did not commit the Board, in the slightest possible degree, to any particular course of action. They would be able to consider first whether it was desirable that the water undertakings should be purchased, and next who should be the purchaser. Ought the Board, as at present constituted, to have charge of the supply of the Metropolis with water? or should the Board seek, through the Government, a broader basis and an increase of numbers before they did anything to get the water supply? In the hope that the matter would receive a satisfactory solution, he should support the motion.

Mr. MUNRO said his opinion was as strong as possible upon the question of the impurity of the water as at present distributed in the Metropolis, and the excessive cost and inadequacy of the supply; but he contended that two years ago, by introducing one Bill for the purchase of the water-works, and another for a continual supply, the Board did all that Mr. Selway now asked them to do. What was the result of those two Bills? He wished to ask the Chairman whether, when he introduced the Indemnity Bill in the House of Commons, he personally gave any pledge that the Board should take no further steps.

The CHAIRMAN said he could not possibly get the Bill through under any other conditions, and he gave an undertaking not to bring in any Bill affecting the character of the ordinary water supply without the consent of Government.

Mr. MUNRO said he hoped under these circumstances Mr. Selway would accept the amendment as the only safe course that the Board could adopt in order to be consistent.

Mr. SELWAY said he was perfectly willing to amend his motion in these terms—to strike out the words after "report," and let it read in this way:—"That it be referred to the Works and General Purposes Committee to consider and report upon the necessity of improving the Water Supply of the Metropolis, either by amending and regulating the powers of the existing Water Companies, by consolidating their undertakings, by providing an additional supply of pure water, or by any other means the Committee may deem desirable, with authority to confer with Her Majesty's Government thereon."

Mr. MUNRO said he would consent to that alteration.

Mr. JONES suggested that in addition to the "necessity" the "means" should be taken into consideration.

Mr. SELWAY accepted the suggestion. The motion would then read:—"That it be referred to the Works and General Purposes Committee to consider and report upon the necessity and means of improving the water supply," &c.

The alteration having been agreed to,

The CHAIRMAN intimated that he should treat it as a fresh motion.

Mr. COOK seconded the amended resolution.

Mr. MUNRO supported the motion. He said if the Board had confined itself to the Purchase Bill two years ago, much more would have been done by this time than had been yet accomplished. He was not surprised at Mr. Selway bringing this motion forward when he found there were certain gentlemen in the Metropolis who met together regularly, and constituted themselves a body representing the various Vestries and District Boards, taking upon themselves the office of being the exponents of the views of the inhabitants on the water question. The Metropolitan Board were the only constituted authority to deal with questions affecting the interests of the whole Metropolis, and he hoped the present Government would listen to the arguments of the Board in favour of giving them the control of the water supply. He trusted that the new Government would not deal with the question as the last Government did—namely, by appointing nominees. He ventured to think that the members of the Board knew more about the requirements of their various districts than any other body of gentlemen of the same number in the Metropolis. If

the Board were increased in numbers it would be able to discharge the duty of controlling the water supply for the benefit of the ratepayers.

Mr. FOWLER said this question had so long agitated the public mind, that some alteration must be effected. He was strongly in favour of the resolution, because he did not think it should be left to parties outside the Board to consider upon what terms the supply should be taken over, or what should be done in order to meet the necessities which everybody agreed existed. He protested against any self-appointed body of gentlemen setting themselves up as representing the whole Metropolis. The parish with which he was connected, as well as a number of others, was not represented in that body, and therefore any conclusions which they arrived at should be regarded as of no effect. At a meeting recently held, the Chairman moved a resolution upon the lines of Mr. Cross's Bill; but this was negatived by a small majority, and he understood that it was the intention of those gentlemen to hold another meeting, and endeavour to carry forward some scheme to improve the Water Supply of the Metropolis. He did not think his friend had been wise in talking about the constitution of the Board. What he wanted to see done, and what the resolution aimed at, was that the Board should go thoroughly into the whole question, master all the details, propose such a scheme as would be equitable between the ratepayers and the Companies, and then to enforce it with all the authority they could bring to bear upon the Government. According to the statement in the Water Companies accounts for the year 1878, their total capital outlay was about £12,000,000. Now the initial question to be decided was whether this property was a monopoly or not. The Select Committee appointed to consider the question reported that when Parliament gave the Companies the power to supply the Metropolis with water they did not give them a monopoly, but left the supply open for competition. That, of course, must affect the question of what was to be done supposing the water-works were to be bought up either by Government or by the Board. Yet now it had been proposed to give for that amount of £12,000,000 upwards of £35,000,000 in the year 1893. Instead of taking the amount of money which the Companies had laid out, the valuator took the income, capitalized it at 3½ per cent., and gave the Companies a sum of £22,315,000 in water stock. But they did not stop there. The Companies had unearned increments, and they spread them over the 12 years, making £9,280,000, and, in addition to this, converted into stock the loans of the several Companies—£3,600,000—making a total payment in 1893 of a sum of £35,185,000 for the income of £773,000. This was paying very largely for the property. It was known that a New supply could be obtained from Wales for £20,000,000, and there was also abundant water in the chalk underneath London. If the scheme were agreed to, what would be the annual sum that the ratepayers would have to pay? They would have to pay 1-80th of the £35,000,000 on the first year, or £400,000 in addition to 3½ per cent., or £1,209,700, and working expenses £600,000, making £2,247,200 a year. A Bill by which the price could be regulated and conditions placed upon the Companies with respect to purity and extending the constant supply system might be better in such a case than purchasing the undertakings, because in the latter case an enormous additional sum would have to be expended in perfecting and purifying the present supply. Everybody agreed that the water-rates were excessive as well as unequal; but what chance was there of getting the rates any lower? The occupiers of warehouses in the City paid a very large sum for their water in proportion to that which was paid by the middle classes. On the other hand, if the supply were given by meter, the consequence would be that City men would be relieved, while the lower and middle classes would have to pay a much larger amount for their water. This showed how difficult it was to express any opinion until the whole subject was carefully considered. He did not say that a Regulation Bill would be the best thing, but it was a question which the Committee should take into their serious consideration. It was the duty of the Board, as being the only body which represented the ratepayers of the Metropolis, to inquire into the matter, and give it most earnest attention, so that they might be able to lay down proper lines for providing a better, purer, and more extensive water supply, at the same time having due regard to the pockets of the ratepayers, and not entailing on those who came after them a burden which they could not bear.

Mr. TOLHURST proposed as an amendment that the consideration of the matter be deferred for six months. If the member for Newington had introduced an abstract motion for the purpose of ventilating the question, and showing the ratepayers that the Board were still fully alive to the importance of the question, he would have supported him; but he could not vote for a practical resolution that the General Purposes Committee should set to work at once for the purpose of submitting a measure to Parliament. The resolution which had been put on the paper was almost similar to that which was brought forward three years ago. The General Purposes Committee then went into the whole matter, and brought forward a scheme which took the form of two Bills—one for a new supply, and the other for the purchase of the existing water-works. The resolution authorizing the Committee to propound that scheme wound up with words similar to those at the end of the present resolution—"And confer with Her Majesty's Government thereon." It was never carried out in its entirety. Her Majesty's Government were not conferred with. The new Supply Bill was referred to a Committee, and the Purchase Bill never reached its second reading. The whole question was a second time referred to the consideration of the Works Committee, and it was resolved to bring forward a single Bill for the purchase only. While all these proceedings were going on, how did the public regard the Board? The Board brought the measure forward for the benefit of the public. An Association was formed in the Southwark and Vauxhall Water Company's district, and a meeting on the water question was held at the Bridge House Hotel, but not a single resolution was passed asking the Board to come forward and assist the ratepayers. He was entirely in favour of obtaining a pure supply of water, and of reducing the rates; but the Board must consider what took place in Parliament last August. Mr. Cross redeemed the pledge he then gave by bringing forward a Purchase Bill, but that Bill met with very little favour throughout the Metropolis.

Mr. SELWAY: With a howl of indignation.

Mr. TOLHURST said that was so, but he was not quite sure that the merits of the Bill were ever fairly discussed. His friend had alluded to the action of what he termed a self-constituted body; but as far as he (Mr. Tolhurst) knew, that body represented all the Vestries and District Boards in the Metropolis. At all events the Vestries and District Boards had been invited to send representatives there, and the gentlemen constituting it knew what were the feelings of their constituents. They had not, however, passed a single resolution asking the Metropolitan Board to take over the Water Supply of the Metropolis. This was an important fact to be considered—that such a body did not request the Board to take the initiative. According to the daily papers there was another public body—the National Chamber for the Protection of the Interests of the Ratepayers of the Metropolis—which had passed a resolution to go direct to the present Prime Minister, and ask him to deal with the question. Ought not the matter to be left in the hands of the Government? The Board had already taken action and failed. They had, at a very great expense, endeavoured to assist the ratepayers, and the ratepayers had never even thanked them. The burden of the song now was that the constitu-

tion of the Board must be altered, the water supply being made a lever to induce the Government to consider the question of reforming the Board. He was quite willing to go to some expense if thereby the ratepayers could get a purer and cheaper supply of water; but he thought the Board ought not to consider the question, even in committee, until the present Government had had an opportunity of explaining their views.

Mr. REDDISH seconded the amendment. He said that some years ago the charge for water was so much on every room in a house, and the object of passing the Assessment Act was to a great extent to relieve the lower class of ratepayers who could least afford to pay, and to throw the expense very much on those who could best afford to pay. That was the reason why gentlemen in the City had to pay a large sum without consuming very much water. He believed that the body which had been referred to as self-constituted, represented the ratepayers of the Metropolis as much as the Metropolitan Board did. His Vestry was invited to send a deputation, and they did so. The Board had not been asked to interfere. It had been suggested that the Board should be enlarged, but in his opinion the only effect of enlargement would be to bring in a greater number of talkers. The present Government had only just come into power, and the Home Secretary had not had an opportunity of giving attention to the question. Another point for consideration was whether the municipal affairs of the Metropolis should be divided among a number of petty bodies, or whether the Vestries, the District Boards, and the City of London should not be under one government. While the City was governed by one body, and the other places by another body, the interests must clash. He, therefore, supported the amendment which had been proposed, and he thought the Board would act discreetly in having nothing to do with the water question at present. So far as his knowledge of the Water Companies went, they had not availed themselves of the power they had, under the new Assessment Act, to increase their charges considerably. With regard to the quality of the water, he thought the public could very well endure a little turbidity occasioned by the floods. He spent some years of his life near London Bridge, when the only water he could get was that pumped up near to the bridge, and yet he was now alive at the age of eighty-one. He believed no man could tell what the cost of purchasing the water-works undertakings would be. Everything had been advancing in price since the New River Company was created, and it must not be forgotten that the Shareholders in some of the Companies invested their money a great number of years ago, and received no interest for a considerable time.

Mr. RICHARDSON thought that the Board were indebted to Mr. Selway for having proposed the resolution. He had felt considerable difficulty in voting for it as it was at first brought forward, because it almost seemed to pledge the Board to go to Parliament, and he wished the Board to be left as free as possible. He was not aware at the time that the Chairman had given any pledge that he would not in future present any Water Bill to Parliament without the consent of the Government. It must be clear to every member of the Board that it would be perfectly useless for them to go for a large measure of water supply without such consent. Mr. Tolhurst's address seemed to him to set the whole principles of local self-government at defiance. If there was one point more than another which he objected to in the Bill of the late Government, it was that it ignored the principles of local self-government. It was a centralization from beginning to end; and he thought the Board ought, in every possible way, to show determined opposition to it. The figures in the Bill could not be judged of except by statements of accounts which were not at the present time before the public. The total dividends of the Water Companies were not known later than 1878: but at that time they amounted to £699,270. Under the Bill the first year's dividend to be paid by the ratepayers would be £773,454, or an increase in the net income of the Water Companies of no less than £74,000. Then it should be remembered the arrangement proposed by the Bill did not include compensation to officers, and though it secured the Companies maximum dividends, it allowed the New River Company to retain all their freehold property except that which was immediately connected with the water supply. Were the ratepayers satisfied with the water supply? His friend who last spoke seemed to like the supply, but very few persons would be found to sympathize with him. They would prefer water without any sewage in it. The Bill of the late Government had proceeded on the principle that the Water Companies were all perfect concerns, whereas the whole Metropolis was of opinion that they were imperfect. The whole Bill was therefore inconsistent. Though the supply was confessedly imperfect, the Companies were to receive as much money as if it were absolutely perfect. Several millions ought to be struck off to represent the imperfection. Mr. Tolhurst's amendment was only a pure negative. The object which the Board ought to have in view was to press on the Government the necessity of dealing with this question at once, and on very different terms from those in the late Home Secretary's Bill. If the Board were authorized to purchase the water-works at a proper price, the districts outside the Metropolis might be supplied on terms not higher than under the existing rates. It was proposed in Sir R. Cross's Bill to make the expense a charge upon the metropolitan consolidated rate. Could anything be more absurd? The consolidated rate might be only on one-third of the area, and yet that smaller area was to be a security for the whole. The Metropolitan Consolidated Stock was an irredeemable stock, and yet there was a clause in the Bill requiring that after ten years there should be a sinking-fund. What on earth was to be done with the sinking-fund if the stock was irredeemable? He thought the Bill was as injurious to the ratepayers as it possibly could be. One principle which he would like to see established was that the representative body of the Metropolis was the only body that could deal with the water supply. No other body could do it properly. If that principle were enforced, he believed the Government would assent to it. The later the solution of the difficulty was left, the worse it would be for the ratepayers, and that was another argument against the amendment.

Mr. ELT said he had noticed that this agitation was got up, not by the general body of the ratepayers, but by journalists, scientific men, and experts. There had been no association of thousands of consumers complaining of the water. Chemists gave frightful accounts of the water, but neither by sight, smell, nor taste could the impurities be discovered. He was not much of a water drinker, but he had no fault whatever to find with the quality of that which was supplied to him by the New River Company. He had spoken to persons who had been accustomed to use the Kent Company's water, and they assured him they preferred that which was supplied to other districts, because their water was so hard. The great towns in which the Municipalities had the control of the water did not get a better or a cheaper supply than the inhabitants of the Metropolis. Glasgow had had a new water supply from Loch Katrine. About three years ago he was talking to some residents in Glasgow, and they complained of the water, and also of the price they had to pay for it—18d. in the pound upon the rental. He had looked into the charges at Birmingham, Manchester, and Liverpool, and there the ratepayers had to pay more than those in London did. If the system pursued in the Metropolis were changed, he did not think the water would be one penny cheaper—on the contrary, he thought the price would be increased; and he very much doubted if purer water would be supplied. He supposed a constant supply would be gradually obtained throughout London by those

who chose to have it. His experience of the Board was that as it was at present constituted it was the worst body that could possibly be conceived for controlling the water supply. They had, at present, quite enough to do. They were an unpaid body. Their work now was double what it was when he first of all had a seat at the Board, and the management of the water supply for the 4 million inhabitants of the Metropolis, and another million outside, would be quite work enough for a separate body. He should, however, like to see that separate body a representative one, and not consisting of nominees. He did not see that any harm could be done by referring the matter to the Works and General Purposes Committee.

Mr. FELL said he was rather amused at the conclusion to which the last speaker had arrived. He had been speaking entirely in opposition to the motion, and yet he meant to support it. There could be no question that public opinion was fully settled on the matter, and a great alteration must take place with reference to the future water supply of London. He did not think the late Government imagined their Water Bill would pass. In a happy (or unhappy) moment, Mr. Cross gave a promise that he would take the question up, and he carried out his pledge. He (Mr. Fell) thought the Board had neglected to place themselves in communication with the metropolitan members of Parliament. They had been to a very great extent ignored by the late Government, and therefore could not be surprised at what had happened. He thought if the Board thoroughly considered all the difficulties which surrounded the question, gave the Government the benefit of their advice, and asked them to do something to bring it to a satisfactory issue, there could be no doubt the Government would do so. He did not think it was likely for a moment that the present Government would establish a third governing body in the Metropolis. The system on which the late Bill was drawn betrayed all the principles of self-government, and he maintained that it was the duty of the Board to do all they possibly could to further the principle of local self-government. By adopting Mr. Selway's motion they would do so. Under the present constitution of the Board, the power had a tendency to dwindle into a few hands, because while some gentlemen could, others could not give their whole time to the business of the Board. He had great pleasure in supporting the motion.

Mr. LLOYD said if the whole of the Metropolis were polled, the expression of opinion would be that the Metropolitan Board was certainly the proper body to have the control of the water supply, and that the terms proposed by the Bill of the late Government were such as never could be accepted. Under these circumstances, what was the bounden duty of the Board? To go to the Government and say, "We have considered the matter fully, and we are prepared to act in the interest of every inhabitant of the Metropolis." From the time when the Metropolitan Board took over the control of the water supply, it would deal with it as a necessary of life, without any idea of making profit. On the other hand, the Water Companies must make profit, and must pay their Directors. When he heard the member for Islington (Mr. Elt) say that the Board were not competent to undertake the task, he would ask him whether the Board had ever failed in performing any duty that had been cast upon them. From the past they had a right to argue for the future; and as the Board had done well with regard to everything else, so would they do well with regard to water. The Companies had maintained that they had an indisputable right to supply the whole Metropolis, and nobody could interfere with them. He wondered whether they had ever considered the 116th clause of the Metropolitan Local Management Act, which said, "Every Vestry and District Board shall have full power and authority to cause all or any of the streets in their parish or district to be watered as often as they think fit, and also to cause any wells to be dug and sunk in such public places as they think proper, and also to erect and fix any pumps in any public place for the gratuitous supply of water to the inhabitants of the parish or district." Attempts had hitherto been unsuccessful to get at the great supply of water underneath London; but the time might at any moment arrive when this supply would be reached, and then what would become of the rights of the Water Companies? What terms would they be inclined to agree to when any Vestry or the Metropolitan Board might sink as many wells as they pleased, and charge the expense upon the district? Why, the Companies would then be in the hands of the Vestries and District Boards. The Companies, therefore, had nothing like a perpetual right. Under these circumstances it might have been imagined that the Companies would have been only too delighted to come to terms. It had been said that the Board had applied to the Government and not obtained an answer; but this was not true. To the best of his recollection, one of the answers received was, "We do not think the Metropolitan Board of Works is the proper authority to have the water supply of the whole Metropolis, because the Companies supply districts outside the Metropolis." But when the same Government brought in a Bill, how did they get over this tremendous difficulty? They proposed a Board consisting of three paid Government nominees to do the work which the Metropolitan Board were at first thought incapable of doing. Then it had been said that the inhabitants did not complain of the present supply; but the truth was that the complaints were endless, and if it were not known that every representative on the Board desired to bring the question to an end, they would be swarmed with complaints. It was the bounden duty of the Board to persevere to the very last in their efforts to supply the inhabitants of the Metropolis with the best quality of water, and he sincerely hoped that the motion would be carried.

Mr. FREEMAN said if he understood the junior member for Islington, the principle he laid down was that the Board should not undertake any duty which was not forced upon them; but he (Mr. Freeman) ventured to think that their business was to attend to the interests of the inhabitants of the Metropolis, and be willing and anxious to act whenever they could see an opportunity of doing good. He thought it had been settled on all hands that the Water Supply of London ought no longer to be conducted on commercial principles, that profit out of it ought to cease, and that henceforward the great object should be to give an unlimited supply of pure water at the cheapest possible rate. In the Bill brought in by the late Home Secretary, a fictitious value had been put upon the property of the Water Companies. Every possible contingency in the direction of increased dividends had been considered, and the ratepayers had been charged with it; but everything that might tell against the Companies had been left out. He ventured to think that a Bill providing for greater disadvantage to the ratepayers of the Metropolis and more unjust benefit to the Shareholders in the London Water Companies was never conceived. The main feature of the Bill was patronage, ignoring local self-government, and it was a measure which the Metropolitan Board as a representative body, could not for one moment sanction. However, Sir R. Cross was gone, and he (Mr. Freeman) hoped that the present Government would see that some representative body of the Metropolis was established strong enough, and on a basis broad enough, to undertake the management of the water supply and everything else that properly belonged to a municipality. The duty of the Board was to carry Mr. Selway's motion, to consider calmly what was needful to be done and the means for doing it, and then communicate with the Government, and place before them what they considered necessary for the Metropolis,

seeking their co-operation, and asking them to bring in a Bill. He had no notion about considering the consequences and results. Their duty was before them; let them perform that duty, and leave the consequences and results to take care of themselves. He quite agreed that it would be folly for the Board to attempt to grapple with the great and complicated power that there was opposed to the Board in the House of Commons. If the Board would come to some arrangement with the Government, so much the better; but if they could not, they would, at all events, do their duty in making the attempt, and they must bide their time.

Mr. Cooke hoped the Board would not agree to any delay, because every year that the settlement of this question was postponed would increase the cost to the ratepayers of the Metropolis. While Mr. Elt was speaking, he could not help thinking of the pumps in the City and in the East-end of London, which, 25 years ago, used to be sought after by the inhabitants because the water obtained from them was so clear and sparkling; but when it was analyzed it was found that the people were actually drinking the vestiges of the previous generation, which had drained into the wells from neighbouring churchyards. The pumps were then closed. People never asked to have them closed; it was the "journalists" and the "scientists" who did it for the benefit of the people. If they waited until all the population of London were sufficiently educated by the School Board to know that it was not wholesome to drink the sewage of Oxford, Windsor, Luton, Hertford, and Ware, they would have to wait a long time. It might be said that the people of London did not drink the sewage of the up-river towns; but would any person who said so tell him what became of the sewage of those towns? With regard to what ought not to be done, they no doubt were all perfectly agreed, and that was that Sir R. Cross's Bill ought not to be proceeded with. He could very readily believe that every one who happened to be the fortunate possessor of a share in the New River Company wished the Bill to be carried; but it would not be to the interests of the consumers or the ratepayers. Then it would be asked, Why should the Board deal with this question? Because no other public body knew so much about it. The Board had in their archives all the facts available both as to the quality of the present supply of water and the prospects of getting other supplies. But the Board had done more than merely obtain all those facts. After a great deal of trouble and expense they had prepared two Bills, and he ventured to say that those Bills represented the best knowledge upon the question which was anywhere available. Why were those Bills forgotten? Because the late Government said they would have nothing to do with them. He really thought that the wisest plan would be to submit those Bills to the present Government, and say, "We took a great deal of pains and went to considerable expense to prepare them. We thought they were very good Bills, but nobody would look at them. Will you look at them, and say what you think about them?" A great many people had theories about bringing water from the mountains of Wales; but the Metropolitan Board had a definite and clear plan, which he thought should be submitted to the Government.

Mr. Jones said the Chairman had told them that he was obliged to commit himself to the promise that he would not again bring forward any measure relating to the Water Supply of the Metropolis, except with the previous consent of the Government. The Indemnity Act of last year had disqualified the Board from spending a single shilling upon this question, for it declared that they had exceeded their powers in endeavouring to pass the two former Bills through Parliament; but if there was one object more than another which a municipal authority should aim at, it was to provide pure air and pure water for the population. It had been said that he (Mr. Jones) was not opposed to monopolies, and that as the Water Companies were private enterprises he would not interfere with them. The Municipality of Paris regulated the water supply of that city, and artesian wells were being sunk which promised to give an abundant supply. It might be that the same thing could be done in London. Then the question arose, had the Board a right to interfere with private enterprise? They had that right if the private enterprise charged higher prices than the thing could be done for by other means; and it was an offence against their judgment to permit private Companies to supply a necessary of life, and charge 10 per cent. for it, when the Board would be able to borrow money at $3\frac{1}{2}$ per cent. and perform the same work. The Royal Commission on Water Supply determined that the upper reaches of the Thames would supply an abundant quantity of pure water, equal to 150 million gallons per day, and those upper reaches might be preserved from contamination by the populations. Mr. Prestwich also had pointed out that the subterranean waters in those upper reaches would afford an abundant supply, even if the superficial supply were untouched. If the Board, therefore, could bring into London an abundant supply of good water at $3\frac{1}{2}$ per cent., upon what principle should the inhabitants be compelled to pay 10 per cent. to the Companies? Mr. Bateman had made a proposition that for £8,000,000 he could bring 120 million gallons of water per day from the River Vyrnwy, which ran into the Severn. There would be no necessity, however, to have a double supply, for if the reservoirs were removed into the chalk country, high levels could be obtained and pure water supplied which would need no clarifying, by being passed through sand. When water was brought to Glasgow from Loch Katrine, the Companies, which had previously asked an enormous price, were worth nothing; and he thought the London Water Companies would take warning from this fact, and offer the Metropolitan Board their mains and their pumping apparatus as old iron. He would be quite willing to come to terms with the Water Companies for the use of their apparatus when the Board obtained a new supply; but he did not think that their property ought to be estimated as worth more than an annual 5 per cent. on their capital in the presence of the competition with which the Board could threaten them.

Mr. Runtz said at the previous meeting he objected to the motion in the form in which it was then presented to the Board; but as it was now amended he could support it. He had always felt that the supply of water should be in the hands of a public body; but the Board would not be justified in taking up the question unless they were prepared to prove that the public would be benefited by their interference. He very much feared it was supposed that when the Board obtained the supply the price would be reduced; but he felt sure that such would not be the case. When they had bought the interests of the Water Companies, they would have to expend some millions more in making the supply adequate, and this would prevent the water being cheaper. Then millions more would have to be laid out in order to secure purity. There was also a great outcry against the Companies for charging on the assessment of property, because this fell very heavily upon people who were assessed at £2000 or £3000 in the City, and who only wanted sufficient water to wash their hands in two or three times a day. If the basis of charge were altered, the burden would fall on the ordinary consumer and the poor, and this also would tend to prevent a reduction in the price. The Board would never be permitted to charge by meter, because it would be a tax upon the cleanliness of the very poor—the class which it was most desired to benefit. Absolute purity, however, was pre-eminently necessary. If any important discovery had been made in the present century, it was in the direction of showing how much pure water had to do with good health. A complaint was sometimes made that the water was too hard; but there was a very simple process

for making hard water soft—Clark's process. It was very economical, and it had been said by a competent authority that if proper soft water were supplied by a public body there would be a saving of three-quarters of a million a year for soap in London. The City of London had spent many thousands of pounds in putting up hydrants, which, however, proved comparatively useless, because the pressure of water could not be depended upon. If the pressure could be relied upon, and was sufficient to throw the water over the tops of the houses, a great deal would be saved in the outlay on fire-engines. The sooner the supply of such a necessary of life as water was placed in the hands of a public authority, the better for the ratepayers, because every year's delay made a difference of at least a million sterling in the cost of purchase. He thought it was the duty of the Board at once to confer with Her Majesty's Government, and impress upon them the necessity of taking immediate action.

Mr. Ewin said if the motion necessitated the expenditure of any money, he should not vote for it; if it did not, he should vote for it. If he understood the Chairman's remarks correctly, a promise had been given that no expense should be again incurred by the Board in promoting a Water Bill. He took upon himself to say that three-fourths of the parish which he at present represented were supplied with good water, and had a continuous supply night and day. Many of the houses in the district had not any tubs, butts, or cisterns; they were supplied by a pipe attached to the mains, and all the inhabitants had to do when they required water was to turn on the tap. This was at the East-End of London. He considered that if the Water Companies undertakings were bought up, and the supply controlled by a public body, such as the Metropolitan Board, the expenses would be very much augmented. Many of the houses in his district were of a very poor character, rated, perhaps, at £10 a year, and had to pay only 10s., 12s., or 14s. a year for a supply of water, while it was a well-known fact that many of the houses contained as many individuals as they were charged shillings for the water. It could not, therefore, be said the Water Company charged a heavy rate. It was the middle class in London who took up the water question and agitated for a change, because they had to pay £10, £12, or £20 a year for the water supplied to their houses. If the matter were equitably looked at, it would be seen that the Water Companies throughout the Metropolis were charging only a fair amount, and therefore there was not very much to complain about. A good deal had been said about the impurity of the water; but he thought if a public body secured the supply and gave purer water than the Companies were giving at present, the price, instead of being less, would be doubled, because the expense would be so much heavier. A fresh staff would be required, and a very large expenditure of money would be incurred over and above the cost of purchasing the present interests of the Companies.

Mr. Pocock said he was very glad to find that the last speaker lived in such a happy place, where there was a constant supply of pure water. He was sorry to say that in Bermondsey the supply was not constant, and the water was not pure; in fact, a worse and an impurer supply could not be dealt out to any parish, especially in the summer season. He therefore hoped that the motion would be carried. Mr. Runtz had alluded to the hydrants in the City of London, and said that the pressure of water was not sufficient; but he (Mr. Pocock) begged to say that the Fire Brigade Committee never met without having put before them a report of a certain number of fires that had been put out by hydrants, and even last week the hydrants proved quite sufficient to put out a large fire without the assistance of a fire-engine.

Mr. Selway, in reply, said the member who represented Bethnal Green (Mr. Ewin) had attempted to quote a statement which the Chairman had made, but did not quote it correctly. The Chairman ended by a very important qualification—namely, that the Board would not promote another Water Bill "without the consent of Her Majesty's Government." He was as familiar with the Indemnity Bill as any other member of the Board, and no one more regretted the terms in which that Bill was passed than he did. But he was perfectly conscious of what those terms were, and therefore, in the motion which he had taken the liberty of presenting to the Board, he laid great stress upon the importance of conferring with Her Majesty's Government, because he knew very well that they could not spend any money without the consent of the Government. Mr. Ewin had asked him to pledge the Board that there should be no expenditure of money. It was not for any one member to pledge his colleagues, and he could not pledge himself as to what the Committee would do. All he could say was that it would be utterly illegal for the Committee to spend any money, and he was perfectly sure the Committee would not spend any without the consent of Her Majesty's Government. The object of the amendment seemed to be that no action whatever should be taken on the part of the Board with regard to this great subject. He ventured to think that this was a conclusion which the Board would not adopt. Over and over again the Board had expressed their desire to deal with the question, and he thought they would again send it to the Works and General Purposes Committee to see if something could not be done. It was said that their action on the last occasion did not meet with any support; but the fact was that memorial after memorial was sent to them from the various Vestries in support of the action they were taking to carry out the purchase of the water undertakings. It was a measure which was popular with all the representative bodies of the Metropolis. He was not very much surprised at the opposition of the gentleman who had seconded the amendment, because at the age at which that gentleman had arrived it was probably unpleasant to him to have to deal with difficulties. He (Mr. Selway) hoped that the Board was not yet so far gone as to be unable to cope with difficulties. The honourable member for the Strand District Board of Works (Mr. Jones) had treated the matter in a manner to which great exception should be taken. He was sorry to find that on a question involving such large interests, jokes should be indulged in. When that gentleman talked of taking possession of the works and mains of the Companies at the price of old iron, it was a mode of treating the subject which the Board would not for a moment entertain. If it came to dealing with the Water Companies, they would be dealt with equitably, but not upon the basis of the Bill which was introduced by the late Home Secretary. He regarded that Bill as defunct, and he cordially concurred in the condemnation which had been heaped upon it by the various speakers. He hoped that the Committee would be able to devise some mode by which the Water Supply of the Metropolis might be placed in the hands of the Board—altered, if need be. The question of a change in the constitution of the Board should not, however, be mixed up with that of the water supply. The Board was the representative body for the Metropolis, and ought to have the control of such an undertaking. He trusted that the result of their deliberations would be that they would secure the support of Her Majesty's Government towards something being done to relieve the Metropolis from the difficulties under which it was now labouring.

The amendment was then put to a show of hands, and was lost—7 hands being held up in its favour, and 20 against it. A division being claimed, 8 members voted for it, and 23 against it.

The Board then divided upon the original motion, when 21 members voted for it, and 8 against it.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

A meeting of the Gas Committee of the Forfar Town Council was held last Wednesday, to consider the proposal to apply to Parliament for a Provisional Order to extend the Corporation's borrowing powers in respect of the gas supply undertaking. After a great deal of discussion, Bailie Laird moved that such an Order be applied for. The motion was seconded by Provost Lowson, and carried. Several members spoke against it, but they all refrained from entering any protest.

The Town Council of Falkirk held a special meeting last Thursday, when a long discussion took place in regard to the quality of the gas supplied by the Falkirk Lighting Company and the Falkirk Joint-Stock Gas Company. The Clerk submitted correspondence from the Companies, replying to a letter of his pointing out the inferior quality of the gas alleged to be supplied by them to the burgh. In the letter from the first-named Company it was stated that, as their gas was regularly tested, they were in no way afraid of losing credit through the gas being tested by the Commissioners, and were quite prepared to bear a substantial portion of the cost in the event of the Council deciding to purchase a testing apparatus. The letter went on to say that the Company invariably found that complaints about gas owed their origin to bad burners and fittings. The Joint-Stock Gas Company replied to the effect that the quality of the gas supplied by them would bear favourable comparison with that of any town in Scotland similarly situated, and where the gas was supplied at the same price. In the course of the discussion, much of which was quite irrelevant, it was suggested that, instead of getting testing apparatus of their own, as had been proposed, the Commissioners might adopt the cheaper method of testing the gas at the works of the respective Companies, where the proper instruments for so doing were being regularly employed. The discussion eventually terminated without any resolution being passed.

On Friday last an official inspection of an "Otto" gas-engine which has been brought into use for driving a fog-horn on the Island of Cumbrae, in the Firth of Clyde, took place, under the supervision of Mr. Thomas Henderson (Chairman of the Clyde Lighthouses Trust), Mr. Harvie, and Mr. Graham (Treasurer), together with Mr. D. W. Watt, of P. Watt and Son, Glasgow, by whom the engine has been erected. It had long been a serious question with the Trust as to the best means to adopt for sounding horns or bells in foggy weather, especially at the mouth of the Clyde, where fogs are so sudden, and sometimes of short duration, but yet sufficient to be dangerous to navigation at these times. The powerful horns which are now adopted as warning signals, and which can be heard at a distance of from 8 to 10 miles, require, as a necessity, to be driven by power. Steam having been tried and discarded on account of the time required to get it up, gas motors were adopted very successfully, where gas as the motive power was easily accessible; but at stations far away from gas, and on islands such as the Cumbrae, the difficulty of obtaining this motive power was felt. Now, it is hoped, this difficulty has been overcome by the adoption of a mode of producing gas in a short space of time, and of sufficient quantity to last for long periods. The gas used for this motive power, and which drives the gas-engine, is a species of hydrocarbon gas. It is a product of the manufacture of paraffin oil, and is usually known as gasoline. The apparatus used is one patented by Messrs. R. Laidlaw and Son, of Glasgow and Edinburgh.

The quality of the gas supplied in the town of Greenock may be judged of by the following report on the observations taken in the Clerk and Collector's Office during the past month, that office being well-nigh two miles from Inchgreen, where the gas-works are situated:—Durability of 4-inch flame—Minimum, 65 min.; maximum, 70 min.; average, 67.64 min. Photometer—Minimum, 27.54 candles; maximum, 32.54 candles; average, 30.16 candles. Average temperature of gas while testing, 58.04° Fahr. The number of experiments was 25. The gas supplied throughout Scotland is generally very high in its illuminating power, but there are exceedingly few cases where the average amounts to 30.16 standard candles. Aberdeen gas usually stands pretty well in this respect.

Notwithstanding the fact that there is an independent gas supply for the burgh of Milngavie, negotiations have recently been opened by the Burgh Commissioners with the Directors of the Partick, Hillhead, and Maryhill Gaslight Company, with the view of a supply being sent to certain districts situated near to Milngavie, as also to the burgh itself. Arrangements are now in progress for carrying the proposal into effect.

Some days ago the stock of the Edinburgh Gas Company stood at £45 15s. per share, but on Friday last buyers were offering only £45.

Referring to the "Note" in last week's JOURNAL regarding the water supply of Perth and the existence of typhoid fever in that town, I find

that Dr. Wallace's report upon the three samples of water sent to him for analysis does not support the suspicion that the disease has had any connection with the water consumed in that town.

The Water Supply Committee of Kilwinning have entered into arrangements with a firm of contractors to connect their special water district with the Irvine main-pipe at Muirside, at a cost of nearly £1600. It is expected that the works will be completed in less than three months.

The supplementary supply of water from the Dhu Loch for the benefit of the higher levels of Rothesay was turned on last Tuesday by Provost McKechnie, in presence of the Magistrate and Town Council and a number of the leading inhabitants. The original surface of the water in Loch Dhu was 310 feet above Ordnance datum, or about 100 feet higher than any eminence around Rothesay, and in the scheme which has just been completed the loch has been embanked 12 feet higher than the original level, so that a supply has been obtained which is equal to 30 gallons per day to a population of 6000 persons. This supplementary scheme is expected to cost about £10,000.

With the view of considering the question of introducing an efficient water supply into the burgh, the Town Council of Wick lately appointed a Committee of their number, who have since come to a general understanding that the Loch of Yarrows is the best source from which to obtain the desired supply. On Monday, the 26th ult., that loch was visited by Mr. Gordon C.E., of Elgin, in company with the Provost and two other members of the Council. Mr. Gordon has been instructed to prepare a report on the subject, dealing with all the matters on which information may be necessary for the consideration of the Committee, and of the Town Council in its collective capacity. It is understood that Mr. Gordon thinks very highly of the quality of the water contained in the Loch of Yarrows.

Last week's pig iron warrant market was somewhat steady, and a degree of firmness was occasionally manifested, which, however, was always followed by a relapse. As high as 48s. 6d. cash was paid on Wednesday, but the close on Friday afternoon was 47s. 3d. cash and 47s. 4½d. one month. Trade continues dull; America is not buying anything; and the Continent shows no signs of activity. These circumstances, coupled with the large production, seem to indicate that prices will soon reach a lower level.

The coal trade is exceedingly quiet. Prices are declining, and miners wages are being reduced in many cases as much as 6d. per day.

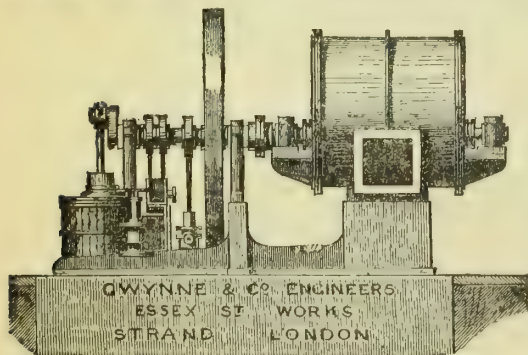
PUMPING GAS AT BECKTON.—We have been asked to mention, in reference to the large exhausters at the Beckton Gas-Works described and illustrated in the JOURNAL for the 20th ult., that each engine is controlled by two of Messrs. George Waller and Co.'s patent compensating water-balance governors, specially designed for the purpose, and made by the firm—one to prevent any risk of accident to the holder from which the gas is being taken, by stopping the engine in time; and the other to control the speed of the engine, so as to keep the gas in the delivery main at any required pressure. On the same subject, Messrs. Körting Bros. write us that, on the Continent, for several years past, their steam-jet exhauster has been employed for pumping gas direct to the consumers. They send a copy of a letter, dated Oct. 11, 1878, from Mr. E. Grahn, of Krupp's Cast-Steel Works, Essen, to Dr. N. H. Schilling, of Munich, bearing out their statement. The letter is in the following terms:—"Several inquiries having been addressed to me, lead me to make the following remarks as to a new application of the Körting steam-jet exhauster in the manufacture of gas. Last autumn an enlarged gas-main and governor, commenced for Krupp's cast-steel works, were not completed when the gas consumption increased so much that, notwithstanding the full pressure of the holders was used, it was impossible to satisfy the requirements with the old arrangements. As we could not well weight the holder, some immediate alteration was necessary. We had another bell made of zinc for the governor, and a steam-jet exhauster was fixed so as to exhaust from the holder and force into the main. After the necessary preparations the arrangement was connected and started in one day, without the least disturbance, and has since worked for nearly three months, and given every satisfaction. An increased condensation was only observed in the immediate neighbourhood of the governor-house, but still without giving any trouble; neither was there any decrease of illuminating power. The exhauster used had 12-inch pipes, and passed a maximum quantity of over 100,000 cubic feet per hour. In special cases, where the day pressure does not suffice, we apply a small exhauster to exhaust from any required part of the main, and give a greater pressure in the branch main. Although these applications may be considered as exceptional, yet, perhaps, one or other of our brother managers may make use of them in similar cases, when he may confidently rely upon good results."

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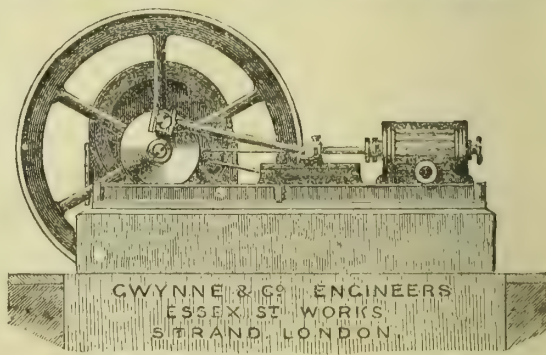
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TO CORRESPONDENTS.

RECEIVED.—“*Nature's Hygiene*.” By C. T. Kingzett, F.C.S. London: Baillière, Tindall, and Cox.—“*A Theoretical and Practical Treatise on the Manufacture of Sulphuric Acid and Alkali*.” Vol. II. By G. Lunge, Ph.D., F.C.S. London: J. Van Voorst.

CORRECTION.—In the JOURNAL for the 20th ult., p. 596, the title of the case tried before Vice-Chancellor Malins, on April 15, should have been stated, as was manifest from the report, as *Buenos Ayres Gas Company, Limited, and Bower v. Wilde*.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

TO SUBSCRIBERS.

In consequence of the Whitsun Holidays, the next Number of the JOURNAL OF GAS LIGHTING will not be published until Wednesday, May 19.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 11, 1880.

Circular to Gas Companies.

At the meeting of the Manchester City Council last Wednesday, a report was submitted by the Town Clerk, Sir Joseph Heron, showing how the several Acts of Parliament in reference to the gas supply affected the appropriation of surplus profits. We cannot contest the Town Clerk's opinion, though we utterly dissent from his conclusions. Sir Joseph Heron's contention is that the gas undertaking of Manchester belongs to the ratepayers of the whole city. All these are not gas consumers, and therefore he argues that the gas profits belong to the ratepayers at large. We have always contended that the gas profits of corporate undertakings should be employed in the reduction of the price of gas. When Sir Joseph Heron argues that the improvements are paid for by the ratepayers at large, he makes a wide admission, for he knows very well that, in 1874, out of 79,600 ratepayers there were only 47,827 gas consumers. The reason, we

take it, is obvious. Gas in Manchester is much too dear. If a liberal reduction in price were made, an enormous increase in the number of consumers and in the consumption would be the result. Let Sir Joseph Heron go to a score of towns in the North, where gas is cheap, and he will find that nearly every householder, and in many cases lodgers take a supply of gas; but the Corporations in these cases do not make “ten per cent.,” and apply but small portions of their profits to public purposes. Let him go farther north to Scottish towns, in which practically everybody is a gas consumer, and he will find that in these places all the profits of the gas undertakings are applied in the reduction of price. We have so often repeated that we are almost ashamed to reiterate, that the “Scottish system” is the only sound one for the management of a corporate gas undertaking. The Gas Committee draw up a series of estimates, showing what is likely to be the cost of the undertaking for the ensuing year, and what will probably be realized from the working, and having regard to these facts they fix the price for the following year. Here all is plain and straightforward. The inhabitants and the ratepayers consume the gas, and whatever profit remains over is carried to the advantage of the next year in a reduction of price. This, as we have repeatedly said, is, we consider, the true principle upon which corporate undertakings should be managed and the profits appropriated. Let Sir Joseph Heron argue as he likes, he knows very well that the present generation of ratepayers had nothing to do with the first arrangement of the gas undertaking. They came into the concern when all was settled, and the Gas Committee had begun their course of making “ten per cent.” and appropriating a large sum for public improvements. We have always contested their right to do this, but Sir Joseph Heron attempts to make it clear that the Manchester Corporation have the power, under several Acts of Parliament, to apply the gas profits as they will. They have chosen to appropriate the greater part of these to what are called “public improvements.” The magnificent City Hall, costing a million of money, is one; and others, costing no less, have been paid for out of gas profits. This looks all very well; still, we consider that the consumer, *quod* consumer, is, to a certain extent, we will not say defrauded, but certainly deprived of his just rights, when gas profits which ought to go in reduction of price are applied in effecting what are called “public improvements.” It is, however, no use arguing this question. Sir Joseph Heron, who is practically the Corporation of Manchester, will have every year a large slice out of the gas profits, and it is only fair to say that very few of the inhabitants object to this course of procedure.

The inhabitants of Gloucester are still dissatisfied with the price charged for gas—3s. 8d. per thousand feet—and they recently sent a deputation to wait upon the Directors of the Gas Company, and seek for a reduction to 3s. per thousand feet. They met with a courteous reception, but the *non possumus* argument was urged, and there the matter ended. It would be well for gas consumers to give the Directors of a Gas Company credit for knowing how to manage their own affairs, and to remember, as the Chairman of the Gloucester Company put it, that they are only trustees for the Shareholders, whose interests they are bound to protect. We will not go so far as to say that the Shareholders are, under all circumstances, entitled to their full maximum dividends, although there is much to be said in favour of the view that such dividends should be paid whenever the earnings of the Company permit it, without reference to the price it is necessary to charge for gas so as to accomplish this end.

Gas affairs at Stone are in a very confused state. As our readers have been informed, the Local Board a short time since desired to set up competing works, and for that purpose applied to the Local Government Board for a Provisional Order to authorize them to do so, and to enable them to raise the necessary funds. After an inquiry by Captain Hildyard, one of the Board's Inspectors, he reported that it was undesirable to have competing works in Stone, the town being too small to support two gas undertakings. There are some curious facts in connection with this case. The works of the Gas Company seem to be situated in the very heart of the town, and only lime purification has hitherto been resorted to. The result is that a certain amount of nuisance has been created, as our readers will well understand. Lime purification always involves unpleasant emanations, and is perfectly inadmissible in the centre of a town. It has been arranged, however, that for the future oxide of iron shall be used instead of lime; and this substitution will remove the principal cause of annoyance. But after this the Company will have to settle accounts with the Local Board. It seems doubtful how much

profit has been made by the Company. One authority puts it at nineteen per cent., and another at ten per cent., or a little under. The one thing wanted by the Company is an Act to incorporate them with statutory powers, and for this purpose they have announced their intention of applying to Parliament next year. This will, it seems, satisfy the Local Board. Let us hope that it will.

In another column will be found the full text of the valedictory address of Mr. R. Mitchell, of Coatbridge, the ex-President of the West of Scotland Gas Managers Association, delivered at the meeting of the Association on the 29th ult. He considers, as we said last week, that the electric "scare" has been beneficial to the interests of the gas industry, inasmuch as it has caused managers and others to look farther afield for new means of cheapening and improving the production of coal gas. We quite agree with Mr. Mitchell in his view that improvements are required in the retort-house and the means used for firing the retort-settings. It is the opinion of many gas managers that great improvements in this direction may be effected by the use of the Siemens or Oechelhäuser regenerator furnaces. The employment of these systems by Gas Companies would, of course, leave them with a large stock of coke in hand. They would then, as Mr. Mitchell said, have to go in "for small profits" and quick returns; but this is scarcely satisfactory. We want to realize the full value of residuals, and not be required to make forced sales. Of course, the ex-President, like ourselves, is in favour of mechanical stoking. He is cautious not to express an opinion on any of the systems now under trial. Which of them is destined to come into most extensive use remains to be seen. It is not our province to express decided opinions when competing schemes are brought under our notice, and we shall not do so on this occasion—the rival inventors must fight for the merits of their own schemes. We content ourselves with thanking Mr. Mitchell for his interesting and instructive address, and are sorry we shall not hear more from him in his late capacity as President of the West of Scotland Association of Gas Managers.

The vaunted superiority of the electric light for lighthouse illumination—a superiority, however, not admitted by many of those well able to judge of its merits in this respect—is not always borne out in actual experience; as witness the following, which appeared in the daily papers at the close of last week:—The crew of the schooner *Conovium*, of Aberystwith, bound from London for Dublin, with cement, landed at Penzance on Wednesday morning, their vessel having struck on the Stag Rock, near the Lizard, on Tuesday night, and foundered. The captain attributed the disaster to the glare of the electric light at the Lizard, which made him believe that he was at a greater distance from the land than he actually was.

We would direct our readers attention to Mr. R. H. Patterson's article on the effects of temperature of gas and the air supply at the point of ignition upon the illuminating power of the gas, which appears in the present issue of the JOURNAL. On the 13th of January last we gave an account, translated from the *Journal für Gasbeleuchtung*, of a series of interesting experiments by Herr F. Siemens, on what he termed "Regenerative Gas Lighting"—that is to say, he described several ingeniously constructed appliances, by means of which the heat developed by the combustion of gas was made to warm the air and gas before they were allowed to combine at the point of ignition, the result being a decided increase in the illuminating power. Herr F. Siemens was led to make these experiments by the known success, in the furnaces which bear his name, of the principle of previous heating, by the waste heat of combustion, of the gaseous fuel and air for the production of intense heat; and as light is only a particular manifestation of intense heat, the inference might clearly be drawn that the agency which will increase the one would, if properly directed, also increase the other. The idea is not new, but practical difficulties have hitherto prevented its general embodiment in convenient and simple form; but it is just one of those principles, depending for success on certain characters in the materials and workmanship of the apparatus involved, which may have to wait many years after their first discovery until the time is ripe for their ultimate success. Mr. R. H. Patterson seeks to exemplify the bases upon which the utility of any process for previously heating fuel and air for combustion depend, with a view to the probability of further experiments in this direction, which, if properly directed and intelligently carried out, can scarcely fail to lead to useful results. It is scarcely necessary to refer to the increasing attention which is now being bestowed on gas-burners designed to give intense light, to show that no time could be more appropriate than the present for

any researches which will tend to increase our knowledge of a field of utility for gas, which has so far been particularly fruitful, even with the very limited amount of labour which has been devoted to it; and we shall look for great progress in this particular matter during the next year. The success which has attended the efforts that have been made so recently to produce gas-lamps capable of illuminating large areas, and the amount of favour which, considering their novelty, they have received, permits us to indulge in the hope that other successful developments of the same idea will speedily follow. The most that can be advanced against the new "lighthouse" style of burners is that they necessarily consume a large quantity of gas. What is wanted now is a burner which, by intensifying the light yielded by the combustion of as much gas as an ordinary burner usually consumes, and which may perhaps be done by concentrating the heat carried off by the products of combustion, shall take an intermediate place between the humble bat's-wing and the concentric "lighthouse" Argand; and we trust that such a burner may be an accomplished fact in the near future. It is a subject to which many of our readers, as we are assured, might devote some research, with credit to themselves and advantage to the cause of gas illumination; and we trust that Dr. Siemens will not in this matter remain without rivals in this country.

On the subject of the benefit arising from the Gas Companies amalgamations carried out in the Metropolis during the last few years, there is a note in a small work recently published by Mr. J. Quick, jun., M.Inst.C.E. With the book itself—"The Water Supply of the Metropolis, and the Proposed Transfer of the London Water Companies to a Public Authority"—we are not concerned in this column (a notice of it appearing elsewhere); but, when referring to the benefit likely to accrue from centralization of management, the author, after acknowledging that the JOURNAL has constantly pointed out the advantages which would have accrued from amalgamation of interests, though "the [Water] Companies" have turned a deaf ear to the suggestion," writes as follows in regard to the Gas Companies:—"According to information, for which we are indebted to Mr. J. O. Phillips, Secretary of The Gaslight and Coke Company, the amalgamation of seven out of nine of the Gas Companies formerly supplying the north side of the Thames, has already resulted in a saving of £40,000 per annum, and it is estimated by the same authority that this economy could be doubled if the whole of the existing Companies, north and south of the Thames, were united."

Water and Sanitary Notes.

It is highly satisfactory to see that the health of London continues to improve, and that nothing is wanted on the part of the Water Companies to make the improvement permanent. The two last reports received from Drs. Frankland and Tidy show a material improvement in the condition of the Thames supplies, and point to a day when even better results may be realized. We shall be bound to hear a good deal about the Metropolitan Water Supply, for the Council of that busy body, the Society of Arts, have resolved to hold a conference, to commence on the 24th inst. It will continue three or four days, if not longer, and, considering that Metropolitan water affairs only are to be discussed, we think the time laid out is ample. But then we remember that the chief speakers at the Society of Arts are verbose to a degree. Let Mr. Edwin Chadwick, C.B., for example, once get on his legs, and nobody knows when he will resume his seat. In fact, most of the speakers at the Society of Arts seem impressed with but one idea—that they must indulge in a certain amount of talk before they are deemed worthy of notice. What will the conference end in? We have a strong suspicion that when it is over, Metropolitan water affairs will remain in the same condition as now. When the several speakers have aired their oratory, and a few votes have been taken, we shall find ourselves in the position indicated when the sergeant-major says, "As you were."

A gentleman occupying a high position in one of the London Water Companies lately told us, in respect to the alleged increase in the profits of the Companies through the operation of the quinquennial revaluations, that if the matter were thoroughly looked into it would be found that the increased rates demanded of the Companies by the Vestries would almost, if not quite balance the advances they actually made on existing water-rates. "A Water Shareholder," writing to *The Times* last week, to some extent bears out this statement, and contends that the Com-

panies might just as fairly ask that the rateable value of their property should not be increased, as that they should be debared from advancing their rates. He states that the Companies in 1878, according to the last published accounts, paid rates and taxes (irrespective of income-tax) amounting to £85,867; while the present dividend on the ordinary share capital is £773,000. So that the parishes take 11·1 per cent. of the Shareholders profit. He concludes his letter by saying: "Not content with this, I am informed that in the quinquennial valuation being made this year some parishes are seeking to raise the Companies rateable value by at least 'fifty per cent.'"

That the Water Committee of the Liverpool Town Council—or rather, we should now say, "City Council," in view of the recent creation of a bishopric of Liverpool—intend pushing on during the present session of Parliament with their Bill for obtaining a supply of water from the Severn watershed, is evidenced by an answer given to a question asked at the meeting of the Corporation last week. The Town Clerk stated that a contract had been entered into for the purchase of an estate for £60,000. Of course, this has been done provisionally, subject to the passing of the Bill, which is every day getting more assured. The opposition to the scheme is considerably reduced to what it was. The details wisely given by the Corporation officials to interested persons have done much to allay the antagonistic feeling with which, in many quarters, the proposal to appropriate the River Vyrnwy was at first regarded. A discussion on the question took place at the Worcester Town Council last Tuesday, in the course of which it was stated by the Chairman of the Special Water Committee that they had good reason to anticipate a satisfactory conclusion to their negotiations for an amicable settlement of the objections entertained to the scheme on behalf of the town. As some of the principal opponents are thus to be got rid of, there is a prospect of a not very protracted fight when the Bill goes into committee.

The arbitration recently held, to determine the question as to the mud-banks alleged by the Conservators of the Thames to have been formed in the river by the discharge of sewage from the Metropolitan Board of Works pumping-station at Crossness, will be fruitful in costs, which will all have to be met by the ratepayers, either directly or indirectly. The twenty-five days the inquiry lasted were occupied by counsel and witnesses of the highest eminence, whose fees and expenses will amount to a good round sum in the total. The first indication—and that a very faint one indeed of the ultimate cost—is that at the meeting of the Metropolitan Board last Friday, the Works and General Purposes Committee's report recommended that a cheque for £1732 10s. be drawn, "being one moiety of the 'Umpire's and Arbitrators charges in the recent arbitration 'between the Board and the Thames Conservators.'"

DEATH OF MR. J. SHIPTON, OF CHESTERFIELD.—We regret to have to announce the death, on the 26th ult., of Mr. J. Shipton, of the firm of Shipton and Hallowell, Solicitors to the Chesterfield Water and Gas Company. The deceased gentleman was admitted as a solicitor about the year 1839, and commenced practice at Stroud, in Gloucestershire. In 1844 he went to Chesterfield, and entered the office of Mr. Charge, who was at that time Clerk of the Peace, and on whose death in 1849 he succeeded to the business. About the year 1850 he was joined by Mr. Hallowell, and since then the business has been conducted by these two gentlemen, who have acted as Solicitors to the Water and Gas Company from 1854. The firm are Clerks to the County Magistrates, as well as to a number of Turnpike Trusts, and their private practice is said to be unequalled in Chesterfield for extent. Mr. Shipton was several times returned as a Member of the Chesterfield Town Council, and in 1859 filled the civic chair, to which he was re-elected in the following year. The deceased gentleman's funeral took place on the 29th ult., when all the customary tokens of respect were shown by the principal private residents and tradespeople in Chesterfield; while at the gas-works the Manager (Mr. C. E. Jones) ordered business to be entirely suspended during the ceremony.

STOCKTON AND MIDDLESBROUGH WATER SUPPLY.—A special meeting of the Stockton and Middlesbrough Corporations Joint Water Board was held on Monday, the 26th ult., when the Chairman (Mr. T. H. Bell) explained that the Local Government Board had granted the Provisional Order applied for by the Water Board, and he had therefore called the meeting to consider whether it was desirable to increase the water supply. Mr. H. G. Faber having read the Order, Mr. E. Williams moved—"That the Provisional Order having been presumably obtained, Mr. Mansergh be requested to consider the whole matter and the position of the Board, and advise the Board how they can best supply the district, it being the opinion of the Board that 70 million gallons per week will be a sufficient supply for several years to come." Mr. Dunning seconded the motion. Mr. Bulmer said he did not see any probability of more water being required than could at present be supplied. He was opposed to spending £130,000 in constructing a compensation reservoir, and taking £5000 a year out of the rates, in the probability that a demand for more water might spring up. The Chairman suggested that no action be taken till the Provisional Order was obtained. In 1872 the maximum quantity of water (6 million gallons) was, he said, pumped on one or two occasions, but since then it had never been reached, and until lately the quantity consumed had declined. The increase in the price of iron brought an increased consumption of water. Iron was again down in price, and, if it remained so, no increase in the water supply would be required. Upon the motion being put, three members voted for, and four against it. The motion was therefore lost.

EFFLUVIUM NUISANCES.

SECOND ARTICLE.

In Dr. Ballard's report to the Local Government Board on effluvium nuisances, he devotes much space to the consideration of offensive emanations arising from the various processes concerned in the manufacture of gas, in the preparation of certain substances made use of in gas-works, and in the disposal of some of the residual products formed therein. Dr. Ballard appears to have taken especial pains to render this division of his inquiry as complete as possible, in the several points of investigation, description, and suggestion, and in so doing he trod what was to him familiar ground; for, as he informs us, he was concerned in an inquiry instituted by the newly-formed Association of Medical Officers of Health, of which he was a member, so long ago as 1857. This early investigation, which had as its principal object the determination of the nature and extent of the influence of the effluvia from gas-works upon the health of the community, had in that respect an aim identical with that pursued on a broader basis in the present inquiry, and eventuated, like the one under notice, in a confession of inability to discover evidence of cause or effect of the nature sought.

In the present instance, Dr. Ballard gives a detailed account of the process of gas-making, as gathered during visits which he paid to thirty different gas-works in London and the provinces. Commencing with the destructive distillation of coal in the retort, illustrating his description by a drawing of a setting of retorts as erected at the Vauxhall station of the late Phoenix Gas Company, he minutely describes all the fittings used in connection with such structures, from the ash-pan to the hydraulic main, not forgetting to mention and illustrate the peculiar arrangement in use at the Fulham works of the late Imperial Company, for supplementing the latter apparatus with a dry main at will. The mode of charging and discharging the retorts is then fully described, particular notice being taken of the operations of quenching the discharged coke with water, and clearing the ascension-pipes and mouthpieces of partially carbonized tarry matters. Proceeding to the next process, of charging the retorts with fresh coal, the difference between the modes of charging with scoop or shovel is commented on, with a result, of course, in favour of the former, special mention, moreover, being made of the advantage possessed by small scoops, filled, say, thrice for a large retort, over heavier scoops which would need only to be filled twice to contain an equal quantity. Backing up the charge is next described, and Dr. Ballard notes that the whole operation of charging retorts with three scoops full, backing up, and securing the lid, can be, and frequently is done by smart and experienced stokers in 35 seconds. This is, of course, good work—less experienced men would take longer; but shovel work is longest of all, and takes a full half minute longer than putting in the same charge with a scoop. Machine stoking does not appear to have entered much into Dr. Ballard's experience, as he does not mention any other examples than that of Dublin, where the Manager informed him that it had broken down, and Manchester, where the hydraulic stoker (Foulis's system) was said to work more expeditiously than hand labour; but of this no comparative evidence is afforded.

Before we follow Dr. Ballard in his subsequent description of the purification of gas, it will be best to take into consideration his remarks on the nuisance which may arise from the processes already described, and his suggestions respecting its mitigation or avoidance. As he says, both in the process of charging the retorts and of discharging them, more or less smoke escapes into the retort-house, and finds an exit from it by the various openings in the walls and roof. Much steam, of a more or less offensive kind, is given off when the coke is quenched. The process of discharging and re-charging goes on at orderly intervals throughout the day and night.

First, as to the smoke and offensive vapours from the retort-house, Dr. Ballard does not take much notice of the issue from the chimney-stack, which, as he says, is comparatively of no moment, especially where coke is used for fuel. The nuisance is from the smoke, &c., that escapes at a lower level from the openings in the walls and in the roof of the retort-house, and which, with some exaggeration, he describes as commonly beclouding the entire neighbourhood of the works. Secondly, as to smoke, &c., issuing during the discharging of the retorts, he admits that a charge thoroughly coked gives off, under the most favourable conditions, no smoke worth speaking of while it is being drawn; but as it sometimes happens that the charge has not become thoroughly coked when drawn, some parts at least are apt to be less perfectly distilled—or, as it would be called in technical language, burnt off—than others, and this is especially likely to happen to that part of the charge which lies nearest to the mouthpiece. Portions of the charge thus imperfectly carbonized give off smoke on being drawn. Or the choking of the ascension-pipe may give rise to an issue of smoky flame from the retort when the lid is removed. Concerning this latter occurrence, Dr. Ballard merely quotes the opinion of Mr. Wright, of the Bromley works, to the effect that it is less frequent when the use of the hydraulic dip is dispensed with, and makes no reference to the debateability of the general question, of which gas managers have so much experience. Thirdly, as Dr. Ballard says, during distillation a deposit of tarry and carbonaceous matters, partly dust from the charge, always accumulates in the mouthpiece, the comparatively low temperature of which favours the condensation of the former in this situation. When a retort is opened for drawing, such matter is found not only lining the lid, but lying in little heaps on the bottom or sides of the mouthpiece, and hanging from the roof of it. This accumulation is often added to by the stoker clearing the ascension-pipe before the charge is drawn. When the incandescent coke, as it is being drawn, passes over this tarry matter, it ignites it, and causes the evolution of large

volumes of offensive smoke. Few things produce more smoke in burning than tarry matters. It is the commencement of the "draw" which thus creates smoke, the succeeding portion seldom giving off any, since the surface of the mouthpiece has generally been scraped clean by what has gone before. The lower the temperature at which the coal has been carbonized, the more deposit there is in the mouthpiece, and consequently the more risk of smoke in drawing.

Concerning the issue of smoke during charging, which is the result of the first contact of the coal with the heated interior surface of the retort, when the coal begins to distil at a low temperature and the gases evolved, being rich in carbon, burn with much smoke, Dr. Ballard, of course, makes the quantity of smoke produced depend upon the time occupied in charging. He, however, states generally that the first evolution of smoke occurs about 12 seconds after the first scoopful has been introduced, without noticing the difference which might be due to the temperature of the retort. Then as to the quenching of the coke, which gives rise to a burst of watery vapour, mingling with or superseding the smoke that issues from the first portion of the drawn charge, Dr. Ballard states that this steam is more or less charged with sulphuretted hydrogen, due to the decomposition by the water of the sulphide of iron left in the coke after distillation. Coal contains a varying proportion of sulphur, the mean of eight varieties of English caking coal (such as is commonly used in gas-making) giving, according to Dr. Percy, 0.86 per cent. of sulphur, in the form of a persulphide of iron, only half of which sulphur passes off in the process of distillation. Highly sulphurous coals are avoided by gas-makers, on account of the increased purification which gas made from them requires; but more or less sulphur is scarcely avoidable, although in some gas-works Dr. Ballard says that he could detect but little odour of sulphuretted hydrogen in the vapour from the coke.

Having thus dealt with the principal causes of offence arising from the retort-house, Dr. Ballard mentions, confessedly as a small matter, the possible nuisance arising from the leakage of tarry and gaseous matters from imperfectly closed retort-lids, which, we should have thought, must, in general, be a very small matter indeed, and one which would be considered a much greater evil by any smart carbonizing foreman, for obvious reasons, than by any disinterested official Inspector. Dr. Ballard, however, deems it of sufficient importance to necessitate the drawing of a comparison between luted and Morton's patent lids for preventing leakage, though without coming to any final preference for either system.

Proceeding now to the remedies for the preceding nuisances, which, as Dr. Ballard says, may almost be deduced from the description of their nature and origin already given, he makes the following suggestions. First, the smoke produced during the drawing of the coke may be reduced to a minimum by distributing the charge of coal in such a way that its conversion into cokes shall be equable throughout its bulk, which is, of course, a *desideratum* for other reasons, as gas managers do not require to be told; by careful and effectual "backing up," the coal being pushed well back into the retort; by keeping the ascension-pipe clear, which should be looked to after the charge is drawn; by careful scraping and cleansing of the mouthpiece from tarry deposits, before the charge is drawn, the matter so removed being taken away altogether, or thrown on the coal to be used in a future charge, and not left where the coke may fall in it; and, lastly, by quenching the first portion of the drawn coke immediately after it falls, and not, as sometimes happens, after the charge is half or three parts drawn.

The smoke produced in charging is lessened by the rapidity of the process. Scoop charging is, therefore, preferable to shovel charging, and Dr. Ballard recommends the use of several scoops—as many, in fact, as the retort is required to take, which might be filled beforehand, and laid ready to be run in one after another. Dr. Ballard mentions the occasional throwing in of a shovelful of coal after the scoops, to put a greater thickness of coal over a thin part of the retort, the time necessary for which may make all the difference between smoke and little or no smoke. The remedy, as he remarks, is a new retort.

The nuisance from sulphurous vapour given off in quenching the coke is one for which the use of lime mixed with the quenching water has been suggested, but, as Dr. Ballard says, without having been practically adopted anywhere, as it would impair the appearance of the coke, and damage its sale, and moreover its efficacy for the purpose intended is more than doubtful. The occurrence of this kind of nuisance would, however, betray the existence of such an amount of sulphur in the coal, that its use would probably be given up on the grounds previously indicated.

It will be seen that a due observance on all occasions of the above regulative conditions would imply nothing short of perfection in the construction, management, and working of retorts; and although it is a regrettable fact that the highest possible standard in these matters is neither understood nor enforced in every gas-works in the kingdom, yet there are many places where great attention and skill are devoted to compassing these same ends, which are dwelt upon with such emphasis by Dr. Ballard; and even there we fear that their complete realization is regarded as something to be dreamt of rather than attained. Nuisance from the retort-house is but another name for loss of gas, or careless waste of money in many different ways, and a good gas manager does not need an official reminder of that fact. Still, some smoke, and a considerable quantity of steam, must always arise from the operation of distilling coal and cooling the residual coke, and therefore the best provision should be made for their dispersion into the atmosphere with as little annoyance to the surrounding population as the circumstances of the case permit. To this end nothing more can be done than attending to the design of the retort-house itself, so that smoke and

steam may only be discharged at considerable elevation through the roof. Free ventilation such as this would imply would also be a great boon to those who are employed in the retort-house, and this fact is practically recognized in the spacious and airy structures which are now generally replacing the cramped and reeking black-holes in which, even in important establishments, retorts and stokers used to be packed, without much reference to the comfort either of the suffering humanity within or without their walls.

In concluding this part of our notice of Dr. Ballard's labours, it is pleasing, therefore, to note that, in his capacity as a Medical Officer of Health, his recommendations are in strict accordance with the ascertained interests of both employer and employed, and that modern progress in this particular direction, starting from a somewhat different base, and impelled by independent motives, bids fair to reach the same goal as that to which his own aspirations are directed.

THE LONDON WATER SUPPLY.*

The plan of this little work is an amplification of that which appears as an addendum to the Author's previous treatise on "The Rating of Gas and Water Works."† Mr. J. Quick considers it desirable that the Water Supply of the Metropolis should be in the hands of a Public Authority; but he likewise shows that great improvement might have been effected had the Companies amalgamated their undertakings. In discussing the policy of amalgamation, the Author refers to the part taken by the JOURNAL in urging the London Water Companies to adopt this principle, and he regrets that our appeals should have been made in vain. The outlay of two millions and a quarter, in pursuance of the Act of 1871, might have been "very considerably reduced" under a system of united instead of separate works.

Much is being said in certain quarters as to the possibility of introducing the principle of competition into the working of the Metropolitan Water Supply. It is contended by some of the opponents of Sir R. Cross's Water Bill that the London Water Companies "have no monopoly," and that this should be taken into account in estimating the value of their undertakings. Mr. J. Quick deals very lucidly with this part of the question, and quotes the Appendix to the Report of the Sanitary Commissioners of 1845, where an account is given of the competition which once existed between the three South London Water Companies. Competition has been tried—or, rather, it has been permitted—and the results were so unsatisfactory that Parliament has legislated on the assumption that competition is henceforth out of the question. The extent to which Parliament is willing to go in the direction of authorizing a competing supply is shown by the Public Health Act of 1875, where it is set forth with regard to the water supply in the provinces that "it shall not be lawful for the Local Authority to construct water-works within such limits [i.e., the limits of supply of any Water Company empowered by Act of Parliament], if and so long as any such Company are able and willing to supply water proper and sufficient for all reasonable purposes for which it is required by the Local Authority;" and any difference on this point is to be settled by arbitration. As Mr. J. Quick observes, this enactment practically affords protection against competition to all Water Companies established under Act of Parliament. But the case of the London Water Companies is still stronger, the Metropolis having no share in the privileges granted to the provincial Local Authorities by the Act just cited. As concerning competition by private enterprise, that was unequivocally condemned by a Select Committee of the House of Commons in 1821, and by the Sanitary Commissioners in 1845.

It is too late in the day to argue that competition is permissible in the case of the London Water Supply. The Companies have been encouraged to expend money, and have been called upon to make certain costly arrangements, on the implied basis of what must be termed a regulated monopoly. So long as the Companies do their best to fulfil their responsibilities, they are obviously in a position to claim protection. But the utter uselessness of competition is shown by past experience, and the doctrine has been laid down "that the principle of competition cannot with advantage be applied to the operations of the London Water Companies." Such was the view of the Sanitary Commissioners who reported in 1845, and of the Select Committee 24 years before. The fact that at the present time there is no single instance to be found throughout the United Kingdom of competing Water Companies, shows the unreasonableness of expecting or demanding such a state of things in the Metropolis. Where competition has been attempted, amalgamation has resulted, accompanied by "the creation of a double capital entitled to statutory dividends," to the consequent damage of the consumers.

Mr. J. Quick repeats in his present work a position which he maintained in his former brochure, that "it is not the business of the purchasing authority to inquire into whether the sellers would gain or lose by the transfer, but to see that they, as purchasers, will get value, present and prospective, for the money of those whom they represent." Such was the principle on which the Metropolitan Board acquired the toll bridges over the Thames. The terms of purchase were settled by reference to the income-earning power of the bridges, irrespective of their original cost. Had these bridges been highly profitable undertakings, it is possible that the Metropolitan Board would have urged the adoption of a different principle; but we cannot suppose that the argument would have been of any avail. The fact that the water supply yields a large and

* "The Water Supply of the Metropolis, and the Proposed Transfer of the London Water Companies to a Public Authority." By Joseph Quick, jun., M. Inst. C.E. London: E. and F. N. Spon. 1880.

† See *ante*, p. 438.

growing profit is to be taken as the basis of value, just as surely as the earning power would furnish the basis in the case of a losing enterprise. Mr. J. Quick goes into the reckoning to show that the terms of purchase laid down in the Bill of Sir Richard Cross are favourable to the inhabitants of the Metropolis, although beneficial to the Water Companies. We may, indeed, observe that according to the doctrine espoused by political economists, a trading transaction is one in which both parties are benefited. It is in this respect that trading differs from spoliation on the one hand, and gambling on the other.

Concerning the mode in which Mr. J. Quick has handled the entire subject of the Water Supply of the Metropolis, we can only do this gentleman the justice to say that he has put the question very clearly, and discussed it very impartially. The book, which is of no great size or cost, ought to be in the hands of every one who wishes to know what can properly be said in defence of a scheme of purchase such as that brought forward by the late Government. There is also much useful information in the book as to the history of the Metropolitan Water Question, rendering it valuable to all parties, whatever their particular views may be.

Communicated Article.

EFFECT OF TEMPERATURE IN THE GAS AND AIR SUPPLY UPON THE ILLUMINATING POWER OF GAS-FLAMES.

By Mr. R. H. PATTERSON, F.S.S.

The recent experiments of Herr F. Siemens (reported in the JOURNAL of the 13th of January last) bid fair to revive and give practical interest to some comparatively old questions connected with the illuminating properties of coal gas. He has constructed gas-burners, or rather lamps, in which both the air and the gas are heated; and although he does not state the results precisely, and apparently has not yet determined them with the accuracy which he desires, his report unequivocally shows that the employment of the said apparatus gives a vast increase in the illuminating power obtained from the gas.

I shall describe Herr Siemens's experiments in the sequel, but shall first treat of the subject generally. The question is two-fold—viz., what is the effect of a higher or lower temperature in the air supply to gas-flames as regards their luminosity? and what is the effect of a higher or lower temperature of the gas itself, as supplied to the burner, or rather at the point of ignition?

There is a very important difference between these two cases. In both, a rise of temperature involves, and is necessarily accompanied by an expansion or dilatation of the substance, whether gas or air. Accordingly, a larger volume of heated or rarified air is required to supply any given quantity of oxygen necessary to produce combustion of the ignited gas; and, *cæteris paribus*, a larger volume of heated gas passing through the burner within a given time is requisite to supply any given quantity of light-giving substance. But the point of difference is, that all the constituents of coal gas are combustible in a very high degree, whereas nearly four-fifths of the air, or atmosphere, consists of nitrogen, which is absolutely incombustible. Accordingly, the effects of heating the air supplied to flames must be considerably different from those attending the heating of the gas itself. The difference is exactly similar to heating the coal in a furnace, and heating the air supply to the furnace, or to the ignited coal.

The value of the "hot blast" in producing an intense combustion in furnaces is well known; but as yet little attention has been given to the heating of fuel in furnaces, which would be a parallel to heating coal gas previous to its ignition. If a furnace be fed by cold air, the four-fifths of the air which consists of nitrogen will all be heated to the same temperature as the furnace, and thereby must absorb a corresponding portion of the furnace heat which otherwise would go to intensify the combustion. Therefore the advantage to be gained by heating the air supply is obvious; for the higher the air is heated before admission into the furnace, the less will be the amount of heat absorbed by the incombustible nitrogen. The same is true of the oxygen; but I believe that almost, if not absolutely, the whole advantage of heating the air supply arises in connection with the incombustible part of it. If it is borne in mind how immensely the mere act of ignition (that is, the mere chemical combining of the oxygen with the fuel) at once raises the temperature of a highly combustible body—for example, raising coal gas from the ordinary temperature of, say, 70° Fahr. to about 5000° Fahr.—it is obvious a prior heating of the oxygen to any lesser extent can have little or no effect. On the other hand, a prior heating of the nitrogen to the extent of merely 300° or 400° Fahr. will lessen the absorption of heat from the furnace to an exactly equal, and therefore very considerable amount. Hence, as it seems to me, the advantage of the hot blast is almost or entirely owing to the fact that the air contains such a preponderance of incombustible matter. In other words, if this view be correct, there could be no appreciable advantage at all from the hot blast, or from heating the air, if the air consisted wholly of combustible or combustion-supporting gases, like oxygen.

Now, this is just the case with coal gas. By far the larger part of coal gas consists of gases which give little or no light; but all of it is combustible, and in the highest degree. Accordingly, when ignited, every portion of the gas contributes to the intensity of combustion, adding to the temperature of the flame. Thus, then, there is obviously a great difference to be expected between the result of heating the air supply to a gas-flame, and of heating the gas itself; and, according to the view above expressed, a certain gain in illu-

minating power (owing to higher intensity of combustion) may, *a priori*, be expected from heating the air supply to a gas-flame (or any other), but no gain at all, or no appreciable gain, from heating the gas itself. As already said, when ignited, coal gas at once acquires a temperature of about 5000° Fahr., and what effect is to be expected from previously heating it to the extent of 500° or 600° Fahr.?

HEATING THE AIR SUPPLY.

It was the Rev. Mr. Bowditch (doubtless as a wise inference from the "hot blast") who first made experiments in heating the air supply to gas-flames with a view to increase their illuminating power. In doing so, he resolved to make the gas-flame heat its own air supply; and this he accomplished by the simple means of putting an extra chimney around the Argand. His apparatus was a common Argand and chimney, with another and larger chimney placed around it; the arrangement of parts being such that the whole air supply to the flame descended through the outer chimney, and then entered at the bottom of the inner and ordinary chimney. The heat radiated from the flame proved sufficient (it is stated) to heat the air between the two chimneys to a temperature of from 500° to 600° Fahr. Dr. Letheby, in 1866, stated that the result of heating the air supply in this manner was to increase the illuminating power about 67 per cent.; and "for equal lights," he said, "it is found that there is a saving of 46 per cent. of gas." He gave the following experiments, made with canal gas—quality not stated, but probably of 24-candle power, like the canal gas then made in London:—

Illuminating Power, in Sperm Candles, burning 120 grains per Hour.

Consumption of Gas per Hour.	Ordinary Argand.	Ditto with Extra Chimney.
2.2 cubic feet.	.. —	13.0
2.6 "	.. —	15.5
3.3 "	.. 13.0	21.7
3.7 "	.. 15.5	—

These experiments are not so complete as is desirable, for only in one of them (the third) can a direct comparison be made. From such experiments alone, I do not think it safe to accept Dr. Letheby's 67 per cent. as a normal result. Nevertheless, it is manifest that the effects of heating the air supply by means of the double chimney were highly advantageous to the illuminating power of the gas.

It is important to observe, however, that Dr. Letheby stated that "he did not find a like increase of illuminating power with common gas." Nor does he say that he found any increase at all with common gas, although obviously he had tried the apparatus upon it. It may be presumed that the experiments with canal gas were made by himself, but his language, unfortunately, leaves it doubtful whether all his statements are from his own experience, or whether part of them are taken at second hand.

Effects of Heat in Rarefying the Air.

Nature is very simple in her principles, but exceedingly complex and conflicting in her phenomena. When all the facts of a case are understood, every question becomes simple. But while experimenters or other investigators are still groping, they constantly meet with phenomena so conflicting that they feel at a loss to find an outlet from the maze. Now, in this question of heating the air supply to gas-flames (or any other) there is one conflicting phenomenon which deserves to be noticed. In proportion as air is heated it becomes rarefied; and, as is now well known, the more rarefied the air, the less light is obtainable from a flame. This fact was first observed in the course of experiments made with flames at a high altitude. Humboldt, when journeying in the Andes, had noticed that the flames of a fire did not present their ordinary appearance, but "dispersed and leapt about;" no doubt because, owing to the thinness or specific lightness of the air at these altitudes, there was less difference than usual between the heated mass of the flames and the surrounding atmosphere; and also, perhaps, because the temperature of the flame itself (and consequently its ascending power) was less than usual; and hence the flames did not rise or shoot up in the ordinary manner.

The effect of the thinness of the air in high altitudes upon the illuminating power of flames was first observed by Dr. Frankland and Professor Tyndall in the autumn of 1859, when they were making experiments on the combustion of candles at the top of Mont Blanc. They noticed that although the candles burned at the same rate as they did in the Valley of Chamounix, yet the flames were blue, and large and feeble. Dr. Frankland was so much struck with the phenomenon that he afterwards made it the subject of careful investigation; and he found that a gas-flame, like that of a candle, gave less and less light as the air in which it was burning was rarefied. His results, as stated by Dr. Letheby in 1866, "show that the loss of light is about 5.1 per cent. for every inch of diminished mercurial pressure up to a rarefaction of 14 inches. If, for example, the light of a flame be equal to 100 at 30 inches of the barometer, it is but 94.9 at 29 inches, and 89.8 at 28 inches; and so on up to 14 inches, when it is only 18.4 per cent. of the original light. Fortunately, in our photometrical inquiries the loss of light is equally great with the gas and the standard, or the variations of atmospheric pressure from day to day, or even from hour to hour, would show a marked difference in the value of the light. As it is, a variation of 3 inches of the barometer must cause a difference of more than 15 per cent.; and it is not improbable that this may have something to do with visible variations in the light of the public lamps. Certain it is that the same gas in places at different altitudes will have very different values. The gas, for example, which in London has the value of 100, would be but 91 at Munich, and only 61.5 in Mexico. Indeed, the difference would be greater than this, for not only is the light actually less for equal consumptions, but as the volume of the gas

expands with the rarefaction and temperature, the real value of the same quantity of gas as measured by the meter in Mexico would be only 46·2. Even in London the difference in the value of the light when the barometer is 31, as compared with what it is at 28, is fully 25 per cent."

Now, what is the import of these facts in the present inquiry? If you heat the air, you rarefy it, and therefore diminish the illuminating power of the flame which burns in it. Therefore, one effect of heating the air supply to a flame must be detrimental. But, manifestly, from the experiments with the double-chimneyed Argand, this detrimental effect must be much more than compensated by the other effect—viz., the hotness of the air in promoting intensity of combustion, by lessening the cooling influence of the surrounding air upon the flame. The former of these effects, however—viz., the detrimental one—has not hitherto been considered; and as the experiments upon heating the air supply are as yet inadequate for the ascertainment of trustworthy results, it seems desirable that further experiments of this kind—with the double-chimneyed Argand or otherwise—should be made.

HEATING THE GAS.

Next, as to heating the gas itself. Upon this point two opposite opinions used to exist; and possibly they exist still. The Leslie burner was constructed expressly with the object of heating the gas before it issued from the orifices. It was an Argand, with separate small metal tubes for each of the gas streams, or jets, which together compose the circular flame of the Argand. Whether this arrangement really effects its proposed purpose—in other words, whether the gas is in this way more heated than it is in the gas chamber of the ordinary Argand—appears to me very doubtful; because, although a larger surface of the gas is undoubtedly exposed to the heated metal of the small tubes (which acquire heat by convection from the gas-flame) than occurs in the hollow chamber of the Argand, it is equally true that these small separate tubes present in turn a larger surface to the cooling action of the atmosphere, whereby heat cannot accumulate or remain in them to the same extent as in the body of the Argand. Be this as it may, the Leslie burner certainly did not evolve so much light from the gas as the Sugg-Letheby, and proved still more inferior to the standard Argand. If I correctly remember the results of experiments which I made with the Leslie burner in 1868-69, its light, as compared with the Sugg-Letheby, was as 88 to 100. This result, however, was doubtless owing in part to other causes than the heating of the gas. The important effect of the structure of a burner upon the light obtained from it is well known, and of course it is possible that the heating of the gas made the Leslie burner better than it would otherwise be—or it might have made it worse—or, just as likely, had no effect at all.

The other view of the matter was, that the gas ought to be kept cool, and that the cooler the gas as it issued from the burner, the greater was the amount of light obtainable from it. This used to be Mr. Sugg's opinion; and although he had at first employed steatite for the rims of his Argands, simply because it was an incorrodible substance, and thereby preserved unimpaired the shape and size of the orifices of the burners, he soon afterwards came to employ this material, because, owing to its non-conducting property, it became but little heated by the gas-flame, so that the gas within the burner was kept as cool as possible.

No exact information upon such points had then been acquired. But there was one circumstance which was strongly in favour of Mr. Sugg's opinion. I find it stated (but without the experimenter or observer being named) that it had been observed that when the gas was heated the flame declined in illuminating power. Nevertheless this circumstance was seen to be of little or no account in determining the question; for the decrease of the light was attributed to the narrowing of the orifices of the burner owing to the expansion of the heated metal, whereby less gas issued from the burner.

Effects of Heat in Rarefying the Gas.

Another cause, however, may have been that when the gas becomes heated it considerably expands; so that, even if the same volume of gas continued to issue from the orifices, this volume would have less weight, and would contain a less quantity of illuminating substance. A high authority has said that to heat gas is equivalent to "diluting" it. But this is wrong; there is no dilution, only dilation,—the gas remaining pure, but occupying more space; so that if it passed through the burner at the same rate (i.e., in the same volume per hour) as before, the gas would be thinner, and would necessarily contain less illuminating substance. In so far as this actually occurred, it would *pro tanto* account for the observed diminution in the light of the gas-flame.

Further, however, this expansion of the gas would tend to impel the gas at a quicker rate through the orifices of the burner. The pressure behind remaining the same, while the gas within the burner increased in bulk, the tendency would be for the gas to be driven through the orifices more rapidly than before. Now this would affect the illuminating power exactly as an increase of pressure does. In fact, the result of increased pressure, and the cause of its damaging effect upon the illuminating power of the gas, is the increased velocity of issue; just as must, to some extent, occur when the gas is heated within the burner.

Thus, then, if the effect of heating the gas be made in such a manner that a less weight of gas issues from the burner per minute (owing to dilation of the gas, or contraction of the orifices of the burner, or both) then, obviously, the gas will contain less illuminating substance; and, therefore, a decrease of the illuminating power may be owing entirely to this fact, and not be an effect of the gas being at a higher temperature than usual at the moment of ignition. On

the other hand, if, in consequence of its expansion, the gas passes so much more rapidly through the orifices as to compensate for its dilation—in other words, if its expansion be one-fifth, while its velocity is increased one-fifth—then the same weight or amount of illuminating substance will issue from the burner per minute as before; but the effect upon the illuminating power will be the same as if the pressure had been increased one-fifth, or 20 per cent.—and this effect in the case of an Argand would certainly be injurious. This, whether the result of heating the gas be to send through the burner the same volume as before, but of thinner gas; or whether the result be that a proportionately larger quantity of this thin gas is passed through, but under greater pressure or with greater velocity, either of these two results will *per se* be detrimental to the illuminating power of the flame.

Experiments at Munich.

In 1870 a series of experiments, as to the effect upon its illuminating power of heating coal gas, were made in the laboratory of the University of Munich, which may be summarized as follows:—The normal temperature of gas was taken to be 64½° Fahr., and the illuminating power of the gas at this temperature, as the standard, was represented as 100. The burner was attached to a U-tube, which was immersed alternately in a freezing mixture and in a liquid at high temperature. When the U-tube was immersed in boiling water (temperature 212°) the illuminating power of the gas-flame rose from 100 to 104; and when melted paraffin was substituted for the boiling water, and the temperature of the gas thereby increased to 288° Fahr., the illuminating power of the flame rose to 118—showing an increase of 18 per cent. in the illuminating power of the gas as the result of the rise of temperature.

A report of these experiments reached this country when I was engaged in preparing the Gas Referees report "On the Construction of Gas-Burners with reference to the Principles of Gas Illumination," issued in June, 1871, and I resolved to make some experiments on the subject. These I carried out with the co-operation of the late Mr. W. Thompson, who was Chemical Assistant to the Referees, and whose premature death I deeply regretted, both from personal regard, and because his abilities, if adequately applied, would have given him no mean place in the ranks of the chemical profession.

In order to test the correctness of the results obtained at Munich, and generally to ascertain for myself what effect temperature has upon the illuminating power of gas, I made the following experiments, as narrated in the report; the temperature of the room, and consequently of the ordinary gas, being about 65°, or exactly the same as the normal temperature of the gas in the experiments at Munich:—A 12-foot coil of half-inch metal pipe was placed in a water-bath; a metal pipe 18 inches long led from the top of the coil to the burner; and midway between the coil and the burner a thermometer was inserted in the pipe in such a manner that the gas passed over the bulb. The water was then raised to the boiling point (212° Fahr.), but the thermometer in the gas only rose 1° or 2°, and remained stationary. Oil was then used instead of water, and the coil was lengthened from 12 to 56 feet; nevertheless, when the oil was raised to its boiling point (about 400° Fahr.), the thermometer in the gas only rose to about 79° Fahr. Inferring (perhaps, as will appear, too hastily) from this, that the gas in passing through the coil failed to absorb the heat from the surrounding oil, large shot were introduced into the coil of pipe, in order to conduct the heat inwards, and bring the gas at all points in contact with heated metal. Even then the thermometer hardly showed any further rise of temperature; but it was incidentally observed that the quicker the gas was sent through the pipe, the greater was the rise of the thermometer, although, of course, the gas was then for a shorter time in contact with the heated metal.

This fact seemed to show that we had been working in the wrong direction, and that the stationary position of the thermometer was not so much owing to a difficulty in heating the gas in the coil, as to the rapidity with which, after leaving the coil, the gas lost the heat so acquired. Accordingly, in the subsequent experiments, we surrounded the pipe leading from the coil with a jacket filled with boiling oil, and extending to within two inches of the point of ignition, the thermometer being again placed between the coil and the burner. The effect of this change in the apparatus was striking; the thermometer in the gas at once rising to 296° Fahr.—i.e., to the highest temperature attained in the experiments made at Munich, and which, according to those experiments, produced an increase of illuminating power to the extent of 18 per cent.

Having thus obtained as high a degree of heat as was employed at Munich, we made a bye-pass from the meter to the burner, through which the cool or unheated gas might be supplied to the burner; and the apparatus was so constructed that the burner could be supplied instantaneously with cool and with heated gas alternately, so that any change of illuminating power produced by a high or a low temperature of the gas could be readily noticed. But the heated and the cool gas gave exactly the same amount of illuminating power. In other words, the effects of heating the gas were nil.

(To be continued.)

THE Directors of the Imperial Continental Gas Association state that at the forthcoming ordinary half-yearly meeting they will (subject to the audit of the accounts) recommend a dividend of 5 per cent. for the half year ended the 31st of December last, and a bonus of 1 per cent., both free of income-tax.

SALE OF SHARES IN THE EXETER GAS COMPANY.—On Tuesday last, Mr. R. W. Best offered for sale 1000 £10 ordinary shares in the above-named Company. They were sold in lots of ten and five shares each, the tens realizing from £120 to £122, whilst the lots of five were disposed of at from £60 to £62 each lot. The competition was brisk, and the sale was well attended.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

PUMPING GAS AT BECKTON.

SIR,—Referring to Mr. G. C. Trewby's letter in your JOURNAL of the 4th inst., we would beg to call that gentleman's attention to our tender for the works at Beckton, dated the 5th of February, 1879, and to the drawing which we sent with that tender. This drawing, if Mr. Trewby will compare it with the arrangement engraved in the JOURNAL of April 20, he will find corresponds exactly with it; and, in fact, is the same arrangement that we then submitted to him for his approval.

If Mr. Trewby will kindly also refer to our letter to him of the 3rd of February, 1879, he will find that we then advised him that we had invented an arrangement by which we had quite overcome the oscillation in the exhausters; and again, on Feb. 6, we stated: "We shall be glad to give you any information on the subject of non-fluctuating exhausters, and explain to you our system, if you would kindly give us a call, or make an appointment to see us at Beckton. We have already supplied machinery on this improved plan, and are also making a set for your own Company at Bromley station."

Further, our Catalogue of 1877 was forwarded to Mr. Trewby, and his attention was personally called to fig. 314, page 14, in which a *fac simile* of the arrangement as engraved in the JOURNAL is shown and fully described.

GWYNNE AND CO.

Essex Street Works, Strand, W.C., May 4, 1880.

HIGH PRESSURE IN TRUNK MAINS.

SIR,—Permit me to ask if it would not be better to look straight at the cost of duplicate or enlarged mains for increased delivery, rather than increase the pressure by pumping. I have always found that increased pressure in gas-mains results in loss by leakage and condensation, which increase in exact proportion to pressure; while an enlargement of area has invariably repaid its own outlay in a short period.

Birmingham, May 7, 1880.

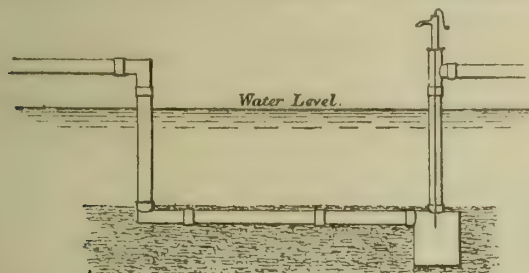
THOMAS PROUD.

CONVEYING GAS ACROSS SMALL NAVIGABLE RIVERS.

SIR,—Will you please find space in your JOURNAL for the following queries:—

I am anxious to carry a supply of gas across a river—say, a 4-inch pipe. The depth of water averages 12 feet. The sides of the river are connected with a flap bridge, which is subject to be lifted daily, to allow small vessels to pass. The sludge at the bottom of the river would secure a pipe from contact with the keels of vessels.

By carrying a pipe down one side, across the bed of the river, and up the other side, with syphon and pump fixed, as per annexed diagram,



what amount of loss by, and trouble with condensation should I have? Altogether there would be about 40 feet of pipe immersed, and the temperature would rarely be below 40° Fahr.

Would wrought or cast iron be best for the purpose? The river being subject to tidal influence is impregnated with sea water.

Would a hose across the bridge, with the necessary connections, be preferable? in which case the supply of gas would be intermittent in the daytime only.

I may state that the present consumption of gas would not warrant a holder being erected on the opposite bank of the river, though I anticipate that in future years this will be the best of all ways of getting over the difficulty.

Perhaps some of your able correspondents will enlighten me on these points, and their answers may be useful to others. I have never seen this subject propounded during the fourteen years I have been a subscriber to the JOURNAL.

D. W.

THE MANUFACTURE OF SULPHATE OF AMMONIA.

SIR,—The lamentable and sudden death of one of the chief officers of my Company has delayed my reply to Mr. Stevenson's letter of the 24th ult.

Instead of enunciating his own opinions by statements of facts or by arguments of reason, your correspondent is driven to the desperate expedient of asking questions, and ascribing dishonourable motives to myself, and imputing to the witnesses of eminence and probity called on the occasion, that their evidence was not the result of honest convictions. In justice to these gentlemen, and on their behalf, I deny the impeachment.

Mr. Stevenson's right to question me is not made apparent in his letter, and from whence his authority to criticize the mode of working of this Company is derived, he leaves your readers to conjecture. As to his first question, he will find an answer to it in the evidence that the apparatus was in perfect order, and perfect of its kind.

The second question refers to my absence from these works at midnight, and I am constrained to admit that at the time, like many other engineers and managers, I was indulging in what a great poet calls

"Tired nature's sweet restorer, balmy sleep."

I venture to hope that your correspondent was enjoying the same inestimable blessing. At no time are my works, or any other well-

conducted gas or water works, at any time, day or night, left without a competent man in charge, nor without instructions written or printed.

Question 3.—I have the honour to number amongst my friends both Mr. Oliver and Mr. Taylor; but why Mr. Stevenson asks this question I am at a loss to understand, unless it be to create an impression that they were not the witnesses of truth—an inference which those who know those gentlemen would resent. The case was watched on behalf of one of the deceased workmen.

Question 4.—The answer to this will be found in my last letter.

It appears that Mr. Stevenson's still is "quite a different thing from the Coffey still," and he claims that the salt made by it is superior to samples from some of the largest works in the kingdom. Further information on this point should be forthcoming; but assuming it to be so, though I have never seen his salt, it does not appear to have occurred to Mr. Stevenson that his modesty might have permitted others to discover and to proclaim the fact.

CHARLES EDWIN JONES.

Gas-Works, Chesterfield, May 7, 1880.

THE BRAY LANTERN AND BURNER, AND MR. SUGG.

SIR,—Though I had intended my letter in your issue of the 20th ult. to be my final one on this subject, I feel that I must ask to be allowed to trespass again on your space, in order to deal with Mr. Sugg's last change of position in his attempt to clear himself from the charge that he has adopted my system of lighting; and as I desire to keep strict faith with yourself and your readers in everything I do in this matter, I wish to make a remark or two regarding the drawing of my first lamp patent (No. 1454 of 1879), which you inserted in your issue of April 20, and which Mr. Sugg states "was not a copy" taken from my specification, and that the alteration was made to "mislead your readers." Had I, instead of giving data for all the important facts I have stated, shielded them from your readers by such sophistry as Mr. Sugg uses, and did I constantly shift my position, as I have shown him to have done, there would then be just ground for the charge that I was attempting to "mislead your readers;" but I will show that there is not the slightest ground for that statement, and will fasten the charge on Mr. Sugg in a way he will find it difficult to get out of satisfactorily before your readers.

It is now well known that part of my lamp improvements consists in "causing a column of air (other than what is required for combustion and ventilating purposes) to flow vertically through the centre of street and other lamps. The air is made to pass up in such volume and at such a rate of speed as will steady, increase the brilliancy, and give control over the lighting power of the flame or flames submitted to its influence." The specification in my first lamp patent (No. 1454 of 1879) shows that the air for this purpose may be taken in either at the bottom or at the top, as may be desired. The sectional drawing accompanying the specification from which the sketch I sent was taken, shows the whole of the parts necessary for taking in the air either at the top or at the bottom of the lantern, and both modes are fully described in the specification. Figs. 1 and 2, in your notice of April 20 (which embody the improvements of my second lamp patent—No. 3347 of 1879), show my improved mode of taking in the air at the bottom; fig. 3 (patent No. 1454 of 1879) was, therefore, only required to illustrate the mode of taking in the air at the top. I therefore showed in that drawing only the parts necessary for carrying out my principle by taking in the air at the top, and left out the arrangement for taking in the air at the bottom, because the improved mode of doing so was shown in figs. 1 and 2. The parts I showed were a transcript of my patent drawing, with the exception—for clearness and brevity—that more arrows were used to show the direction of the air currents, and the letters, 46 in number, left entirely out—a plan I observe you also adopted in the complete sketch which you published. If your readers will kindly refer to your issues of April 20 and 27, they will see that my draughtsman, though he had to reduce the sketch, has scarcely departed in the slightest particular from the patent drawing. Had your readers been able to see my full specification along with the lettered drawing, as Mr. Sugg has done, they would have perceived, without the above explanation, how false is his charge that I had altered my drawing, and that I had done it to "mislead your readers."

I have now to deal with the drawing Mr. Sugg sent you, which he stated to be a copy of his "shadowless lantern, registered in 1879." In passing, I would say that in his letter in your issue of the 13th ult. he stated, in language that could not be mistaken, that this lantern was patented Jan. 27, 1879, thereby "misleading your readers," including yourself and myself, as in my letter of the following week I showed that there was no patent. In his last letter he shifts his ground, and says the lantern he showed at Birmingham was "registered" only, the effect of which, I may inform your readers, is to prevent any one seeing it without visiting London, and to prevent any one taking a copy without first obtaining a judge's order, or being supplied with one by Mr. Sugg. Notwithstanding this, he sends a sketch (not a copy of the registered article) which he states is a copy of the "shadowless lantern registered in January, 1879," and which you published. I have to ask you to publish alongside the sketch Mr. Sugg sent [see accompanying engraving, fig. 1], the actual lantern he registered [see fig. 2], with the description of it; and may I ask that you will also publish alongside these, fig. 3 of my lantern from your issue of the 20th ult., which shows the arrows [see fig. 3].

If Mr. Sugg's sketch be now compared with my lantern and burners, it will at once be seen that his alterations are all in the direction of my apparatus. The shape of the registered lantern is altered; the cone is placed in the top of the lantern, for diverting the incoming air down its sides; a chimney is introduced for the production of the "vertical column of air," for dealing with my flat flames in the way described in my specification; and the Argand burner, for which the registered lantern was evidently designed, is taken out. The fundamental principle carried out in my apparatus is, as I before stated, the production of a "vertical column of air," and the use of this vertical column for dealing with flat-flame burners, as before described. For the production of this vertical column I take in the air either at the top or at the bottom of the lantern. The top mode is the one shown in the accompanying drawing, and it is this that Mr. Sugg exactly copies in the

sketch of his lantern, and the words of my specification exactly describe it as follows:—

"When the upper ventilator is used for an inlet and outlet combined, a small conductor chimney is used extending towards the top of the interior cylinder, having a funnel-shaped bottom extending into the lamp. This conducts the products of combustion to the top of the interior cylinder, from whence they pass through the upper perforations and escape into the air in the direction shown by the arrows, whilst the outer air is admitted at the bottom and passes over the funnel and down the sides of the lamp."

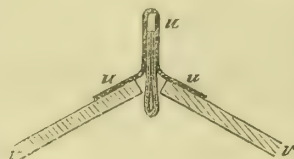
Then Mr. Sugg produces his column of air by passing it up his chimney, while I produce it in a more efficient manner by passing it up my chimney with the conical base, and the column of air in both cases is used, in the words of my specification, to "steady, increase the brilliancy, and give control over the lighting power of the flame or flames submitted to its influence." If Mr. Sugg's specification be now looked at, it will be seen that no mention is made of a "vertical column of air," or of dealing with flat flames with same, either "singly, doubly, or in clusters;" and that the transparent object of the design is to produce a quiet atmosphere for the use of an Argand burner, for which purpose it has always been used until Mr. Sugg's Birmingham exploit. In other words, what Mr. Sugg claims, I neither claim nor use, but he transfers bodily my patented parts to his lantern, and sends the sketch, declaring it to be a copy of his registered apparatus.

I am sorry that I have still further to trouble you with the disagreeable duty of showing that Mr. Sugg has in other instances misrepresented facts. From Mr. Sugg's filed specification it will be seen there is nothing new for any one to imitate beyond the peculiar design of the lantern. Mr. Sugg, in his letter of the 27th ult., states that "Mr. Bray has adopted my lantern even to its ribs and reflectors. He has adopted my hollow-top flat-flame burners under another name," &c. None of these features are mentioned in Mr. Sugg's claims. White glass, as most of your readers will know, has been used for lamp tops for a

generation. As to my having used *his* hollow-top flat-flame burners, I should like him to attempt to prove, with evidence other than his own word, that he ever had anything to do with the invention of the slit union (hollow-top) burner. Meanwhile, Mr. Sugg knows that the patent he said he took out for these burners in 1874 (No. 4227) did not mention them in any way; and he is now advertising them as patented in 1875 (without giving the number), and this statement is as baseless as the other.

As to the lamp ribs, though there is nothing claimed for them in Mr. Sugg's design, I have been at some trouble to examine for myself the ribs of his lamps, and find that they are of the ordinary T-kind, and that there is no indication in them of the improvement which I have added, and those who possess Mr. Sugg's lanterns will be able to prove this for themselves. To show this conclusively, I have had an engraving prepared of the section of the rib (fig. 7 in my second patent, No. 3347 of 1879, a copy of which I herewith send you), which I ask you to insert along with this letter. My specification states that this improved lamp rib (designed to give a maximum of strength with

a minimum of light-obstructing surface) "consists of a thin strip of metal being placed edgeway up along the centre of inside of lamp ribs, *v*, and sufficiently high above the rib sides on which the panes of glass, *v*, rest to form a separating barrier between the panes, and prevent each pane encroaching on the other pane's portion of the rib."



Now, Sir, I tell you candidly that on no hypothesis can I account for Mr. Sugg's conduct in this controversy, and must leave that to be judged by your readers.

GEORGE BRAY.

Blackman Lane, Leeds, May 8, 1880.

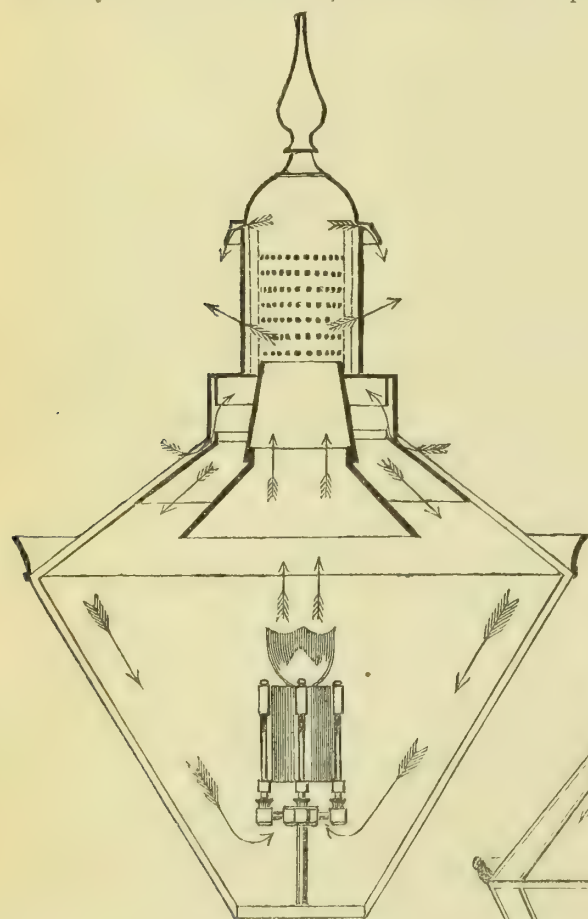


FIG. 1.

DESCRIPTION OF THE ENGRAVING,
FIG. 2.

This design has reference to the production of a street-lamp which, while it is properly ventilated, shall be unaffected by gusts of wind, and shall throw little or no shadow upon the ground. The design relates solely to that portion of the lamp which may be termed the lantern. This consists of two skeleton pyramidal frames, *a a'*, joined together at their bases, and forming a chamber for the burner. The lower frame, *a*, is connected to the lamp-post by supports, *b*, and it may be open at the bottom for the supply of air to the burner. The lower frame is glazed with clear glass, and the upper one with opal glass. The upper frame terminates in a ring, *c*, which is pierced with large oval holes for

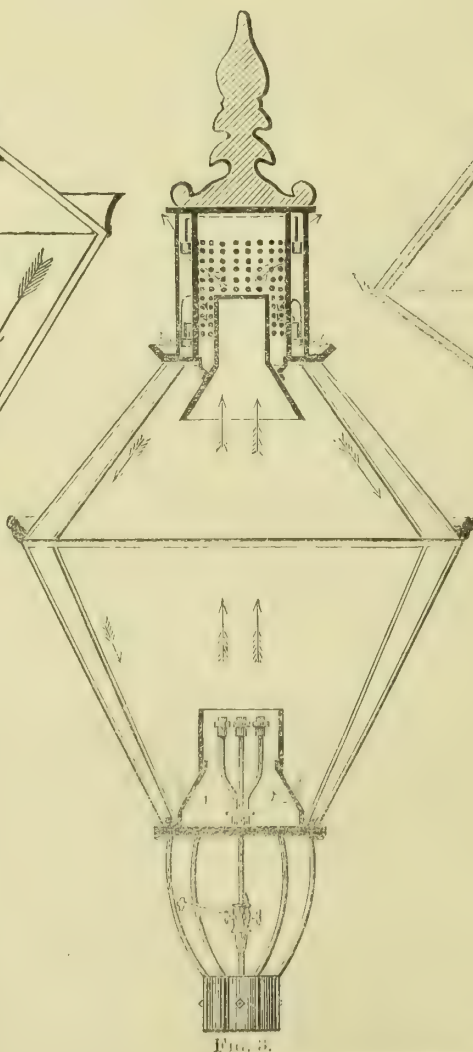


FIG. 3.

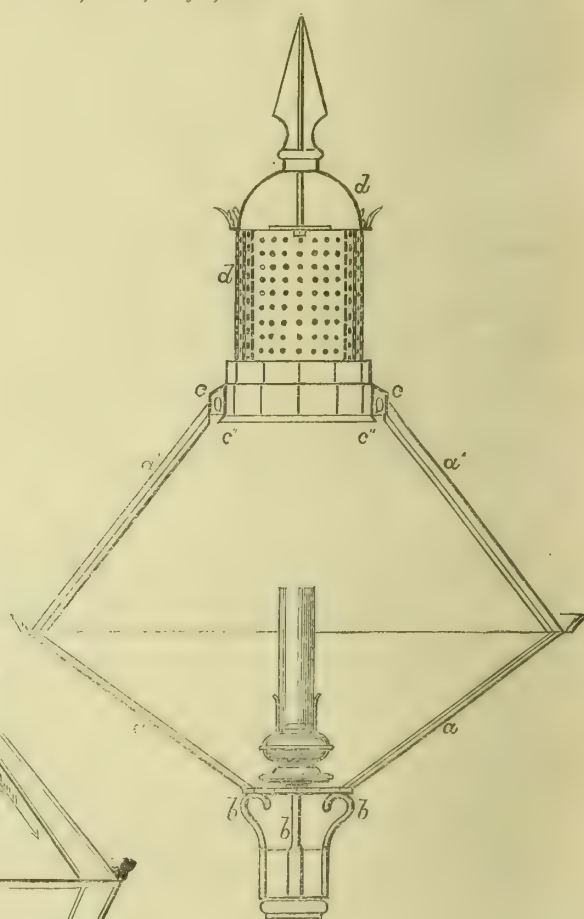


FIG. 2.

the purpose of ventilation. Upon this ring is mounted a dome, *d*, the vertical walls of which are cylindrical and pierced with small holes, through which the gases of combustion escape. Within this dome are two cylindrical linings formed of pierced metal. Thus the walls of the dome may be said to consist of three concentric cylinders. The middle cylinder is so arranged that its solid parts will be opposite the holes of the other cylinders, and thus any gust of wind striking the dome can only enter by a zig-zag path. To prevent any air blowing through the openings, *c*, a curtain, *c'*, is provided which covers the openings, leaving a free space for the circulation of air. The design is new in so far as regards the shape or configuration of the parts, *a, a', b, c*, and *d*.

W. S. M'G. writes: "Can some of my brother managers give me the benefit of their experience in trying to keep tight a leaky gasholder tank. The tank is brick with puddled clay behind, and has a cement bottom. We want the tank; so, if we can diminish the leakage, although

it should only be a temporary cure, it will assist us considerably. Various plans have been tried and failed—one of them my predecessor tried being to pump about 6000 gallons of tar into it. I want this tar out, hence the increased leakage."

Legal Intelligence.

FENTON POLICE COURT.—FRIDAY, APRIL 30.
(Before Mr. H. C. GREENWOOD, Stipendiary.)THE STAFFORDSHIRE POTTERIES WATER-WORKS COMPANY AND
THEIR CUSTOMERS.

The Staffordshire Potteries Water-Works Company were summoned for unlawfully neglecting and refusing to furnish to Mr. Alfred Patterson, of the Eagle Vaults, Loughton, a supply of water at and after the rates and in the manner mentioned and specified in the 47th section of the Staffordshire Potteries Water-Works Act, 1853.

Mr. PAINE, who appeared in support of the summons, said the 47th section of the Act referred to provides that in cases of schools, manufactories, dyers, printers, brewers, innkeepers, livery stable keepers, ale-house keepers, and other persons requiring a supply of water for other purposes than consumption by his or their own families, such supply shall be furnished by the Company, in such cases, at and after the following rates—that is to say, not exceeding 6d. for every 1000 gallons up to 500,000 gallons; and not exceeding 7d. for every 1000 gallons in excess of 500,000 gallons up to 1,000,000 gallons; and at 6d. for every 1000 gallons in excess of 1,000,000 gallons. In this case Mr. Patterson made application to the Company, requesting them to fix a meter, and they refused. For water for house and trade purposes, he provided one of Tylor's patent water-meters, and on Dec. 24 he informed the Company that he had obtained it, also stating that he should use the water by meter, and giving them notice that he should refuse to pay his water-rate unless charged at the special rate above referred to. The Company refused to supply water in that manner, and would not allow any plumber over whom they had control to do the required work; whereupon Mr. Patterson had the meter united to the Company's main. He subsequently refused to pay his water-rate when demanded, and the Company stopped the supply of water.

In reply to the Stipendiary,

Complainant said the domestic supply of water passed through the meter, and he wished to be charged for that at the rate mentioned in the Act.

Mr. KNIGHT, who appeared for the Company, pointed out that the Act only intended the rate to apply to water supplied for other than domestic purposes.

The STIPENDIARY thereupon held that Mr. Patterson had no right to do what he had done, and could not claim to be charged at the special rate when he used the water for domestic purposes. The case was therefore dismissed.

SOUTHWARK POLICE COURT.—SATURDAY, MAY 8.
(Before Mr. BRIDGE.)

A WATER COMPANY FINED FOR NON-SUPPLY OF WATER.

The Southwark and Vauxhall Water Company were summoned by Mr. Joseph John Kain, the owner of several small houses in George Row, Bermondsey, to show cause why they refused and neglected to supply water to No. 21, thereby depriving the inmates of that and four adjoining houses of the required supply.

Mr. LICKFOLD appeared for the complainant; Mr. LANFEAR, Solicitor to the Company, defended.

It appeared that Mr. Kain was the owner of five houses, Nos. 16 to 21, George Row, Bermondsey, and he contracted with the Company to supply water to No. 21 by a pipe from the main. The other houses received their supply from a pipe fixed to the former, and continued to the other houses, each having a butt to receive the water. The Company were aware of this, but on the 14th ult. the water was cut off from No. 21, so that all the houses were deprived of their supply. A complaint was made to the Company, and on the 16th the water was laid on again; but the complainant, being dissatisfied with the Company's conduct, took the present proceedings to recover damages for the inconvenience.

Mr. LANFEAR, on behalf of the Company, contended that they were justified in what they had done, inasmuch as the Company's Act of Parliament, coupled with the Metropolis Water Act of 1871, gave them power to discontinue the supply of water when the apparatus for the reception of the water was defective.

Henry Hopton, one of the waste inspectors in the service of the Company, said that on the 23rd of January last he inspected the houses, and found the pipe and everything correct at No. 21, but the other houses were defective. The water-butts were uncovered, and the water was running to waste at all the houses. He reported the circumstance to his superior officer. On the 8th of March he inspected the houses again, and some repairs had been done, but they were insufficient.

Robert Dunn, one of the Company's superintendents, said from the report of last witness he inspected the houses, and found the water-butts leaky, and not lined with zinc or metal, consequently the water became dirty. As soon as he found Mr. Kain had caused the butts and connecting-pipes to be so placed as to prevent waste, the supply was laid on again.

Mr. LICKFOLD contended that neither the Company's Act nor the Act of 1871 empowered the Company to do as they had done. The pipe from the main leading to No. 21 and the fittings to that house were proper, consequently the Company had no right to discontinue the supply.

Mr. LANFEAR reminded his worship that the fixtures connected with the other houses were defective, and this was the reason the supply was discontinued. Mr. Kain had proper notice of this.

Mr. BRIDGE said he must decide against the Company, but as the latter had not acted recklessly in the matter he should merely inflict a nominal penalty of 10s., and 1s. for each of the three days the water was disconnected, making in the whole 13s., and 2s. the cost of the summons.

BRIGHTON CORPORATION WATER SUPPLY.—At the last meeting of the Brighton Town Council the minutes of the Water-Works Committee, which were confirmed, contained the annual statement of the accounts of the Department for the year 1879-80. This showed that the expenditure, including £9581 9s. 6d. for working expenses and £17,630 13s. 3d. for interest, amounted to £23,425 9s. 2d., and the income to £33,301 18s. 7d., leaving a balance of £876 9s. 2d., £4000 of which the Committee ordered to be transferred to the borough fund. The balance of £876 9s. 2d., together with £109 18s. 10d. received during the year for dividends on previous investments, the Committee resolved to invest in the purchase of 3 per cent. consolidated bank annuities.

PROPOSED PURCHASE OF THE RUNCORN WATER-WORKS BY THE TOWN COMMISSIONERS.—At the meeting of the Runcorn Board of Commissioners last week, the Committee appointed to consider the desirability of purchasing the Runcorn, Halton, and Weston Water-Works reported in favour of the water supply of the town being in the hands of the Commissioners, and recommended that a letter should be sent to the Secretary of the Water Company, stating that the Board had under consideration the desirability of acquiring the rights of the Shareholders, and requesting the Company to state whether they would be willing to enter into negotiations for the sale of the works, and to appoint a Committee to confer on the matter, and (subject to the approval of the respective Boards) to decide on a basis on which they could treat. The report was adopted.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health on the Composition and Quality of the Metropolitan Waters in April, 1880:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.		Nitro- gen. — As Ni- trates, &c.		Ammonia.		Hardness (Clark's Scale).	
						Sal- line.	Or- ganic.	Before Boil- ing.	After Boil- ing.
<i>Thames Water Companies.</i>									
Grand Junction	19.61	0.050	0.112	0.000	0.005	11.3	3.3		
West Middlesex	19.24	0.021	0.151	0.000	0.008	13.8	3.3		
Southwark and Vauxhall	20.04	0.066	0.142	0.002	0.010	14.3	3.8		
Chelsea	20.11	0.005	0.151	0.000	0.001	14.0	3.3		
Lambeth	20.82	0.064	0.167	0.000	0.008	14.3	3.8		
<i>Other Companies.</i>									
Kent	30.63	0.004	0.203	0.000	0.025	20.6	5.6		
New River	19.57	0.016	0.151	0.000	0.005	13.8	3.3		
East London	21.75	0.028	0.151	0.000	0.006	14.3	4.2		

Note.—The amount of oxygen required to oxidize the organic matter, nitrates, &c., is determined by a standard solution of permanganate of potash acting for three hours.

The water was found to be clear and nearly colourless in all cases but the following, when it was turbid—namely, West Middlesex Water Company.
C. MEYMOTT TIDY, M.B., &c.

THE SOCIETY OF ARTS AND THE WATER SUPPLY.—The Council of the Society of Arts announce that they have decided to summon a public conference, "to consider the question of supplying London with pure water." At present the date for it has been fixed for Monday, the 24th inst., but it may be found necessary to alter the day. The arrangements are now being considered by a Committee, and full particulars will be made known as early as possible.

MAURITIUS GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held at the London Offices, 14, St. Mary Axe, on Wednesday, the 5th inst.—W. WHITE, Esq., in the chair.

The SECRETARY (Mr. A. Hersee) read the notice convening the meeting, and the following report of the Directors was taken as read:—

The Directors beg to report, with extreme regret, that the Company's operations during the past year have, through adverse exchange, hurricane damages, and other circumstances beyond their control, again resulted unfavourably. This may be not altogether unexpected, for the Shareholders were informed at the last annual meeting that exchange was in such an unsatisfactory condition that heavy loss thereby must be looked for, and that exceptional expenses had arisen in consequence of damages by the unfortunate hurricanes which had just previously occurred; but the extent of the injuries has proved more serious than was anticipated. The average annual loss to the Company by exchange from the commencement has been under 10 per cent., but for the past year the rate was 22½ per cent., causing a difference of about £600 on the amount remitted. The losses by the hurricanes are estimated at more than £500. It will be seen, therefore, that the Company have thus been deprived of a considerable amount of profit.

The new Manager arrived in Mauritius in June last, and entered upon his duties on the 1st of July. It is encouraging to find that the general business of the Company is already showing signs of steady improvement under Mr. Darney's management, and economy is being effected in several branches.

The gas-rental, which declined throughout the first half of the year, recovered to nearly the same extent in the second half, with hopeful prospects of continued increase, and several new consumers have been obtained.

The Municipality have given an order for 23 additional street-lamps (of which 7 were erected towards the end of 1879), and orders for additional lamps are expected.

The consumption of gas by the Port Department and at the Cernée Dock has been resumed, the Garrison Theatre has been fitted up with 80 jets, and efforts are being made to secure the lighting of the Central Railway Station. The non-residence in Port Louis of the wealthier classes, which could not have been foreseen, is a serious drawback, for on extended private consumption of gas the prosperity of the Company so greatly depends.

The price paid for coal in 1879 was higher than in the previous year, owing chiefly to the advance in cost of freight and scarcity of vessels. The extra outlay for coal was partly recouped by increased receipts for coke, and it is hoped that like compensation will be obtained in the current year.

The proposed extension of gas to Curepipe is for the present abandoned. The Manager, having inquired into the matter, is of opinion that separate works, erected at moderate cost, would afford a remunerative profit, provided a minimum consumption of gas at fair rates were guaranteed by Government and others; but, as such assurances are not forthcoming, the Directors decline to undertake such an uncertain extension.

The balance at the credit of general revenue account is £963 8s. 4d., out of which it is proposed to declare a dividend of 6d. per share, free of income-tax (or 1½ per cent.). The alteration in the nominal value of the shares need now no longer be delayed, and the Directors have determined to recommend the reduction of the capital of the Company to £70,000, divided into 20,000 shares of £3 10s. each, in lieu of £100,000, divided into 20,000 shares of £5 each, whereby the liability per share in respect of uncalled capital will be £1 5s. instead of £2 15s., as at present. An extraordinary general meeting has been summoned to consider the formal resolution approving the above alteration.

The Director who retires from office is James Sydney Stopford, Esq. Both Auditors—John Robinson Peill and Thomas Newton Stokes, Esqs.—also retire. All are eligible for re-election, and offer themselves accordingly.

The CHAIRMAN, in moving the adoption of the report, assured the Shareholders that it and the accounts submitted on this occasion were quite as disappointing to the Directors as they would be to the Shareholders, if not more so; but the result was due entirely to exceptional circumstances. When he addressed them last year, intelligence had just reached the Directors of serious damage to the Company's property by the hurricanes. The actual amount of loss had not then been ascertained, but, unfortunately, it proved greater than was expected. The larger gasholder was greatly injured by the first hurricane at the end of February, and was being repaired when the second hurricane at the end of March occurred, inflicting fresh injury to the holders, and entailing an expenditure of more than £300 for repairs. To remedy the damage at the works cost over £50; an outlay of £150 was required to reinstate the broken lamp-posts and glass; the value of the tar lost by the blowing over of the vats was fully £70; and there were many minor losses. So that the Directors were justified in estimating the total loss at about £500. Had that been their only trouble, a more presentable account would have been put before the Shareholders; but the profits had been diminished to an equal extent by the unprecedentedly low rates of exchange which prevailed throughout the past year, and which the Directors were quite unprepared for. He hardly liked to weary the meeting with details, but he should mention that when the Company was started it was believed that the effect of exchange would be scarcely felt. Such was the case during the first five years, when the average loss was only 2½ per cent.; in 1876 it rose to 14½ per cent., in 1877 it was 13½ per cent., and in 1878 it was 11½ per cent., thus showing a gradual decline. The Shareholders could, therefore, imagine the disappointment of the Directors at the excessive rise to 22½ per cent. in 1879.

It had actually reached 27 per cent., but was at present at 19, and they could only hope that the improvement would go on. Had they not been subjected to these unfortunate circumstances, the profits would have been sufficient for paying a dividend of 3 or 3½ per cent. The Shareholders were aware that a new Manager was appointed in the middle of the past year, and he (the Chairman) was happy to tell them that Mr. Darney was doing his utmost to increase the revenue and diminish the expenses. His efforts thus far were very encouraging. For instance, the gas-rental had been declining for many months prior to his taking office, but it had since steadily increased. He had also reduced the wages, and had otherwise improved the working of the concern. If the Company's affairs continued to progress as they were now doing under Mr. Darney's management, and no exceptional visitations overtook them, they might reasonably look forward for a decided improvement in their position. Gas appeared to be rising in favour, for some of the Government buildings had resumed the use of it. The Directors were trying to get the lighting of other public buildings, though, in consequence of the low price at which they were supplied, the profit would be small. The Municipality had at last shown a disposition to extend the street lighting, and the Company would probably get a small annual addition to their street-lamps; but they had been compelled to resist the proposals of the Municipality requiring the erection of lamps in isolated and detached localities, where there was no prospect of private lighting. Mr. Darney was also exerting himself to extend the private consumption, but the desired result had only been partially attained. The merchants and persons of means who formerly resided in the town, but who left it at the time fever prevailed, now resided in the country, and the remaining inhabitants seemed unable or unwilling to become consumers of gas. Still, some progress was being made. He was happy to say that coal freights were now lower, and the Directors hoped to do much better in that direction. They had cleared off their entire stock of coke at satisfactory rates, and the demand at present exceeded the supply. There was, unfortunately, not the same demand for tar; but Mr. Darney was using every exertion to create a better market for this product. There was nothing to justify their proceeding with the Curepipe extension, which had been mentioned before. It had been felt from the first that, unless there were some sort of guarantee that a minimum quantity of gas would be taken, at rates assuring a fair dividend on the capital employed, it would be impolitic to take any action towards making provision for the works. Mr. Darney thought that about £10,000 would meet the first requirements, and that the gas need not cost more than it did in Port Louis. The residents expressed themselves in favour of gas, but would not bind themselves to use it, and no distinct promise could be obtained from the Authorities; so that the matter must remain in abeyance. The alteration in the nominal value of the scrip was a step which would serve as a relief to the minds of many Shareholders. In reducing the par value of the shares from £5 to £3 10s. each, sufficient margin had been retained as security for the debentures and for working capital, and there would also be sufficient to carry out the Curepipe extension if it should hereafter come to the Company in an acceptable shape.

Mr. J. S. STOPFORD seconded the motion.

Mr. H. P. STEPHENSON said the Shareholders could not help feeling that the report was eminently unsatisfactory, particularly looking to the fact that the price of coal had been lower, and freights lower, for some considerable time. It would be presumptuous on his part to attribute blame to the Board; but he could not help feeling that the accounts that were put before the meeting were in such a very meagre shape indeed that there was not the slightest opportunity on the part of the Shareholders to look into the working of the Company at all. He presumed and hoped the Directors examined into the working, and saw that they were getting all they ought from the management out at Port Louis. He felt very strongly that the Company had been going from bad to worse. First they had a misfortune with their gasholder, then other misfortunes, and they still seemed to be going lower and lower in the scale of profit; and had now arrived at the extraordinary position that the Shareholders only had about 2½ times the Directors' fees, which, to his mind, was a thing unique in a gas company. He hoped that the make of gas per ton, the amount of fuel used in the retorts, the details of management, and the wages—that all such points would be most carefully looked into by the Board. He could not but think there was something wrong at the works. No doubt there had been great depression of trade, and no doubt the Company were suffering greatly from the exchanges; still, those were circumstances which he did not think ought to put the Shareholders, with a rental of £7000 a year and an income of about £9000 a year—though, no doubt, very small—in the position of having to receive such a miserable dividend, that one would almost say, "Sell the thing for what we can get for it, divide the proceeds amongst the Shareholders, and get rid of the concern." As to the reduction of the capital, he thought it a most judicious act on the part of the Board; but he could not conceive, going as far as they did, why they did not go farther. What was the necessity for still retaining a liability of about £25,000? To carry out the extension referred to would be most injudicious and improper, unless they could get the consumption guaranteed to them; for if the larger works did not pay, surely the smaller would not. He should advise that the liability be reduced to sufficiently cover the debentures, which he would also pay off afterwards.

Mr. C. HILL dissented from Mr. Stephenson's remarks about the Directors' fees. He thought all the Shareholders ought to be indebted to the Board for sticking to the concern as they had done, for it was greatly to the Shareholders' advantage that the Directors had had the pluck to do so. The great misfortunes of the Company had been altogether beyond the control of the Board. He hoped the Directors would continue till they secured better results.

Mr. STEPHENSON said that his remarks were not in the least degree intended to reflect on the Board.

The CHAIRMAN, in reply, said they had had a vast number of difficulties to contend with, and over and over again he should have been glad to get away from the concern, if he could have done so; but once engaged in an undertaking, whether good or bad, he felt it was his duty to stick to it. Mr. Stephenson made one remark with which he could not at all agree. He said coals and freights had been very much lower. Coals had been lower, but not to such an extent as might have been anticipated. The best coals the Company had were from Australia, and up to within the last two months they had cost them 14s. a ton. The Directors had therefore been compelled to buy English coals, at about 6s. 6d.; but the freights had been nearly double. There were no home freights from the Mauritius, and for a long time the Directors despaired of getting a ship to go at all. As to the Board, he thought he might fairly say they had been very generally credited with looking into their business. They met very frequently, and went into all the accounts. The difficulty was that they could not go out and personally set things to rights. If they could, he had no doubt that they would make a very different affair of the Company. They, however, looked into every expense, and every voucher came before them, and he could assure Mr. Stephenson that they were not carrying on the concern at more expense than was absolutely necessary.

The motion was unanimously adopted, and the retiring Director and Auditors were re-elected.

The CHAIRMAN, in proposing the dividend recommended in the report, said he was almost ashamed to do so, and some large Shareholders had said they would rather not have it; but he thought it would be a pity for them to go into the state of a non-dividend paying company, especially with their present prospects.

Mr. STOPFORD seconded the motion, and it was carried unanimously.

An extraordinary general meeting was then held with regard to the proposed reduction of the capital.

The CHAIRMAN said the matter was entirely in the hands of the Shareholders. They had asked the Board to reduce the capital, for many people thought it looked unsafe to have a quantity of uncalled capital. The Directors had, therefore, agreed to ask the Shareholders to pass this resolution—"That in lieu of the capital and shares of the Company being £100,000, divided into 20,000 shares of £5 each, such capital and shares shall henceforth, until otherwise determined by the Company in manner prescribed by law, be reduced to £70,000, divided into 20,000 shares of £3 10s. each."

Mr. STOPFORD having seconded the motion,

Mr. STEPHENSON asked why the Directors required so much as £25,000 of uncalled capital. There were, he contended, no circumstances in the Company that required it, and if he could obtain a seconder he would move that the matter be referred back to the Directors with the view of increasing the reduction further.

The CHAIRMAN put the motion, and it was carried. He then announced that within about a month another meeting would be required to confirm the resolution.

Mr. HILL said it was always a pleasant thing to pass a vote of thanks to directors when a company was flourishing, but when it was not, he thought they required such encouragement all the more. He moved a vote of thanks to the Chairman and Directors.

Mr. STEPHENSON seconded the motion, and it was carried unanimously.

The CHAIRMAN, in acknowledging the compliment, said it was certainly under very discouraging circumstances that the Directors appeared before the Shareholders on this occasion. They, however, tried in every way to set the Company on its legs, and his impression was that it would come round. He did not expect it would ever be a very flourishing concern, but he believed it would eventually pay a moderate dividend.

The proceedings then terminated.

AUSTRALIAN GAS COMPANY, SYDNEY, NEW SOUTH WALES.

The report of the Directors of this Company for the half year ended Dec. 31, 1879 (the 88th half year), stated that the profits, after deducting for bad debts, interest on borrowed money, cost of repairs and renewals, and depreciation of plant, working expenses, and all charges, amounted with the balance brought forward (viz., £927 8s. 7d.) to £28,686 16s. 8d. The Directors recommended a dividend for the half year of 7½ per cent., which would absorb £18,740 9s. 6d., and leave a surplus of £9946 7s. 2d.; out of which it was proposed to transfer to the reserve-fund £8315, leaving a balance to carry forward of £1631 7s. 2d. Since their last report the Directors had introduced gas into the borough of Randwick, the inhabitants having promised their substantial support. The public lighting of the borough was commenced on the 1st of January. The following is the

Net Revenue Account, for the Half Year ended Dec. 31, 1879.

Dividend payable July 30, 1879	£18,740 9 6	Balance on June 30, 1879	£23,667 18 1
Reserve-fund	4,000 0 0	The half year's profits	27,759 8 1
Balance to next account	28,686 16 8		
	£31,427 6 2		£31,427 6 2

Liabilities and Assets, Dec. 31, 1879.

Sundry creditors—temporary loans	£106,055 18 3	Fixed investment:—Land, buildings, and machinery at head station and the four out-stations (Haymarket, Woolloomooloo, Balmain, and Petersham); main and service pipes laid; implements and furniture	£329,948 5 1
Suspense accounts	933 17 10	Floating investment:—Coals, residual products, apparatus in store, meters, lamps, and pillars	56,580 1 7
Capital paid up	249,873 0 0	Sundry debtors	20,371 18 3
Reserve-fund	19,184 5 6	Suspense accounts	2,101 1 2
Reserve for replacement of meters	4,484 3 10	Cash	1,560 17 2
Dividends unclaimed	1,344 1 2		
Unappropriated profits	28,686 16 8		
	£410,562 3 3		£410,562 3 3

WELLINGTON (NEW ZEALAND) GAS COMPANY.

The report of the Directors of this Company for the year ending Dec. 31, 1879, stated that satisfactory progress was made in the past year. The 5000 new shares were issued in accordance with the resolution of the Shareholders on the 8th of May last, and 4918 of the number were allotted. The available profit was £5212 4s. 5d., and an interim dividend of 7½ per cent. was paid in the month of July last, amounting to £2557 12s. 10d. The Directors recommended the payment of a dividend at the rate of 6½ per cent. for the past half year—all amounts paid in since July 1 to receive dividend as from the date of payment, calls paid in advance receiving interest as agreed—the balance to be carried forward to next account. The new retort-house, containing 96 retorts, had been completed, and would suffice for the requirements of the Company for some years. The mains were extended about one mile during the year, further extensions being in progress. The number of consumers in December was 1503, being an increase of 275 during the year. The following is the

Profit and Loss Account, for the Year ending Dec. 31, 1879.

Coal, wages, and renewals	£14,889 2 9	Balance on Dec. 31, 1878	£5,086 4 10
Less stock on hand	1,592 5 1	Less paid in dividends and reserve	4,273 4 9
	£13,296 17 8		£813 0 1
Amounts written off	247 5 6	Gas-rates and meter-rent, 1879	21,612 18 2
Interest	1,461 7 0	Products	1,328 6 1
General expenses—		Goods	352 19 3
Directors, 1878	150 0 0	Rents and fees	261 5 0
Auditors	15 15 0		
Salaries and bonus	780 12 0		
Annual licence	25 0 0		
Legal charges	138 10 2		
Insurance	73 2 4		
Printing, &c.	150 7 4		
Rates	100 15 10		
Stamps and sundries	158 18 6		
Interim dividend and interest to June 30, 1879	2,557 12 10		
Balance	5,212 4 5		
	£24,368 8 7		£24,368 8 7

CHRISTCHURCH (NEW ZEALAND) GAS COMPANY, LIMITED.

The Fifteenth Annual General Meeting of this Company was held on Monday, March 1—Mr. E. G. WRIGHT in the chair.

The SECRETARY (Mr. C. W. Bishop) having read the notice convening the meeting, the following report was presented:—

In submitting the fifteenth annual statement of accounts, your Directors congratulate you upon the satisfactory result of the year's working. The private consumption during 1878 was 25,272,000 feet, and during 1879, 30,951,000 feet; while the public lamps have been increased from 152 to 202.

The Directors, in their last report, informed the Shareholders that they had contemplated extensive additions to the works, but they had delayed the same pending further information as to how far the electric light was likely to supersede coal gas. Although this question still remains unsettled, your Directors felt convinced that it would not be conclusively determined for some years, and that the public would have just cause for complaint if they failed to meet the public requirements; and, after careful consideration, your Directors decided to proceed with the works during the past year. The arterial main has been enlarged from 10 inches to 18 inches in diameter, and the total mileage of street-mains has been increased from 15½ miles in 1878 to 28½ miles in December, 1879. The Company are also building a new retort-house, new purifiers and condensers, and a gasholder of a capacity of 300,000 feet, to supply the estimated demand consequent upon the extended area of the Company's operations.

To avoid making heavy demands upon the Shareholders during a period of general depression, your Directors have borrowed a sum of £15,000 from the Australian Mutual Provident Society, for a term of years.

The amount to credit of profit and loss, including the balance brought forward from last year, is £8101 17s. 6d., of which £3336 13s. 4d. was paid as an *ad interim* dividend, and the Directors now propose that a sum of £4320 be paid as a further dividend, leaving a balance of £4145 4s. 2d. to be carried forward.

The retiring Directors are Messrs. Blakiston, Cowlshaw, and Wright, who, being eligible, offer themselves for re-election.

Dr.	Balance-Sheet, Dec. 31, 1879.		Cr.		
Capital	£80,000	0 0	Freehold property and build- ings	£6,138	6 5
Loan from A.M.P. Society	15,000	0 0	Working plant, mains, meters, &c.	60,028	0 8
Interest on loan to date	70	5 5	Office furniture	116	10 7
Deposits at interest	3,265	0 0	Capital available by calls	32,000	0 0
Bills payable	3,223	13 6	Unpaid calls	139	0 0
Debts due by the Company	397	2 8	Shares in P.I. Association	190	0 0
Insurance-fund	261	4 8	Funds invested	4,000	0 0
Unclaimed dividends	203	2 5	Debts due to the Company	4,001	0 1
Reserve-fund	4,788	14 5	Stock on hand, coals, &c.	1,493	10 4
Balance	4,765	4 2	Gas-stoves	25	6 0
			Cash at Bank of New South Wales	3,636	19 2
			Cash in hand	202	14 0
	£111,974	7 3		£111,974	7 3

Dr.	Revenue Account, for the Year ending Dec. 31, 1879.		Cr.
Stock of coal, &c., on Jan. 1, 1879	£898	15 1	Sale of gas and rent of meters £23,932 10 1
Purchases of coal, &c., during the year	7,904	15 7	Sale of coke, tar, and sundries 2,574 4 6
	£8,803	10 8	Rents 119 10 8
Less stock on hand, Dec. 31.	1,493	10 4	Transfer fees 3 4 0
	£7,310	0 4	Sale from gas-stoves account 0 15 9
Stock of gas-stoves, Jan. 1	£26	1 9	
Less stock on hand, Dec. 31	25	6 0	
		0 15 9	
Wages—			
Carbonization	1,438	17 1	
Purification	291	9 10	
Repairs, &c.	350	13 6	
Lamp-lighters, service-layers, &c.	895	11 5	
Salaries—			
Secretary, Manager, Assistant Manager, and Collector's commission.	1,347	0 0	
Directors fees	400	0 0	
Auditors fees	21	0 0	
Rent, taxes, and insurance	297	0 4	
Tools, materials, and renewals.	466	7 2	
Stationery, advertising, and printing	132	12 11	
Law charges	64	2 0	
Miscellaneous	321	19 2	
Discount and interest account	2,520	19 2	
Amounts written off	110	0 7	
Reserve-fund	2,880	0 0	
Depreciation-fund	500	0 0	
Balance	7,261	15 9	
	£26,630	5 0	£26,630 5 0

The CHAIRMAN, in moving the adoption of the report, said perhaps he might be permitted to point out that the Directors at one time during the past year found themselves in a somewhat difficult position with reference to the proposed extensions. They were threatened with the introduction of the electric light, and the consequent extinction of gas companies, and at the same time they had to consider the demands of the public to supply their wants in the outlying districts, and to increase their supply in the centre of the city. The Directors, for the reasons stated in the report, decided upon the adoption of the bolder course, notwithstanding that it necessitated the employment of something like £25,000 of additional capital. Naturally they felt a little hesitation in the matter, but so far they had seen no reason to regret the step they had taken, and they hoped their action would be endorsed by the meeting. The Shareholders would have noticed that there had been some trouble in connection with sinking the foundations for the tank of the No. 4 gasholder. The difficulty was caused by a bed of quicksand being met with, and this shifting sand caused a settlement in the concrete walls of No. 3 tank, and rendered the holder for a time unserviceable. Just as it was being again brought into use the foundations of No. 2 holder collapsed in a similar way. The lower portion of the tank for the No. 4 holder had now been rivetted together and placed on the foundations, and no further difficulty was likely to arise.

Mr. J. ANDERSON seconded the motion, and it was carried.

Mr. J. GOULD moved—"That the Directors be hereby authorized to pay a dividend in accordance with the recommendation contained in the report."

Mr. THOMPSON seconded the motion, and it was unanimously agreed to.

The retiring Directors were re-elected, and Messrs. Harley and Alport were chosen Auditors for the present year.

The proceedings closed with the usual votes of thanks to the Chairman and Directors.

HASTINGS CORPORATION WATER SUPPLY.—The Water Committee of the Hastings Town Council announce that the working of the undertaking during 1879 resulted in a profit of £4876 9s. 2d., of which amount they propose that £4000 should be carried to the borough-fund, and the remainder (£876 9s. 2d.) to the contingent-fund.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held at the London Offices, 30, Gracechurch Street, on Tuesday, the 4th inst.—Mr. H. P. STEPHENSON (in the absence of Mr. T. Hughes, Q.C., the Chairman) presiding.

The SECRETARY (Mr. Alfred Lasse) having read the notice convening the meeting, the following report was taken as read:—

The Directors have much pleasure in submitting to the Shareholders the accounts of the Company for the half year ending Dec. 31, 1879. These, with the annexed report of the Engineer, show the progress of the Company.

The Directors have to state that the profit for the half year has amounted to £1508 2s. 2d., which, added to the balance brought from the last account, makes £3007 2s. 10½d., and that after paying the dividends to June 30, 1879, the interest on debentures to Dec. 31, 1879, and transferring a sum of £150 to the reserve-fund, there remains an available balance of £1443 1s. 3½d., out of which the Directors recommend the declaration of a dividend for the half year ending Dec. 31, 1879, on the preference share capital at the rate of 8 per cent. per annum, and on the ordinary share capital at the rate of 7 per cent. per annum, both less income-tax (except upon those dividends payable to the local Shareholders), leaving a sum of £275 13s. 3½d. to be carried forward to the next half year's account.

The Directors retiring by rotation are Arthur Clarke, Captain Henry Thurburn, and Joseph Quick, who, being eligible, offer themselves for re-election.

The retiring Auditor is James Waddell, who, being eligible, offers himself for re-election.

(Engineer's Report.)

Gas-Works, Georgetown, Feb. 24, 1880.

To Thomas Hughes, Esq., Q.C., Chairman, and the Directors of the Georgetown (British Guiana) Gas Company, Limited.

Gentlemen,—I have the pleasure of submitting to you my report for the half year ending the 31st of December last, which I hope you will consider satisfactory. The returns which I have forwarded will, I hope, meet with your approval. They will give you full particulars on all matters relating to the working of the Company.

I have much pleasure in stating that the buildings and apparatus are in thorough repair and good working order, and that the gasholders and tanks have not given me either trouble or anxiety. The stelling, or wharf, was partially completed during the past half year; since then it has been finished.

During the half year 15 additional consumers, with 115 lights and 3 stoves, have been added, and 77 additional lights have been fitted to old consumers; making a total of 192 extra lights. The demand for gas has been very good. Coke and breeze have realized fair prices. The gas-fitting department has been fully employed.

In conclusion, I beg to thank the Directors for their attention to our wants in the colony.—I have, &c.,

(Signed) THOS. B. YOUNGER, Engineer and Manager.

Dr.	Balance-Sheet, Dec. 31, 1879.		Cr.
Share capital—			Fixed plant, mains, and ser-
6200 fully paid £5 shares	£31,000	0 0	vices, as per last account .
£12 £5 preference shares,			Since expended
fully paid	2,060	0 0	
Debtenture bonds	6,950	0 0	
Insurance-fund account	15	16 10	£36,253 13 9½
Retort renewal-fund account	105	14 9	Stock in hand
Bad debt fund	205	15 0	Cash at bank and in hand
Reserve-fund account	650	0 0	784 3 9½
Bills payable	800	8 6	Bills receivable
Amounts owing to sundry			1,000 0 0
persons	735	4 9	Amounts owing by sundry
Suspense account	50	0 0	persons
Profit and loss account, net			2,402 9 6
revenue	1,443	1 3½	

Revenue Account, for the Half Year ending Dec. 31, 1879.	
Coals and bitumen	£395 8 8
Purifying account	30 2 5
Wages account	506 14 4½
Repair and maintenance of works and plant, &c.	218 5 6½
Salaries	623 6 8
Rent, rates, and taxes	51 0 10
Directors and Auditors fees	158 8 0
Trade and general charges	126 16 11
Bad debts and allowances	27 7 7
	£2,637 10 11½
Balance carried to profit and loss, net revenue	1,508 2 2
	£4,145 13 1¼
	£4,145 13 1¼

Profit and Loss Account (Net Revenue) on Dec. 31, 1879.			
Dec. 1, 1879—		July 1, 1879—	
Dividend, &c., to Share-		Balance brought from last	
holders to June 30, 1879	£1,167 8 0	account	£1,499 0 8½
Dec. 31, 1879—		Dec. 31, 1879—	
Interest on loans, &c., to		Revenue account, balance	
Dec. 31, 1879	246 13 7	brought down	1,508 2 2
Reserve-fund account	150 0 0		
Balance carried to next half			
year's account	1,443 1 3½		
	£3,007 2 10½		£3,007 2 10½

The CHAIRMAN: I have now to move—"That the report and accounts of the Company be received and adopted," and in doing so I have very few remarks indeed to make. The working of the Company in the past half year is very similar to that of the corresponding half of the previous year. The rental has slightly increased, and the result of the whole half year's work is that our profit is about £110 more than in the corresponding period of last year.

Captain THURBURN seconded the motion, and it was carried unanimously.

The CHAIRMAN next moved, and Mr. ROBERT KING seconded the re-election of the retiring Directors, and the motion was unanimously agreed to.

On the motion of the CHAIRMAN, seconded by Mr. BLYTH, the retiring Auditor was re-elected.

The dividends recommended in the report were then declared, and a vote of thanks having been passed to the Chairman and Directors, the proceedings were brought to a close.

EDISON'S HORSESHOE LAMP v. GASLIGHT.—In last week's issue there appeared an abstract of a report by Professor Henry Morton, Professor Alfred M. Mayer, and Mr. B. F. Thomas, on "Some Electrical Measurements of One of Mr. Edison's Horseshoe Lamps." This report is the subject of a short article in the *Scientific American* of the 1st inst., in which the authors make certain additions and corrections. The corrections do not affect our summary, but the following interesting addition is made:—"Two other sets of experiments, made since those given in our paper of April 17, in which the candle power of the loop was in its best position, 17.6 and 19.8 candles, corresponding to averages of 11.7 and 13.2 candles respectively, showed a consumption of energy of 0.104 and 0.109 horse power per lamp, or 9.6 and 9.1 lamps per horse power. This would give 112 and 120 candles respectively per horse power of electric energy consumed or transformed in the lamp. These results certainly agree very closely with each other and with our former determinations."

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Tenth Quarterly Meeting of this Association was held at the Midland Hotel, Birmingham, on Thursday, the 22nd of April. Present:—Messrs. P. Simpson (Rugby), President; C. Hunt (Birmingham), ex-President; J. Tindall (Walsall), Treasurer; W. North (Stourbridge), Hon. Secretary; J. Collett (Dudley); H. Peaty (Burslem); H. S. Pike (Hinckley); J. E. Palmer (Malvern); R. O. Paterson (Cheltenham); J. S. Cranmer (Stratford-on-Avon); W. Winstanley (Newcastle-under-Lyme); J. Annan (Wolverhampton); T. Layton (Redditch); and J. S. Reeves (Bilston).

The HONORARY SECRETARY read the minutes of the last meeting, which were confirmed and signed. He then read the notice calling the present meeting.

The PRESIDENT: I am sorry to say we have received a letter from Mr. Cross, stating that he cannot read the paper he intended. I should also mention that the Committee met previous to this meeting, and recommended for admission as members Mr. John Searle, Manager of the Tewkesbury Gas-Works, and Mr. W. Barratt, Manager of the Grantham Gas-Works.

The gentlemen named were elected by a show of hands.

The PRESIDENT: I need not say how sorry we all feel that Mr. Cross is unable to be present. It has made a great blank in the business of the day. With your permission I will call upon Mr. Hunt to give us his remarks on the experiments recently made at the Windsor Street Gas-Works with lanterns and large burners.

Mr. HUNT: Mr. President and gentlemen, having been invited to lay before you the results of some further experiments with improved lanterns and burners of large power, I do so with much pleasure, although I regret that my other engagements have entirely prevented my writing anything in the shape of a paper upon the subject. At the same time, I have had some little hesitation in making known these results, since the previous ones have been seized hold of by interested parties, and made a kind of advertising medium; but, after all, the interests of the public and of the profession are the first things to be considered. Before handing round the diagrams, perhaps it will be as well for me to relate the conditions under which the experiments were made; after which I shall be glad to answer any inquiry that may suggest itself to the members. Many who are here to-day were present at the inspection of these lanterns a few weeks ago, and are perhaps fully conversant with the arrangements. The ground was first of all levelled, and coated with clean sand, and the posts designed to carry the lanterns that were to be compared with each other placed at exactly the same height above the ground, and at distances of 150 feet apart. Before any tests were made, the lanterns and the chimneys of the Argand burners were thoroughly cleaned. Meters were attached to each burner, and these were adjusted to pass the same quantity before any observations were made, and the consumption checked and adjusted from time to time during the continuance of the experiment. In every case the position of the shadow meter was reversed, and the mean of the distance between the two results was taken as the correct result. That is to say, supposing the observer were looking due north, having recorded the distance at which the shadows were equal, he would then turn himself round and look in the opposite direction, and the mean between the two distances thus obtained was recorded. As a further check, a newspaper was used to ascertain if the light thrown from each burner was equal at the spot recorded by the shadow meter, and the same test was also applied for the purpose of ascertaining the distance at which the observer could read with equal facility. Any doubts as to the accuracy of the tests were resolved by a second test. These experiments that I now lay before you were, I may say, for the most part, carried out by my assistant, Mr. Colson, whose aid in this matter I have previously acknowledged.

[Mr. Hunt then handed round the diagrams—10 in number—which we have had slightly reduced in size, and give them as a separate plate of engravings in this week's JOURNAL.]

The following discussion took place:—

Mr. NORTH thought that although more light was obtained from the Argand burners, they were very objectionable for street lighting.

Mr. CRANMER considered that the cost of the globular lantern would be much against its introduction, although there was no doubt as to its superiority. Its cost for repairs, too, in case of breakage, would probably be double that of the ordinary lantern. From the diagrams it appeared that the light was thrown a greater distance when the clear glass lantern was used, than when one with an opal top was employed; but he would like to know whether more light was not thrown down immediately round the lamp-post in the latter case than in the former. In Stratford they had fixed some globular lamps with opal tops which had given great satisfaction. The public, who were generally hard to please, were in this case satisfied with the result. The lamps cost about 36s. each, while the cost of the old ones would be about 12s.; but in the former case they are made of copper, and in the latter of tin. The cost of the glass would be three times that of the glass in the ordinary street-lamps. After having seen the results obtained by Mr. Hunt, he should certainly try clear glass globes against those with the opal tops.

Mr. COLLETT said judging from appearances the globular lantern was to be preferred, but he feared that the cost of repairs would be against its general use, especially in the Black Country. He thought the ugliness of some of the new lanterns was quite sufficient to condemn them.

Mr. TINDALL wished to know whether Mr. Hunt obtained the photometrical results by using sperm candles, and if he had tried globular lanterns with opal tops against those composed entirely of clear glass.

Mr. PATERSON said the consumption of gas in the spherical lamp was not recorded. It was stated a few minutes ago that with opal glass in the upper section of the lantern, part of the light would be reflected to the pavement, and part would pass on to light the space above the lantern. If, however, clear glass were substituted for the opal, less light would be reflected to the pavement, and consequently a greater portion would pass on to light the space overhead. With clear glass, therefore, while there would be a less brilliant light on the pavement, there would be a better or more equal diffusion of light all around the lantern than would be the case if the upper section were glazed with opal glass. If the opal top was injurious to the overhead light by diminishing its intensity, it was clear that the same condition did not exist in the tests between the spherical and octagon lanterns referred to, because in the former case clear glass alone was used, while in the latter the upper section was of opal glass. The shadow meter was intended to show the relative intensity of the two lights; but if the spherical lantern was allowed to light to the utmost the overhead space, and this light was taken advantage of at the shadow meter, the octagon lantern with its opaque top, and consequently dimly lighted overhead space, was placed at a disadvantage. The top light could not be excluded from the calculation. If a light was placed behind a brick wall, although the light itself could not be seen, there would be a lighted atmosphere all around, and the rays of light projected above the wall might be measured relatively with the shadow meter. He used this illustration to show that top light was an element which could not be ignored in the estimation of the relative values of burners and lanterns, and under different conditions of the atmosphere it was probably of more importance than was generally attributed to it. It was a question,

whether lanterns with opal tops were better adapted to street lighting than those with clear glass, or whether the spherical form gave more light, with equal quantities of gas, than either the octagon or the square form. At present he was not inclined to believe the matter settled.

Mr. ANNAN said it seemed to him that there was a greater reflection from a circular lamp than from a square one, because it was more concentrated to a given point.

Mr. PEATY thought that when the light was in the middle of the lantern it must go straight out in every direction. He fancied the explanation might be that if it was a square lantern the light did not go straight out—it must strike more or less at an angle, and some of it was lost.

Mr. HUNT, in reply, said that he fully agreed with the objections that had been stated to the Argand burners. In Birmingham they were about adopting flat-flame burners in clear glass globular lanterns, the expense of which would not be great if a large number were required. The height of the lantern must be increased in proportion to the magnitude of the light, as pointed out by Mr. Sugg last year. The opal tops threw a little more light immediately around the base of the column, but they also absorbed a very large quantity, and he was of opinion that they were not at all required, and that nothing would be found to be better than all clear gas. Although the experiments were not decisive upon the point, he believed that the globular lantern diffused the light better than any other form. This, in fact, was borne out by experiment No. 2, in which, under the same conditions, the light from the globular lantern was as good at 80 feet as that from Bray's own shadowless lantern was at 70 feet. The burners were in all cases tested in the photometer-room against a standard burner consuming 5 feet of gas per hour—the gas having been previously tested in the ordinary way. He believed it was quite possible to get a shadowless effect with clear lanterns. In reply to Mr. Paterson, he said that he did not see how the rays of light passing upward could influence the results obtained by the shadow meter, unless they were reflected, and this could not have been the case in any of the experiments.

The PRESIDENT: We have had a very nice conversation, and, as an Association, are deeply indebted to Mr. Hunt for his great kindness in this matter, not only to-day, but on previous occasions, and especially on that particular night when we had the privilege of viewing the experiments under very pleasant circumstances. I am sure I spent a pleasant night myself, and I have no doubt all were highly gratified and entertained, and went away very much informed. We have had still more information to-day, and it is a subject we might all do something in. If we cannot all try with large lamps we can try with small ones, and at some other meeting we might bring forward the experiments with small lamps as well as large ones. I am pleased we have Mr. Cranmer here, because it is a great thing to have those here who have been trying the experiments, and it is satisfactory to find that he agrees in general with Mr. Hunt in favour of circular lamps. I personally thank Mr. Hunt for introducing the subject, and giving such a lucid account of the various experiments, and will move that our thanks, as an Association, be given to him.

Mr. PATERSON: I have much pleasure in seconding the vote of thanks to Mr. Hunt for his excellent information given us to-day. We must go away with the desire to carry out more of these experiments. Although Mr. Hunt has done so much to relieve us from the drudgery, no doubt something more can be done yet. Information of this kind gives us an idea of the importance of what we are doing.

The motion was carried.

Mr. HUNT said that he could only express the great pleasure he had felt in bringing these experiments before the Association, and for the general appreciation of them. At any time any information that he might have, and was at liberty to impart to his fellow-members, was at their service.

The PRESIDENT: There is the subject of securing papers for future meetings. This is a question which must have your serious consideration. I will not detain you upon it, as we have had such an interesting discussion; but you will see the propriety of having papers provided in good time before our meetings. I would ask you all to think over what paper you would like to give us, and send your names to the Secretary, and perhaps you will not take offence if you do not get the first turn. But we should like to have one or two in hand. At the last meeting we almost persuaded Mr. Woodall to give us a paper to-day. He was going through some experiments, but they have not turned out as he expected, and he is not, therefore, able to bring the subject before the meeting.

The HONORARY SECRETARY then entered the names of several members who were willing to undertake papers.

After a short discussion, it was agreed, in view of July not being a period when many of the members could conveniently meet, to hold the next meeting in October.

WEST OF SCOTLAND GAS MANAGERS ASSOCIATION.

The Eighth Annual Meeting of this Association was held in the Town Hall, Hamilton, on Thursday, the 29th ult.—Mr. ROBERT MITCHELL, of Coatbridge, the President, in the chair.

Mr. S. DALZIEL (Kilmarnock) the Secretary of the Association, read the minutes of the previous meeting, which were approved.

ELECTION OF OFFICE-BEARERS.

The following gentlemen were unanimously elected Office-bearers of the Association for the ensuing year:—

President—Mr. R. S. Carlow, Port Glasgow.

Vice-President—Mr. S. Dalziel, Kilmarnock.

Secretary—Mr. J. Johnston, Hamilton.

Treasurer—Mr. W. Smith, Helensburgh.

Auditors—Mr. D. Black, Wishaw, and Mr. L. Monk, Lanark.

Committee—Messrs. R. Mitchell, J. Fullerton, D. Jeffrey, J. McGilchrist, J. Renfrew, W. Young, and S. Stewart.

Mr. CARLOW returned thanks for the honour conferred upon him.

The Auditors report—which stated, *inter alia*, that £20 had, during the past year, been given from the Benevolent Fund to persons in need of assistance—was adopted on the motion of the PRESIDENT, seconded by Mr. RENFREW.

PRESIDENT'S ADDRESS.

The President then read his Valedictory Address, which was as follows:—Gentlemen,—Allow me at the outset to congratulate the Association on its present meeting in Hamilton. It is not the first time in the comparatively short history of the Association that its members have met within these historic bounds; and although, as a body of gas engineers combined for the purpose of forwarding the interests of gas manufacture, we have nothing to do with considerations such as bear on the civil and religious struggles of our ancestors, or the particular spots which are interwoven in the history of these struggles, it does lend a charm to our meeting to think that the surrounding district is distinguished in history as the place where patriots have fought and bled for their country. The march of civilization is rapidly and effectually eradicating the romantic and the beautiful. The whilom inaccessible recesses of Cadzow's ancient forest have been laid open by the woodman's axe, or the slower yet equally sure ravages of the elements, and gaping pits and noisome machinery are rampant. Since our previous meeting in this town, many

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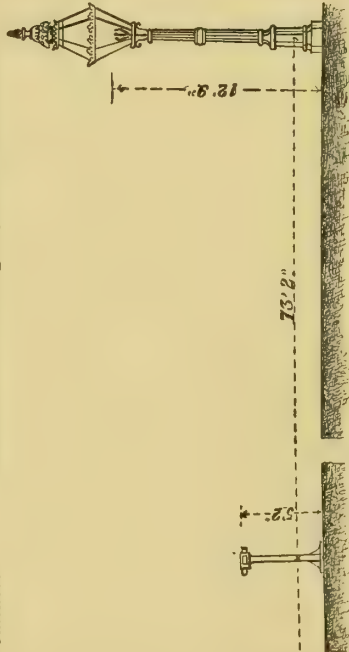
SUGG'S 200-CANDLE ARGAND, consuming 46.75 cubic feet per hour, fixed in globular lantern 36 inches diameter, with opal top.

Photometrical value per foot, 3.95 candles.



(1) BRAY'S 200-CANDLE ARGAND, consuming 46.75 cubic feet per hour, fixed in Bray's shadowless lantern.

Photometrical value per foot, 3.34 candles.



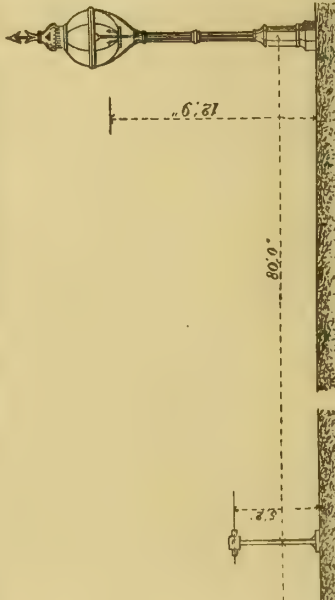
BRAY'S 200-CANDLE QUADRUPLÉ BAT'S-WING, consuming 46.75 cubic feet per hour, fixed in Bray's shadowless lantern.

Photometrical value per foot, 3.34 candles.



(2) BRAY'S 200-CANDLE QUADRUPLÉ BAT'S-WING, consuming 46.75 cubic feet per hour, fixed in a clear glass globular lantern.

Photometrical value per foot, 3.08 candles.



BRAY'S 200-CANDLE QUADRUPLÉ BAT'S-WING, consuming 46.75 cubic feet per hour, fixed in Bray's shadowless lantern.

Photometrical value per foot, 3.34 candles.



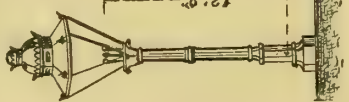
(3) BURNER AND LANTERN used by the Paris Gas Company in the Rue du Quatre Septembre, consumption 46.75 cubic feet per hour.

Photometrical value per foot, 2.90 candles.



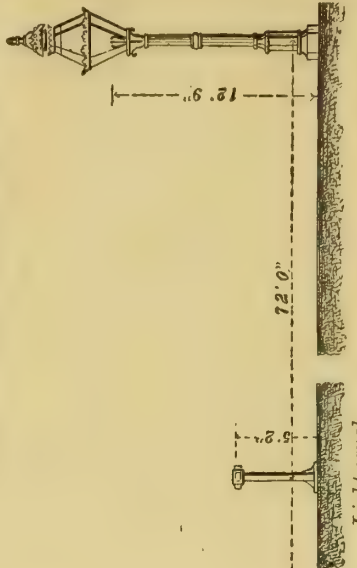
SUGG'S 200-CANDLE FLAT-FLAME BURNER, consuming 47.36 cubic feet per hour, fixed in Sugg's octagon lantern.

Photometrical value per foot, 3.42 candles.



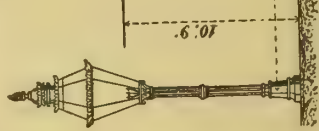
(6) BRAY'S 200-CANDLE QUADRUPLÉ BAT'S-WING, consuming 47.36 cubic feet per hour, fixed in shadowless lantern.

Photometrical value per foot, 3.34 candles.



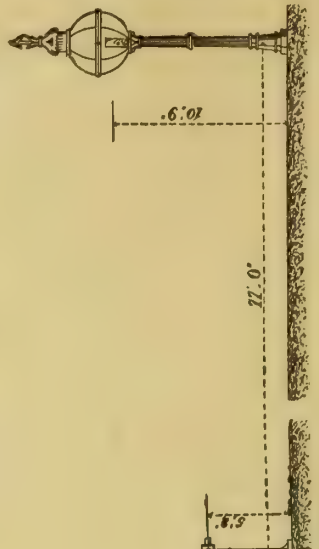
BRAY'S 60-CANDLE TRIPLE BURNER, consuming 22.08 cubic feet per hour, fixed in shadowless lantern.

Photometrical value per foot, 2.92 candles.



(7) SUGG'S 80-CANDLE ARGAND, consuming 22.08 cubic feet per hour, fixed in globular lantern with opal top.

Photometrical value per foot, 3.26 candles.



BRAY'S 60-CANDLE TRIPLE BURNER, consuming 21.17 cubic feet per hour, fixed in globular lantern with opal top.

Photometrical value per foot, 2.92 candles.



(8) SUGG'S 80-CANDLE ARGAND, consuming 21.17 cubic feet per hour, fixed in shadowless lantern.

Photometrical value per foot, 3.26 candles.



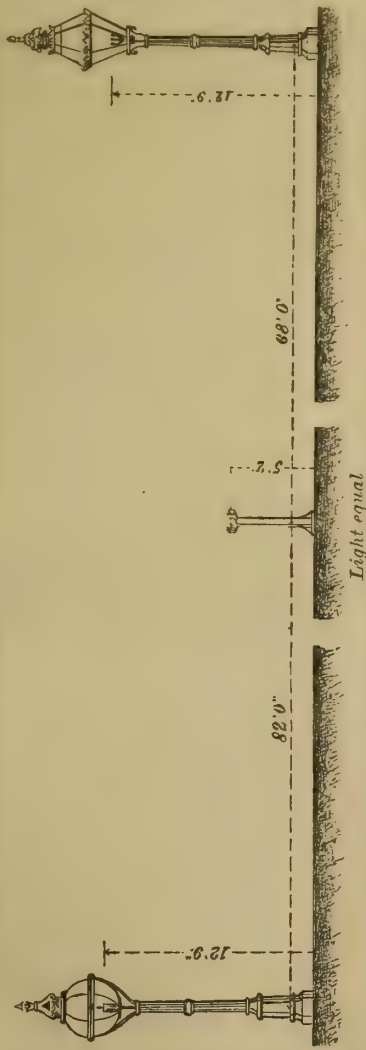


SUGG'S 200-CANDLE ARGAND, consuming 45·85 cubic feet per hour, fixed in globular lantern, 36 inches diameter, with opal top.

Photometrical value per foot, 3·95 candles.

(4) { BRAY'S 200-CANDLE QUADRUPEL WING, consuming 45·85 cubic feet per hour, fixed in Bray's shadowless lantern. V. }

Photometrical value per foot, 3·18 candles.

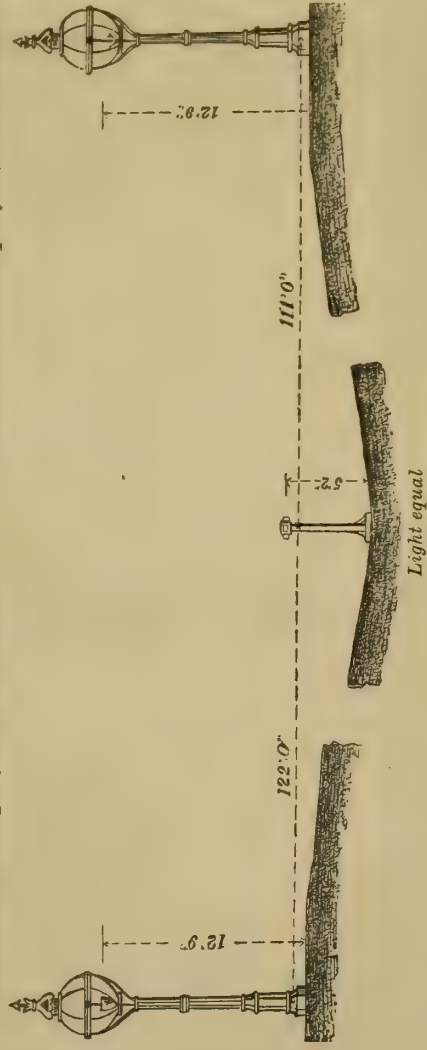


SUGG'S 200-CANDLE ARGAND, consuming 43·37 cubic feet per hour, fixed in globular lantern, 36 inches diameter, with opal top.

Photometrical value per foot, 3·95 candles.

(5) { BRAY'S 200-CANDLE QUADRUPEL WING, consuming 43·37 cubic feet per hour, fixed in clear glass globular lantern. V. }

Photometrical value per foot, 3·08 candles.



(9) { BRAY'S 60-CANDLE TRIPLE BURNER, consuming 23·07 cubic feet per hour, fixed in shadowless lantern. V. }

Photometrical value per foot, 2·92 candles.

{ SUGG'S 80-CANDLE ARGAND, consuming 23·07 cubic feet per hour, fixed in shadowless lantern. V. }

Photometrical value per foot, 3·26 candles.

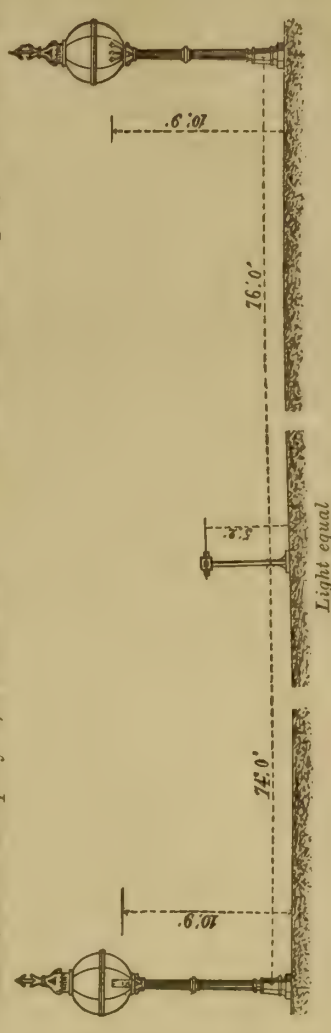


(10) { SUGG'S 80-CANDLE ARGAND, consuming 22·92 cubic feet per hour, fixed in globular lantern with opal top.* V. }

Photometrical value per foot, 3·26 candles.

{ BRAY'S 60-CANDLE TRIPLE BURNER, consuming 22·92 cubic feet per hour, fixed in globular lantern with opal top. V. }

Photometrical value per foot, 2·92 candles.



* The glass in this lantern was observed to be very thick and opaque, and could not, by cleaning, be rendered as clear as the glass in Bray's lantern.

LANTERN AND BURNER TESTS AT BIRMINGHAM.

[See Mr. HUNT'S REMARKS at the MEETING of the MIDLAND ASSOCIATION OF GAS MANAGERS, April 22, 1880.]

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changes in this direction have taken place. The town is surrounded by a coal of pits, and Hamilton may now be regarded as the centre of the coal industry of Lanarkshire. Connected as our Association intimately is with the destructive distillation of the products of these pits, I regard Hamilton, without any consideration at all of the beautiful, as a most appropriate meeting-place for the members of the Association.

I have to thank you, gentlemen, for the great interest you have manifested in the affairs of the Association, and I take this opportunity of expressing my thanks to the members of the Committee for their attendance at our various meetings, and the encouragement afforded me in the discharge of my duties as your President. I congratulate you on your selection of my successor, Mr. Carlow. You have in him a gentleman who will reflect credit on the Association; and I feel confident that whatever is in his power for the furtherance of the usefulness of the Association will be carried through with his wonted zeal and indefatigable energy.

I again ask your indulgence while I make a few remarks on subjects which are more or less interesting to all of us, and in so doing I will endeavour to be as brief as possible, as the programme of business is lengthy, and as there is nothing more hurtful to the author of any paper than the want of sufficient time for the proper discussion of its various points.

Since the electric "scare" two years ago, every gas engineer has been more than ever diligent in research—experimenting, and working out some scheme which might be instrumental in cheapening the production of gas, whether in the retort-house or any part of the apparatus, or in the proper combustion of the gas after it is produced. Many deserve the best thanks and encouragement of all of us for their arduous labours. What has been the result of the last two years experience?

We have reached a point when there is an appearance of a thorough revolution of not a few systems of working, and as the retort-house is the most important place in which any change that would have a direct influence on the reduction of first cost of the article produced could take place, there we might now reasonably expect this, if we consider the various systems of generator furnaces, mechanical stokers, and other alterations, or the hydraulic main with and without dips, with and without valves—in short, with and without hydraulic mains—that are now in operation. In passing, I would say a few words with reference to furnaces. Generally speaking, in the coke produced from cannel coal, which forms the larger portion of the firing used in Scotch gas-works, the quantity of ash ranges from 10 to 20 per cent. The inferiority of the cannel coals in many instances improved by an admixture of free or heading coal, but the percentage of the fuel consumed for a given quantity of gas produced in many cases bears no resemblance to each other, and instances are to be found where only a small proportion of the make is sold. Economy in fuel being a matter of great importance to every gas manager, careful attention is necessary so that the admission of air to the furnace should be in proportion to the amount of work required.

On the careful building of the retort-bench success in carbonizing in no small degree depends. The material used ought to be well selected, the joints of the brickwork should be as close as possible, and to allow the bricks to take thorough hold they should be dipped in water, so that the moisture in the fire-clay will not be absorbed quickly, and no setting ought to be heated up for at least three weeks after completion, which should not be by very high firing, so that the moisture may be driven out slowly, and leave the building one homogeneous mass.

The retorts generally used in Scotch gas-works are D-shaped and oval; experience having proved that these are more advantageous for gas manufacture than the round ones, which were the favourite for so many years, although the last mentioned are by far the strongest and most durable. I consider that D-retorts, 24 in. by 14 in., and 8 ft. 6 in. long, a most serviceable size, set four in one oven, with an oval top 24 in. by 15 in. by 8 ft. 6 in. The length stated is only applicable to works where they work single ovens, owing to the fact that they cannot in the light season have more than, say, two stokers on each shift. In larger works, where the number would never be less than six stokers, three through retorts of like dimensions could be worked to advantage.

Those of us who are located in the midst of the iron industry have many opportunities of witnessing the action of the gas furnaces on Siemens's principle. The adoption of this style of gas furnace to a retort-bench would in many cases be very expensive, especially where the charging-floor was the firing-floor, as it would necessitate the entire alteration and reconstruction of the bench. Not so in many of the large works, where the charging is carried on with a stage. Under this condition there is not any real difficulty in the adoption of the Siemens furnace, and I am confident the saving effected in wages, not to speak of the increased amount of work which might reasonably be expected out of the same number of ovens, as compared with our present system, would be very considerable. One argument against the adoption of these furnaces may be that of the increased quantity of coke at the disposal of the gas company. Then we should have to go on the principle of small profits and quick returns.

Another form of generator furnace is that known as Oechelhäuser's. This furnace would require but a very slight alteration for its adoption in any of our gas-works. It is nothing more nor less than a tapered shaft furnace, with a strong iron grate for the bottom, the bars of which are made sufficiently wide for the admission of air, and also to allow any slag which may gather being removed. The air passing through the grate, and coming in contact with the incandescent fuel, forms first carbonic anhydride (CO_2), which, after passing upwards through the layers of heated fuel, is converted into carbonic oxide (CO), while at the same time some of the fuel is undergoing destructive distillation, thereby causing a certain amount of hydrocarbons to be thrown off into the passing gas. Water or a steam blast might be used under the bars. If water were used, it would become vaporized, and, passing through the highly heated fuel, would be decomposed, adding additional heating power to the gas formed, carbonic oxide being formed and free hydrogen, thus— $2\text{H}_2\text{O} + \text{C} = \text{CO}_2 + 2\text{H}_2$. By careful working of one of these furnaces, the desired temperature could be uniformly kept by regulating the proportions of air at the ports. The intensity of the flame could be varied with as great ease as an ordinary blowpipe.

Before leaving this very important subject, I would name a few of the great points of importance to us, as gas managers, that the gas furnace has over the present system. With a gas furnace we could (1) use an inferior description of fuel, such as a mixture of coke, small dross, or peat; (2) the cost in the retort-house would be reduced by having fewer stokers; (3) the amount of work done by each oven would be greater, owing to the almost unlimited calorific power at our disposal; (4) a larger yield of gas per ton would be obtained, owing to the uniformity at which distillation could be carried on; and (5) the durability of the retorts would be extended, all clinkering and feeding the fires having been dispensed with. In the ordinary system, the draught of the chimney has full scope over the entire setting, and causes a diminution of temperature, consequently a slight contraction of the retort; and the air admitted during these operations, say, at 60° Fahr., is heated, say, to 1200° Fahr., and it is quite evident that this increased temperature is due to the heat of the retort, and that therefore there is a loss of heat on the setting. This great loss of heat is obviated by the use of the gas furnace. I may mention that the nearest approach to the gas furnace that I have yet seen in retort-

setting is that carried out by Mr. Hislop, of Paisley, where he takes advantage of the waste heat of the flues to heat the air previous to its admission to the ovens, which is done by an ingenious arrangement of vertical flues and small dampers, although I do not think Mr. Hislop would set his arrangement against the one I have just described.

For many years there has been a great desire on the part of not a few gas engineers to have the hard and laborious work of the stoker, if not supplanted, at least reduced to a minimum, by the introduction of some mechanical appliances. In no piece of apparatus in connection with gas manufacture is there greater diversity of engineering skill shown than in the machines patented from time to time for charging and drawing retorts, each patentee thinking, no doubt, that he has solved the problem. As this is a subject in which I take considerable interest, my inclination was to have gone fully into it, but the time at my disposal would not admit such a digression. I fully expected to have been able to give you at this meeting a few facts as to the working of the two systems which claim the supremacy for charging and drawing retorts. I refer to the Foulis and the West machines. Feeling assured that the days of shut gates to brother managers were ended, I put myself to considerable inconvenience so that I might see the two systems. I visited the works where these machines are in operation, and was most courteously received by the Engineer, who, unfortunately, had another engagement, and could not accompany me to see the machines at work. Before leaving me, however, a message was sent to one of the patentees, stating that I was there, and wished to see his machine working; my curiosity being increased on having read the figures which appeared in the JOURNAL OF GAS LIGHTING a few weeks before my visit, as to the amount of work capable of being done by this particular machine. I waited till my Scotch patience was exhausted, without seeing either the patentee or his machine, and left the station no wiser than I entered it. Since then, however, a "report" has been issued on the two systems, after a comparative trial, and this does not require any remark from me, as every gas manager can form his own opinion of the various circumstances and the results. One point brought out in connection with Mr. West's machine, and to which there appears to be attached considerable weight, is the breaking of the coal. I believe it to be the experience of many gas managers that if coal is not broken into reasonably small pieces the yield of gas will not be so great as if it has been; but even on this point there is difference of opinion. I visited a works some time ago where the coal was being charged in lumps having a cube of at least 200 inches, and the yield of gas from that works over the year's working was fully 11,000 cubic feet per ton of coal carbonized; so that in different localities the material to undergo distillation requires different treatment. My own opinion is that the length of the pieces is not so much a hindrance to the evolution of the gas as the thickness. As the retorts most in use in Scotland are D-shaped, with a good stoker there is little difficulty in having the charge put in in good time and evenly. I read some time ago of a meeting of gas engineers, where mechanical stoking was the subject of discussion. One gentleman mentioned that the time for charging and drawing a retort was "nine minutes." Then, in these circumstances, a great saving could be effected by that gas company with the use of the mechanical stoker. I consider the time mentioned much in excess of what it should be. An oven of five retorts can easily be drawn and charged in from ten to twelve minutes by two men; but we must look to having a simple reliable machine, and companies having works laid down suitable for their use ought to encourage every attempt at overcoming the difficulty. The patentees of the two machines I have mentioned, and also Mr. Warner, of South Shields, deserve the best thanks of the whole gas community for their endeavours in this way.

That every gas manager should have the means of satisfying himself as to the position he has attained in the production of gas from the material employed, it is essential that he should make periodical testings of the deliveries of coal at his works, because although an analysis of the coal produced at the pit at a certain date be correctly made, it might bear a very indifferent relation to the coal raised from the seam that day six months. We have many instances of changes or variations in the quality of the same seams in this district, so much so that in two pits belonging to the same firm the difference in the yield of gas per ton of coal is known to vary from 1000 to 1500 cubic feet, and the quality from one to two candles. Take the Kirkwood seam as another example of the changes in the same strata—two pits within a very short distance of one another. The No. 1 coal, as it is named, gives over 1100 cubic feet more gas than No. 2, and the quality of the gas is $1\frac{1}{2}$ candles better. In fact, in one part of the field operated on by one of the pits named, the two classes are raised, the physical characteristics of the coal being very different. I only cite these two instances to show that a change in the quality of the coal may occur, while the seller may be acting perfectly honestly with the purchaser. He cannot foretell the upheavings of the field he is engaged on, all having their dip and rise, and their dislocations, which might throw the seam up or down, or thin it out and away from him altogether. But in all these changes how important it is that the manager should be able to know, both for his own satisfaction and that of his company, the constituents of coal, which may be classed in the following order:—(1) The combustible non-illuminating constituents. (2) The illuminating hydrocarbons. (3) The constituents that are not essential as regards illumination. (4) The impurities. As there are not two seams alike in the proportion of these constituents, hence the cause for, and the advisability of gas managers endeavouring to overcome any little difficulty in their way to enable them to make periodical tests for their own satisfaction as to the material they are called upon to use.

I fully expected that we should have been favoured with a paper on scrubbing and washing, by Mr. Monk, of Lanark, and I regret very much that he has not been able to see his way to give it. This is a subject of great importance, and, as far as I can learn, Mr. Monk has been very successful in his adaptation. His arrangement is thoroughly unique, and is effective in its action. I trust that at no distant date we shall have Mr. Monk with a paper on his system of condensing, scrubbing, &c.

The amalgamation of the two Associations is again to be brought up, and this time for disposal. I hope you will consider calmly the importance of the step under consideration. The change cannot injure the Association asking your co-operation, but I am afraid many members who have stood by this Association in the struggles of its infancy will be somewhat difficult to convince of the improvements that may accrue from the annihilation of the West of Scotland Association as it now stands. Seeing, then, that it is a matter of great importance to you as members, I again ask you to consider well what is your duty, in the best interests of the Association, and the advancement of the object of its existence.

Mr. Niven has been induced (no doubt from his experience of the now recognized tables for correcting the quantity and quality of the gas under examination) to strike out in a new line of thought, and, as it were, to make a short cut. From Mr. Niven's clear philosophical mode of reasoning, and his good sound logic, I have no doubt we shall have a highly interesting and instructive paper from him. Most of us who have used the tables have found, I dare say, very little inconvenience in their application; but we shall be glad to hear Mr. Niven's views on the subject.

We have a paper from Mr. Brodie on gasholder construction. From

the nature of the subject, and his long experience in the work on which he has kindly consented to give a few remarks, I have no doubt it will be like its author—thoroughly practical, and full of good sound advice.

On Mr. Hislop's limo process I will say but little, as the report of our Committee will fully convey to you their finding of a test made under their supervision.

Mr. Mayer has volunteered his services at this meeting as a contributor, by way of a paper on "Painter's Hydrostatic Joint for Gas and Water Mains." It is a little unusual to have gentlemen outside the Association giving papers; but if the end and aim of the Association is to be attained, papers must be forthcoming. There are many inventions and new adaptations in every department of the manufacture and distribution of gas, which cannot fail to elicit much interest and profitable discussion, and the members must really consider their duty to the Association. We cannot all of us be listeners, otherwise the progress will not be creditable to the character of the Association. Hitherto the work done has been good, and I may be pardoned if I say it has not been without its influence and benefit to the gas world. It is not necessary that the papers should be embellished by fine oratory. We want the important subjects connected with our every-day experience brought forward and discussed in a simple, homely, and business-like manner. Then the contributor of the paper will be benefited himself, and will have the pleasure of knowing that he has furnished his quota to the furtherance and the extension of the usefulness of the Association, because it is by individual effort alone that success can be attained. I consider it an injustice to your own feelings, if you are possessed of an opinion on any subject which may be under discussion, should you, through diffidence, allow the opportunity to pass without giving expression to it. Do your part of the work nobly. You would not consider it complimentary if some of your neighbours were to undertake the management of your affairs. In the same spirit, show that you realize the responsibility you are placed under to the Association by forming a part of its membership, and doing your share of its work cheerfully, and show that you are worthy of membership in an Association which has for its object mutual improvement and advancement in our professional duties.

A hearty vote of thanks was, on the motion of Mr. DALZIEL, accorded to the President for his interesting address.

[The report of the further proceedings at the meeting will be given in subsequent numbers of the JOURNAL.]

THE APPROPRIATION OF GAS PROFITS AT MANCHESTER.

The Quarterly Meeting of the Manchester City Council was held last Wednesday—the Mayor (Alderman Patteson) in the chair—when a report was submitted by the Town Clerk (Sir Joseph Heron), conformably to a resolution passed at the previous meeting, on the 7th ult.—"That the Town Clerk be requested to examine the various Acts of Parliament which regulate the purposes to which the surplus gas profits may or are to be applied, and to prepare and submit a report to the Council, showing the legal position both of the Gas Committee and the Council in relation thereto."

The report contained an extract from a lengthy report made to the Gas Committee by Sir J. Heron, in 1864, in which all the various clauses in several Acts of Parliament (now, in fact, repealed) bearing on the question were set forth. The Town Clerk submitted that the references to the provisions in the various Acts of Parliament clearly showed:—

1. That the gas-works belong to, and are the property of the inhabitants or ratepayers of the township of Manchester.
2. That such works and the management thereof are vested in the Corporation as trustees for the inhabitants of such township.
3. That the mortgage debt owing and secured upon the gas-works is the debt of such township.
4. That the amount of profits fairly or reasonably obtainable by the manufacture and sale of gas can only be determined by reference to the capital employed; or, in other words, the value of the property employed in its manufacture.
5. That the amount obtained upon mortgage for the purposes of the gas-works, or which may at any time be owing, in no way affects the value of the works.
6. That so far as the property in the gas-works, and the rights of the township of Manchester in respect thereof, are concerned, it is immaterial whether the amount expended on such works has been paid out of the surplus profits belonging to the inhabitants of such township, or out of moneys borrowed upon the security of their property; and that, assuming that the whole of the debt contracted had been paid off, and that there was no charge whatever upon the gas-works—that there was not, in fact, one farthing of debt owing—the capital employed, as represented by the value of the works belonging to the inhabitants of the township of Manchester, would remain the same.
7. That the whole of the surplus rents or profits obtained by the supply of gas belong to, and ought—subject, of course, to any special legislation upon the subject—to be expended for the benefit of the ratepayers at large of such township; and that by the law now in operation the surplus profits are required to be expended "in and towards the improvement of the township of Manchester."

The report next submitted for the information of the present members of the Council a copy of a further report on this subject, made by the Town Clerk to the Gas Committee, and by them presented on Feb. 4, 1874, to the Council. That report stated:—"The gas-works belong to, and are the property of the inhabitants of the township of Manchester, and such works and their management are vested in the Corporation, as trustees for the inhabitants of such township. Such is the strictly legal position; but for the purpose of this report, it will be assumed that the gas-works belong to the inhabitants of the city, and that they are vested in the Corporation as trustees for the whole of such inhabitants. It is the obvious duty of the Council, as such trustees, to secure by the sale of gas, at a fair market price, a reasonable return upon the capital—or, in other words, upon the value of the property—employed in the manufacture of gas; and that return the Council has determined ought to be 10 per cent. To sell gas at cost price, or at any price avowedly below the fair market price, would be an absolute breach of trust; it would be to deprive the inhabitants or ratepayers at large of profits or returns on the capital employed, to which they are fully entitled, in order to benefit the gas consumers only, who form but a portion of the ratepayers of the city, and would be such a breach of trust as would, in the opinion of the Town Clerk, be prevented or restrained by a Court of Equity. Some years ago the Gas Consumers Association was formed in order to effect a reduction in price. They sought to obtain gas, not at cost price, but at what they contended was the fair market price, and they fixed that price—with the then low-priced coal—at 3s. 9d. per 1000 cubic feet; and it is certain that when that price was sanctioned the Association voluntarily ceased to exist. Liverpool is supplied with gas by a private Company, which, like the Corporation of Manchester, enjoys a complete monopoly; whilst the population is greater, and the consumption of gas more general than in

Manchester. In Liverpool, equal facilities for obtaining coal and cannel exist; and for a long period (during which the price of gas was lower than in Manchester) the gas consumers here pointed to the price paid in Liverpool as the price which ought to be charged in Manchester. At the present time the price in Liverpool is 3s. 9d., whilst it is only 3s. 8d. per 1000 feet in Manchester. It is true that the Council has determined that a return of 10 per cent. upon the capital employed in the supply of gas ought to be obtained, for the benefit of the ratepayers generally; but—even if necessary to secure such return—it would be difficult to defend a higher price in Manchester than might be charged in Liverpool. The amount of profits made (so long as they do not exceed the percentage allowed), or the appropriation of such profits, has nothing whatever to do with the price charged for the gas. It is sometimes asked, 'Why should the improvements be paid for by the gas consumers?' The reply is easy and conclusive. The gas consumers do not pay for the improvements; they pay for gas, just as the man who goes into the baker's shop pays for bread. The improvements are paid for by the ratepayers, and it is for them, and for them only, to determine whether the gas profits, which belong to them, shall (as now required by law) continue to be applied for that purpose, or whether such expenses shall be defrayed by means of an improvement-rate, and the gas profits paid to the credit of the city fund and in payment of the general expenses of the Corporation, or applied in any other way that may be deemed more beneficial to the inhabitants. Parliament would no doubt be quite prepared, at the instance of the Corporation, to alter the existing law, and to authorize the appropriation of the gas profits in any way and for any purpose which might be deemed to be most beneficial to the ratepayers. Having shown that the price of gas is altogether unaffected by the amount or the appropriation of the profits, and that, under all circumstances, nothing more nor less than the fair market price ought to be charged, the Town Clerk will shortly refer to the proposal or suggestion made that the expenses, or a portion of the expenses, of the improvements should be defrayed out of, and by means of an improvement-rate. What is meant by this proposal it is difficult to understand. If it is proposed to keep down the price of gas below the market price, and by means of an improvement-rate to obtain the amount of profits which by such a course would, for the benefit of the gas consumers, be sacrificed, there is no doubt that such a course would be both dishonest and illegal. What the imposition of an improvement-rate has to do with the price of gas has yet to be shown. It is quite possible that such rate may, in addition to the gas profits, be required to pay for improvements in progress or contemplated, but the exigencies or requirements of the Corporation in that respect, be they great or small, ought not in any way to affect the price of gas. When it was recently proposed to raise the price of gas 5d. per 1000, or to 3s. 9d. per 1000 feet, as charged in Liverpool (and which price it is said would, considering the present price of coal, be rather below the fair market price), the advance was objected to, and it was suggested that instead of any advance an improvement-rate should be levied. How such a proposal, if carried out, would affect the ratepayers, was clearly shown in a letter from a 'Ratepayer,' which appeared in the Manchester papers, and in which it was stated that 'there are more than 30,000 householders who do not consume more than 4500 cubic feet of gas per annum, which gives (at the additional price of gas of 5d. per 1000 cubic feet) 1s. 10½d. per annum each. An improvement-rate of 4d. in the pound would be necessary to raise the £30,000, and, calculated on the rental of a house at £12 rateable value, would be 4s.;' or, in other words, the 30,000 tenants would, if the advance in the price of gas were not made, and instead (as suggested) an improvement-rate of 4d. only were levied, save 1s. 10½d. in the amount paid for gas, and be called upon to pay an additional 4s. in the shape of an improvement-rate. It appears from the last published report that there are 15,000 gas consumers outside the city, who, it need hardly be said, have no interest whatever in the gas-works, or in the profits made; and it is thus coolly proposed that the ratepayers of Manchester—to whom the gas-works do belong—shall be called upon to pay an improvement-rate in order that such outsiders, who have no interest in the works, may have gas supplied to them below the market price. The position of ratepayers who are also gas consumers within the city only has been referred to. But what would be the position of the ratepayers who do not consume gas? There are within the city 79,600 separate assessments, and only 47,827 gas-meters, or, in other words, there are 30,000 tenements of which the occupants pay rates but do not consume gas. If, therefore, the advocates for low-priced gas and an improvement-rate could have their way, it is obvious that such 30,000 ratepayers, or whatever the number may be, who do not consume gas—to whom, be it remembered, with the ratepayers who are gas consumers, the works and the profits of the works belong—would, in addition to present rates, be called upon to pay an additional improvement-rate, in order that the gas consumers both within and beyond the city might, at their expense, be supplied with gas below the fair market price. From the statements now submitted it will be manifest, when the legal position and the responsibilities of the Council in relation to the gas-works are considered—1. That the Council, as trustees of the property for the whole of the ratepayers, is bound to obtain a reasonable profit or return on the capital employed in the manufacture of gas. 2. That the gas consumers have only the right to require, and the Council are only justified in selling gas at a fair market price. 3. That the imposition or otherwise of an improvement-rate, or the amount or appropriation of the gas profits, has nothing to do with, and ought not in any way to affect the determination of the fair market price which ought to be charged for gas. 4. That there is no pretence whatever for the statement that the gas consumers pay the expenses of the improvements, inasmuch as the profits (at present so employed) belong to the whole of the ratepayers, and in no sense to the gas consumers."

In a note appended to the report the Town Clerk said—

"The only change which has taken place since such report was presented is that the gas-works, which at that time were the property of the ratepayers of the township of Manchester, have been made and are now the property of the ratepayers of the whole city, and that the gas profits are by law applicable no longer to improving only the township of Manchester, but 'in and towards the improvements of the city of Manchester.'"

The report was received, and ordered to be entered on the minutes.

SEVERE EXPLOSION OF GAS AT ILKESTON.—Last Tuesday, about dusk, the inhabitants of Cotmanhay Road, Ilkeston, were alarmed by a loud report, caused by an explosion of gas, which had accumulated in a disused sewer. The ground near had given way, by reason of the mining operations carried on beneath; and the main, which has frequently been repaired, was rendered unsound at the joints. About 30 yards of asphalt pavement were blown into the road, several doorsteps and windows broken, and a man who was passing was severely injured. Intelligence was at once sent to the gas-works, and Mr. F. C. Humphrys, the Manager, was soon on the spot with a number of men; but it was some hours before the pathway was restored. The unusual occurrence attracted a large concourse of people.

THE GAS SUPPLY OF STONE.

THE APPLICATION OF THE LOCAL BOARD FOR A PROVISIONAL ORDER REJECTED.

At the Meeting of the Stone Local Board on Monday, the 3rd inst., the Clerk read a letter which had been received from the Local Government Board in reference to the Board's application for a Provisional Order empowering them to erect works to supply gas in competition with the existing Gas Company. The letter was in the following terms:—"I am directed by the Local Government Board to state that they have had under their consideration the report of their Inspector (Captain Hildyard), made after the inquiry held by him with reference to the application of the Stone Local Board for a Provisional Order under the Gas and Water Works Facilities Act. The Board understand that gas is at present supplied to the district by the Stone Gaslight and Coke Company, and that the Local Board have been desirous of purchasing the Company's undertaking. The Company and the Local Board, however, have not been able to come to terms, though it was stated at the inquiry that the former would have been willing that the price should have been settled by arbitration. The Local Board could not acquire the undertaking compulsorily, and, consequently, they could only be empowered to establish separate works. The Board learn, however, that the Gas Company are prepared to apply for parliamentary powers, and also to introduce the oxide of iron process of purification instead of the present lime system. Captain Hildyard reports that in this way all legitimate cause of complaint will be removed. Moreover, the Board think that under ordinary circumstances a local board should provide their districts with works of sewerage and water supply before they set up a gas undertaking, and it appears to them that this course should be followed in the present instance. Having regard, therefore, to the foregoing considerations, the Board are not prepared to issue the Provisional Order applied for."

The report of Captain Hildyard, on which the above-mentioned determination was based, is appended, omitting a few of his preliminary remarks as to population and area:—"The Stone Local Board's case was as follows: They maintained that the price of gas was exorbitant, that the profits made by the Gas Company were unreasonable, that the works were carried on upon an obsolete and wasteful system, that the works as carried on and placed were a nuisance to the town, that it was most desirable that gas-works should be in the hands of the local authorities, and that under these circumstances they had done all in their power to come to terms with the Gas Company, whom they asked either to sell or to obtain statutory powers to so place themselves under statutory control. Failing in these negotiations, the Local Board proposed now to set up their own gas-works, though understanding that the size of the town was not such as to support two gas undertakings. The case of the Local Board failed altogether. The price of gas—4s. 2d. per 1000 feet—is not high for the size and position of the town. The profits of the Company from first to last were proved to be under 10 per cent. per annum. The works, though capable of improvement, are in good working order. Considering the position of the works, close to the main street, the present process of purifying should be altered; but the Local Board actually proposed to take the works in their present position, thus showing that they do not consider this as a serious nuisance. Doubtless it would be better for gas-works to be in the hands of the local authorities, but in the present case, the Local Board, being a newly-formed one, with all its works (sewerage and water supply) before it, I think that these works should first be carried out. As to the negotiations between the two parties, the Gas Company certainly wrote saying they would take a certain sum, £20,000, and that it was useless to offer less; thus, in the opinion of the Local Board, breaking off the negotiations. This letter, however, did not preclude the Local Board from proposing arbitration, and this the Company say they would have been ready to accept. Looking at the size of the town, it is evident that two gas-works cannot be supported, and the proposed action of the Local Board could then only have one of two results—the ruin of the Gas Company, or the amalgamation of the Gas Company with the Local Board. Either of these results would be most undesirable. The Chairman of the Gas Company pledged himself most distinctly that, as far as he knew, he could answer for his Shareholders that they would be ready to go to Parliament for a private Bill in the ensuing session; and, further, that they would be ready to introduce the oxide of iron purification instead of the present lime system. This will, I believe, remove from the town all legitimate cause of complaint. Recommendation: That the Provisional Order be not granted to the Local Board to authorize their constructing and maintaining gas-works."

ULVERSTON LOCAL BOARD GAS AND WATER SUPPLY.

At the last Meeting of the Ulverston Local Board, the Manager of the Gas and Water Works (Mr. John Swan) read his annual report, which was as follows:—

To the Chairman and Members of the Ulverston Local Board.

Gentlemen,—I have pleasure in laying before you the operations of your gas and water works for the year ending March, 1880.

Gas.—Notwithstanding the depression of trade during the last twelve months, there has been a slight increase in the consumption of gas. The quantity of gas manufactured during the year ending March 31, 1880, has been 16,106,200 cubic feet; the quantity made during the year ending March 31, 1879, was 15,752,900 cubic feet, being an increase of 350,300 cubic feet, or 2·2 per cent. The quantity of gas registered by the consumers meters during the year ending March 31, 1880, was 13,149,500 cubic feet; quantity sold for public lighting, 1,911,186 cubic feet; quantity consumed on the works, 161,600 cubic feet—total, 15,222,286 cubic feet. The unaccounted-for gas has been 883,914 cubic feet, or 5½ per cent. as compared with 6½ per cent. last year. The gas consumed on the works last year was included as leakage, but the amount during the last twelve months has been accounted for, so that the net saving has been ¼ per cent., or 40,265 cubic feet. The average make of gas per ton of coal carbonized during the year has been 10,231 cubic feet, showing an increase of 20 cubic feet over the production of last year.

The future prospects of trade are not yet sufficiently bright to warrant the Board in proceeding with the erection of the proposed new retort-bench, and with an ordinary increase in the consumption of gas the present manufacturing power will be sufficient for another winter. The new exhaustor and scrubber continue to do their respective work in the manufacture and purification of the gas very efficiently.

The extra production of gas per ton of coal carbonized has averaged 1027 cubic feet, and the sale of gas per ton has realized as much as was previously manufactured. The quantity of ammoniacal liquor produced during the last twelve months has been 49,000 gallons, as against an average of 29,000 gallons previous to the erection of the scrubber; the extra amount of money realized representing £112 per annum, while the gas has been free from ammonia and carbonic acid.

There is a deficiency of tar and liquor storage room at the works, and I would recommend the Board to erect a cast-iron tank above the engine and exhaustor house, with a pump attached by an eccentric rod to the shaft which drives the machinery of the scrubber. There would be then very little manual pumping required, and consequently the cartage could

be done for less money, while the convenience and general appearance of the works would be improved. I estimate the cost of the foregoing at £112.

All the apparatus, buildings, &c., have undergone during the year the usual repairs, and are in good working order and condition. The mains and services are also in good condition, which is borne out by the continued reduction in the unaccounted-for gas.

The illuminating power of the gas during the year has averaged 17·43 candles. The number of street-lamps is 214, six new ones having been added during the year, and are lighted with 120 burners, consuming 5 cubic feet of gas per hour, and 94 consuming 3½ cubic feet per hour. Nearly all the lamps have been fitted up with Peebles's patent needle governors, and the result has been a great improvement upon the lighting of the town. The total number of meters in use is 890. Twenty-eight new consumers have been added during the year, and twenty have ceased to use gas, or have left the town, making a net gain of eight consumers over the previous year.

The total length of mains added during the year has been 137 yards.

Working Statement.	
Gas made, as per station-meter	16,106,200 cubic feet.
Gas sold to private consumers	13,149,500 cubic feet.
Gas sold for public lighting	1,911,186 "
Gas used on the works	161,600 "
	15,222,286 "
Unaccounted for (5·5 per cent.).	883,914 cubic feet.
Coal carbonized—common, 1323 tons; cannel, 251 tons.	1,574 tons.
Illuminating power required by Act.	14·00 candles.
Illuminating power supplied	17·43 "
Gas made	16,106,200 cubic feet.
Gas made per ton	10,231 "
Gassold	15,069,086 "
Gas sold per ton	9,568 "
Gas sold, per cent. on make	93·50 per cent.
Gas used at works	161,600 cubic feet.
Gas used at works, per cent. on make	1·00 per cent.
Gas unaccounted for	883,914 cubic feet.
Gas unaccounted for, per cent. on make	5·50 per cent.
Coke made	985 tons.
Coke used for fuel	592 "
Coke used for fuel, per cent. on make	60 per cent.
Tar made	23,400 gallons.
Tar made per ton of coals	15 "
Liquor made	49,000 "
Liquor made per ton of coals	81 "

Water.—During the year there has been a constant supply of water furnished throughout the Board's district, except on one or two occasions, when a temporary inconvenience was occasioned through the bursting of the 9-inch main between Pennington and the filter-bed. The reservoir at Pennington was finished for formally opening on Sept. 3, 1879, and since then the supply of water to Ulverston has been very much improved in quality.

During the year the Committee have had before them the question of meter *versus* gauge, for the purpose of measuring the compensation water to be delivered by the Barrow Corporation to the Board, and after a considerable delay the system of measurement by gauge has been satisfactorily agreed upon between the Barrow Corporation and the Board, the position and construction of the gauge to be carried out as per agreement.

Water has been laid on from the Board's mains to 73 additional premises during the year, and the total number of premises now supplied is 1855. Thirteen extra hydrants have been added during the last twelve months, and the total number of hydrants in efficient order is 116. All the services in Sontergate have been disconnected from the old main, and attached to the new 4-inch main on the opposite side of the street.

The total length of mains laid down during the year has been 1881 yards.

(Signed) JOHN SWAN, Manager.

ODESSA WATER-WORKS COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held at the City Terminus Hotel, Cannon Street, on Wednesday, the 21st ult.—Sir FRANCIS S. HEAD, Bart., in the chair.

The SECRETARY (Mr. Emanuel Allen) having read the notice convening the meeting, the report of the Directors was taken as read.

The CHAIRMAN said the first paragraph of the report gave the result of the year's work, and he thought that this result was satisfactory as compared with the previous year. The receipts had been £47,334, as against £39,061 last year, which, of course, was a considerable increase. The expenditure was about the same, but in reality it was £1800 less, consequent on the diminution in the loss by exchange. The surplus of £4021 was, as before, applied in aid of the dividend on the A shares, now making the amount for this purpose over £10,000. The next paragraph referred to the guarantee—the very moderate amount promised by the Municipality of Odessa, under a so-called guarantee. He need hardly remind the Shareholders that the amount guaranteed was 300,000 roubles, which was to be made up if their receipts were below that sum, on the condition that when they exceeded it such amounts should be paid out of the excess, and the report explained to them what the effect of this would be if it were enforced—that they would absolutely, after supplying the town of Odessa for six years without getting one shilling of dividend, stand indebted to that town to the extent of 378,000 roubles for giving them the water for nothing. It was very desirable that this matter should be clearly and broadly put before the Shareholders, the public, and the Russian Government, because the altogether absurd, unjust, and unbearable terms on which this contract was concluded were some of the most monstrous things that could be mentioned and explained them more clearly than he could. The Directors would, of course, try to bring the matter strongly before the Authorities, and, if they had any feeling of justice or sense of right, he hoped the Company would obtain an alteration. He might take this opportunity of saying that while the Municipality were so exceedingly particular about enforcing the terms of their contract as regarded payment, they were constantly pressing the Company to lay down additional mains. They had had an application for a main to be laid seven miles north of Odessa, estimated to cost 90,000 roubles, and at the beginning of last February a threat was made to take legal proceedings to have it carried out. They also wanted the Company to lay another main beyond the concession on the road to Nicolai, and legal proceedings were also threatened in this case. There were also two other new mains situated within the boundary, but the Directors hoped to postpone them for the present, because the work would not pay expenses, and they would do what they could to prevent laying these mains. The other two were of more importance. In one case the Directors had agreed to an extension in the boundary, but the cost would probably only be £350, and the return was likely to be remunerative. On the other hand, with regard to the fulfilment of their own obligations, he was afraid the Municipality were not quite so careful; and the report informed the Shareholders that, with regard to the construction of sewers, which was promised to be effected immediately on the Company's formation, and upon which, in fact, the

whole future of the Company was based, this had never been carried out. The town, as he had told them frequently before, suffered enormously in many respects from the want of these sewers, and they were still very far from completion. At present there were constructed about 31 miles of sewers, of which 4 miles had been completed since the beginning of 1879; but there were still 9 miles to be built of the sewers which were promised to be opened immediately on the completion of the Company's works, and about 31 miles of sewers had also to be constructed in the suburbs and the poor quarters. These were works which the Municipality were bound to perform, and for the neglect of their performance the Company were suffering enormously in their receipts. As soon as the houses were connected with the sewers a very considerable amount of water would have to be taken by each house for flushing and cleansing the sewers. When, however, they were completed, they had no outfall. There were at present only two provisional outfalls, and both were very objectionable and defective. One would have to be removed very shortly, and would involve the Municipality in considerable expense. All these matters were beyond the control of the Board. On the other hand, a certain amount of progress had been made. Some 528 houses had already received authority to make connections with the sewers, and other houses were being daily added to the list; but, after all, the total number of houses supplied with water at all was only 3407, those having received authority to connect with the sewers being only 17 per cent. of this number, and there were still 2000 houses unsupplied with water. If the Company only had something like decent or fair treatment, they would not be in their present position; but, as it was, they must wait, as they had done, till they obtained more justice. He mentioned these things because he did not wish it to be supposed that the Directors were querulously complaining. They were telling the Shareholders the circumstances of the concern being in its present position when it ought to be flourishing. The next paragraph in the report went on to say that the Board had paid off £5800 of debentures during the last year out of the earnings of the Company, and they were still obliged to retain the cash balance at the credit of the dividend account to meet others falling due. That explained their inability to share the small dividend they had earned. They were obliged, in the present condition of the concern, to keep what money they had for dealing with their debentures. If gentlemen who were largely interested as Shareholders would consider the security they offered and the interest they paid, they might see that it would be worth their while to put the Company in a better financial position. This year they had about £15,800 debentures falling due. Of these about £5000 had been renewed, so that about £10,800 had to be paid off, and this would have to be paid off from the only funds at their command—the receipts to which he had referred. The receipts had increased very considerably over last year, owing to the natural requirements of the town, in spite of their disadvantages. He might say that he had the returns of the last three months—January, February, and March—and they showed that the Company's receipts had been 81,932 roubles (say, 82,000 roubles), as against 72,000 roubles in the corresponding months of last year. That was, roughly, something like 15 per cent. increase during the last three months, which showed that the increase was fairly to be expected to continue—in short, it would be very different from the history of other water companies if this were not the case. At that moment, too, they had outstanding claims of one sort or another amounting to about £20,000, including, of course, their claim on the Government for the water supplied to the garrison of Odessa. The report next stated that "the action which for the last four years has been maintained by Messrs. Schwaben and Müller against the Company has at length been decided in the Court of Common Pleas." Perhaps the Shareholders would allow him to say a few words on the nature of this action. In July, 1875, Messrs. Quick, their Engineers, reported to the Board that they were unable to certify to the amount claimed by Mr. Müller, who was the Company's contractor. Of course, that statement was laid before the Board. Almost one of the first things he heard of when he joined the Board was the receipt of a letter on the 1st of September from Mr. Müller's solicitor, threatening an action against the Company, and claiming £95,000. This was followed by a writ, which was served on the Company for £70,000, and on Nov. 29, 1875, the particulars of claim were sent in, amounting to £72,110. The Board discussed the matter, and after much consideration they came to the conclusion that they would resist it. They felt it was a matter which they had better fight, and a very long fight it had been. The case first of all came before Justice Field, but was afterwards referred to an arbitrator. All the accounts were gone into one by one, and the effect of it, after all, was that the referee reported in the Company's favour, and judgment was given in the Court of Common Pleas by Justice Field to the extent described in the report—that Mr. Schwaben had to pay them £14,696, and Mr. Müller £6483, with all costs, the costs amounting to about £2100. Those costs had to be taxed, and when that process was completed they would see what they could recover. He thought, as far as the Board were concerned, that they could take credit for having protected the interests of the Company very effectually. The next paragraph referred to the increasing enlargement and prosperity of Odessa, on which he could only say that the trade of Odessa and everything in Odessa was satisfactory, except the Odessa Water-Works Company. They were all going ahead there, they had the tramway lines down, they were building new railways and tramways, and, in short, they were all very happy; and he ventured to repeat that a great deal of this prosperity was owing to the circumstance that the inhabitants had now what they never had before—an abundant supply of water, which was a thing unknown in the south of Russia. Before the Company's works were in operation, Odessa was subject to absolute dearths of water, and he might say that the people were almost dying of thirst, and had to buy water by the pint. Such a state of things was a great drawback to a commercial place. Water was what the inhabitants wanted, and the Company had supplied it to them, with the result the Shareholders saw. The report went on to speak generally of the affairs of the Russian Government, and upon this point he could say very little just at present, because, among other reasons, it was rather difficult to express the hopes he felt without a certain amount of explanation; but he might say that the policy likely to be pursued by the new Government was sure not to be more unfriendly to Russia than that which had been existing. He need not say that the sort of antagonism which had existed between Russia and England had made it very difficult for a Company like theirs to obtain that attention which he thought under other circumstances they might expect; and if a different feeling should exist hereafter, and Russia should be anxious for the good-will and kind feeling of this country, as he hoped she might be, he need not tell the Shareholders that this would be a very material matter to the concern, and upon it depended the treatment they might expect to receive from the Russian Government. In conclusion, he said he thought that, upon the whole, their position was certainly a good deal better—naturally better than it had been—and that they had fair ground for hope that it would continue to improve; but the unfair grievances under which they had laboured, and still laboured, had not been redressed; and until they were, the Company would never be in that position which water companies in England—in fact, in any other country but Russia—were in,

and he hoped that Russia would soon see that she ought not to stand in such an exceptional position. He then moved the adoption of the report and accounts.

Sir ARTHUR T. F. CLAY, Bart., seconded the motion, and it was at once carried unanimously.

The retiring Directors—Messrs. F. Wigan and John Wood—having been re-elected,

A SHAREHOLDER asked the amount due for the supply of water to the troops.

The CHAIRMAN replied that the amount was £6500, and that a Government order had been given for its payment; but in Russia giving an order and having it executed were two different things. The Government admitted the claim, and he had no doubt the Company would get it; but his feeling was that they ought not to have been kept five years waiting for it. Replying to a further question from the same Shareholder, he said he was afraid he could not say much as to what they would get from Mr. Schwaben, but they would try and get all they could.

The Auditors—Messrs. R. Mackay and Co.—having been re-elected, Mr. G. A. NORTHOVER moved, and Mr. RAYDEN seconded, a vote of thanks to the Chairman and Directors.

The motion was carried unanimously, and the proceedings terminated.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is not only no indication of any improvement in the coal trade of this district, but, if anything, all classes of round coal are becoming more difficult to move. Of the better qualities there is considerably less going into consumption for house-fire purposes, and the commoner sorts are not meeting with any better demand for steam and forge purposes, the quantity taken by works being still very limited. There is a good deal of pressure for sales, which naturally has a tendency to weaken prices, and this, with the abundance of round coal in the market, cannot fail to have some effect upon the value of coals for gas-making purposes. For gas coals there have been a fair number of inquiries recently, but these seem to have been sent out more for the purpose of feeling the market, as I do not yet hear of much having been done in the shape of actual business. It is therefore difficult to say what prices sellers will be prepared to take. Judging, however, from the figures generally spoken of in the market, 5s. 9d. to 6s. per ton would seem to be about the price which it is expected good unscreened Lancashire gas coal will fetch at the pit; but at present there is really no fixed price. For best screened Wigan Arley mines not more than about 6s. per ton is being obtained at the pit for anything like quantities, and inferior sorts range as low as 6s. per ton, with Pemberton four-feet fetching about 6s. to 6s. 6d., and common round coals for steam and forge purposes, 5s. to 5s. 6d. per ton; in some cases, where sales are pressed, lower prices even than these being accepted. In the engine coal trade there is generally a firm tone, owing to the small production of slack, some of the colliery proprietors finding it difficult to meet the requirements of their customers; but there does not seem to be quite so much push for this class of fuel as there was a short time back, and for burgy there is still only a moderate demand. The average quoted prices at the pit mouth are about 4s. to 4s. 6d. for good burgy, and 3s. 6d. to 4s. for good slack.

The shipping trade fluctuates a great deal. Last week there were indications of improvement, but this week the demand is again dull, and very low prices are being taken.

For coke there is less demand.

The iron trade is in a very unsatisfactory condition. There is little or no demand for legitimate requirements, and it is only where speculative buyers can obtain deliveries over the year at the lowest prices that transactions are reported. There is a great deal of underselling with iron in second hands, and very low prices are ruling in the market. Lancashire makers of pig iron, although they would take under 55s. per ton, less 2½, for both foundry and forge iron delivered into the Manchester district, are unable to secure orders. Stocks are accumulating at the works, and the Wigan Coal and Iron Company have blown out one of their furnaces for repairs. Hematites are being pressed upon the market by speculators who had bought for the American demand, and good brands are being offered for delivery into this district at about 78s. 4d. per ton, less 2½ per cent. The finished iron trade is very dull, and second-hand holders are offering bars delivered into the Manchester district at as low as £7, plates at £7 10s., hoops at £8, and puddled bars at £4 10s. per ton.

THE YORKSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The coal trade throughout Yorkshire is much depressed, particularly in the southern part of the coal-field, where of late years some of the largest collieries in the country have been sunk, at an enormous cost. There can be no doubt that the output is far too great for the demand, the new undertakings having, with few exceptions, been constructed with appliances capable of raising fully 1000 tons per working day. The house coal trade during the past two months has been very moderate. Coalowners complain that the high tonnage rates charged for carrying coal by rail prevent their competing with other colliery districts who send supplies to London, and a strong agitation is going on for the purpose of inducing the new Government to grant a Commission of Inquiry into the rates charged from Yorkshire as compared with other districts. At some of the largest collieries in South Yorkshire a large tonnage of gas coal is being raised, which is being for the most part supplied by contract to the leading gas-works in Yorkshire, Lincolnshire, and elsewhere.

A very fair tonnage is being sent to the eastern counties. A good deal of interest is being taken with respect to the renewal of several contracts for gas and steam coal which are now in the market. It is stated that the prices at which the last contracts were placed were far too low, and it is known that an understanding has been come to, with a view of not tendering below a certain figure. It is, however, doubtful whether this will be adhered to, owing to the very quiet state of trade and the scarcity of orders. Many of the collieries in the South Yorkshire coal-field possess such tender roofs, and are so liable to sudden outbursts of gas from the coal and floor, that the owners dare not set them down, and this will doubtless greatly influence them.

There is rather more doing in steam coal for exportation from Hull and Grimsby, the leading merchants taking a good tonnage. Daily prices of this, as of nearly all other kinds of fuel, continue low, whilst stocks at some places are accumulating.

The coke trade, although scarcely so brisk as it was a short time ago, may be said to be good. The output of the South Yorkshire district has, during the past four months, been more than doubled. At the present time, long ranges of ovens are being erected or put in repair at many places in the district. At Silkstone Common, where there are already three long rows of ovens at work, a fourth, which has been idle for several years, is undergoing repairs. The Silkstone and Dodworth Coal and Iron Company, Limited, who are noted producers of gas coal, have about 100 ovens in operation, and in a short time they will blow in two

large blast furnaces at Winfield, in Derbyshire, which have recently come into their hands.

The iron trade does not present so inviting an appearance as it did a month or rather more ago. The blast furnaces at Ardsley, Milton, Elsecar, Thorncliffe, and elsewhere in the district, are kept fully going, but prices continue much easier than they were. The general foundries which for the most part are dependent on colliery work, are not over well off for orders; but at Thorncliffe, where a good business is usually done in gas and water-pipes, moulders and kindred workmen have no cause to complain.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the Tyne begins to show more activity with the advent of the month of May. The shipments of gas coals to the Mediterranean and Baltic are very considerable. Some large contracts were made some time ago to supply Cronstadt and Moscow with gas coals. These contracts have been commenced with. There are fair inquiries, too, in the open market for gas coals for shipment. The exports have been larger this week than for some time past. Prices are unchanged. In the early part of last week the finished iron trade of the county of Durham was thrown into considerable confusion through the men striking against a reduction of 5 per cent. upon their wages, which had been made through the operation of the sliding scale. In consequence of the sudden stoppage of an important branch of local trade, coke, which is largely supplied to the iron furnaces, fell in price; but the dispute was settled by the end of the week, and coke gave signs of an improvement in prices on Saturday. Other branches of the coal trade are unchanged. A little more business has come to the steam coal trade; but coalowners continue to experience a difficulty in maintaining prices. The demand from the Baltic for coal is much below an average for the season of the year. It is very disappointing to the trade here.

The freight market is still very dull. Coasting rates are rather down than otherwise. There is scarcely any coasting business offering. Steamers are taking cargoes of coals to London at 3s. 11½d. per ton. The Channel rates for sailing ships show a fall of about 3d. per ton.

The general manufacturing trade of the Tyne and other northern rivers is quiet. The chemical business was somewhat better last week, but it showed no substantial improvement in prices. Shipments, however, are somewhat better. The exportation of fire-bricks is as good as ever. The overseas shipments are large and pretty general. The tone of business in the North of England iron markets is stronger. Prices are firmer in Middlesbrough. No. 3 foundry iron was sold at 40s., whereas the previous week it was 37s. Copper, however, was easier to sell. The price of lead has suffered to the extent of 10s. per ton. Quotations are now about £16 a ton. Spelter is in moderate demand. There are pretty good shipments of cement; but this branch of northern industry is not strong.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At the monthly meeting of the Dundee Gas Commissioners, held last Wednesday, it was reported that 341 million cubic feet of gas had been manufactured during the year just closed, being 15 million feet more than the estimated quantity, and an increase of 18 million feet as compared with the make of the preceding year. Favourable contracts for the supply of coal during the current year having already been entered into, it is understood that the present low price of gas will be maintained.

For a long time the price of gas at Kennaway, in Fifeshire, has ruled at 10s. per 1000 cubic feet, a price which has been complained of by many persons, and has been the means of causing a number to use paraffin oil and other modes of lighting instead of gas. On Monday, the 10th inst., the Directors of the Gas Company agreed to a proposal to reduce the price 1d. per 100 feet, or to 9s. 2d. per 1000, hoping thereby to encourage more of the inhabitants to use gas instead of oil, and thus prove advantageous both to consumers and the holders of gas shares.

The new gas-works at Thurso are being rapidly pushed forward, so as to be ready for the supply of the town by the 1st of October. The Gas Company are determined not only to supply the immediate wants, but also to make ample provision for the future extension of the town for many years to come.

At the annual meeting of the Gas Company of Innerleithen, in Peeblesshire, which was held last Thursday, a dividend of 8 per cent. was declared, and a small balance was carried to the reserve-fund. The price of gas is 5s. 10d. per 1000 cubic feet, the illuminating power being from 28 to 29 candles.

The annual general meeting of the Kilsyth Gaslight Company was held last Tuesday—Baillie Brown presiding. The Auditors report for the year was submitted and approved of. It showed that the affairs of the Company were in a favourable condition; for, notwithstanding the large amount paid for renewal of pipes and plant throughout the past year, the Directors were still able to recommend a dividend of 5 per cent., while carrying forward a considerable balance to the depreciation of plant account. It was resolved to approve of the recommendation, and to continue the price of gas at 5s. 5d. per 1000 cubic feet. Preparations are being made for the further extension of the works.

A special meeting of the Milngavie Burgh Commissioners was held last Thursday—Provost Macaulay in the chair—when Bailie Strathdee reported that he had received no definite answer from the Partick, Hillhead, and Maryhill Gas Company as to what they were willing to do in the way of furnishing a supply of gas for the burgh, but that their Manager, Mr. James Hislop, said his Company could supply gas to Milngavie at 4s. 7d. per 1000 cubic feet. It was stated that the cost of laying a pipe from Canniesburn to Milngavie would be about £2000. The Clerk was directed to invite the Proprietors of the different public works in the district to a conference on the subject.

Business was done last Wednesday in the Glasgow Corporation 6½ per cent. Gas Annuities at £161 10s.

There is still a feeling in Perth that much, if not all of the present unusual sickness in the city is due to the contamination of the water, caused by carelessness in some of the work connected with the new supply, and Dr. Wallace's report has not removed this impression. Workmen were on Friday engaged in excavating the roadway between the water-house and the Tay, for the purpose of ascertaining if there was any flaw in the joining of the pipes leading from the filter-bed to the water-house, and if by any possible means contaminated water could find an entrance into the supply-pipes. Mr. Bateman will arrive in Perth on Tuesday (to-day) for the purpose of making a final examination of the works connected with the new water scheme. The whole of the works are now in such a forward condition that the new water supply can be turned on at Whitsunday, if the Water Commissioners are agreeable.

A meeting of the Dundee Water Commissioners was held last Thursday—Provost Brownlie in the chair—when the subject of an interim water supply for Newport was considered. It may be remembered that the Commissioners were sending a supply of Lintrathen water to that trans-pontine suburb of Dundee by way of the Tay Bridge, and that the supply

was suddenly cut off by the dreadful disaster which happened to that structure on the 28th of December last. An application was presented to the Commissioners by the Local Authority of Newport, requesting them to supply Newport with water from the Wornit stream for £253 beyond the sum of 6d. per 1000 gallons, which was the rate charged for the Lintrathen water. Several of the members objected to the proposal on the ground that it was illegal, and that the sum to be paid by Newport would not pay the cost; while, on the other hand, it was set forth that if the Dundee Water Commission did not supply the water to Newport, the Local Authority there might take up the matter itself, and refuse the Lintrathen water supply when the bridge was re-erected. On a division, the proposal was carried by a large majority. At the same meeting of the Commissioners the Engineer reported that the average daily consumption of water for the month ending the 26th of April was computed to be 5,513,000 gallons, being a decrease of 266,657 gallons.

Estimates for the new drainage works for the town of Annan have just been received, ranging from £2401 to upwards of £5000. The two lowest were within 2s. 7d. of each other. They were remitted to Mr. Barbour, C.E., Dumfries, to report upon.

The Town Council of Wick held a special meeting last Thursday, to consider a complaint from the Board of Supervision regarding the defective drainage of the town. A reply was adopted by the Council, denying the allegations on which the complaint was founded.

Last week's Glasgow pig iron market was dull and comparatively inactive, and latterly it assumed quite a languid tone, neither buyers nor sellers showing much desire to operate. Only a moderate amount of business was done. The market closed on Friday with buyers at 46s. 7½d. cash, and 46s. 9d. one month; and sellers 1½d. per ton higher.

The coal market is exceedingly dull. Both prices and wages are undergoing reductions.

REDUCTION IN THE PRICE OF GAS AT ILKESTON.—The Ilkeston Local Board, the owners of the gas-works supplying the district, have just reduced the price charged for gas. The scale of price varies according to consumption. The charge to the small consumers has been lowered from 4s. 2d. to 3s. 9d. per 1000 feet, with ½d. in the shilling discount for cash payments; while the price for the largest consumers has been reduced from 3s. 8d. to 3s. 3d. per 1000 feet.

INSTITUTION OF CIVIL ENGINEERS.—At the meeting of the Institution last Tuesday, Mr. George Seaton, Engineer-in-Chief to the East London Water-Works Company, was elected a Member; and Messrs. Robert Ormiston Paterson, Engineer to the Cheltenham Gas Company, John Charles Mackay, of the Port Elizabeth Water-Works, and Matthew Wilson Hervey of the West Middlesex Water-Works, Associate Members.

EAST RETFORD WATER SUPPLY.—At the meeting of the East Retford Town Council on the 30th ult.—the Mayor (Alderman Wilkinson) in the chair—the Town Clerk read a letter from the Local Government Board sanctioning the borrowing, on the security of the rates, of £15,000 for water-works purposes, and stating that a recommendation had been made by them to the Public Works Loan Commissioners to lend the money at 3½ per cent., to be repayable in a period not exceeding 30 years. It was resolved to accept the terms proposed by the Commissioners.

UCKFIELD GAS COMPANY.—The annual meeting of this Company was held on Thursday, the 29th ult., when the report which was presented by the Directors was adopted, and the dividend recommended was declared. The gas-rental for the past year was only £882 3s. 3d., as against £914 15s. 7d. in 1878-79, owing to the reduction in the price of gas to 5s. 10d. per 1000 feet. The receipts for coke and tar were £139 4s. 9d., which was about the same as the previous year. The assets and liabilities account showed a balance of £790 6s. 8½d. available for dividend and reserve, and of this sum the Directors proposed to appropriate £200 in payment of a dividend at 10 per cent., and to retain the balance for working capital and reserve. The balance-sheet showed that the gross receipts from all sources for the year were £1116 19s. 10½d., while the payments were—For coals, £409 3s. 8d.; for meters and services, £46 0s. 7d.; salaries, £95 9s. 2d.; wages and labour, £124 4s. 9d.; sundries, £52 1s. 4d.; dividend last year, £200; the remaining items being balances in hand and at the bankers.

SHOREHAM WATER-WORKS COMPANY.—The half-yearly general meeting of this Company was held on the 24th ult., when the report of the Directors for the half year ending Dec. 31, 1879, was presented. It stated that the Company's gross income for the period reported upon was £630, and that after paying out of this amount the ordinary working expenses, there was left a balance of £358 divisible among the Shareholders. The Directors recommended the payment of a dividend of 2½ per cent., which with the interim dividend paid in October last would make 5 per cent. for the year, leaving a balance of £170 to be dealt with by the Shareholders. Of this sum it was advised that £100 should be carried to the reserve-fund, and the remainder to the next account. To meet the requirements of the Company's district the Directors recommended the construction of two reservoirs, each capable of holding 75,000 gallons of water, instead of the single reservoir previously sanctioned by the Shareholders. The report was adopted, the retiring Directors and Auditor were re-elected, and the proceedings closed with the customary vote of thanks to the Chairman.

STAFFORD CORPORATION GAS SUPPLY.—The quarterly meeting of the Stafford Town Council was held last Tuesday, when the Gas Committee reported that, during the year ending March 31, 66,762,000 cubic feet of gas had been made and 61,385,000 feet sold. Reductions in the price of gas and of coke had caused a decrease in the receipt for gas to the amount of £504 4s. 4d., and in that of coke to £167 8s. The gross profits for the twelve months amounted to £5413 7s. 9d., and, after paying interest due on the loans and income-tax, there remained a net balance of £2056 13s. 4d. The sum of £1500 had been paid over to the general district fund towards the reduction of rates, and the balance at the credit of the net revenue account would enable the Committee to hand over a similar sum this year; and this they recommended should be done. Alderman Cox, in moving the adoption of the report, said the proposed transfer of £1500 to the district fund account would leave the Committee £1318 in their working account, and in making the payment he thought they should congratulate themselves upon their excellent Manager (Mr. John Storer), for without good management it would be impossible to effect the saving of so large a sum.

TOTNES GAS COMPANY.—The annual meeting of this Company was held on Monday last week—Mr. J. W. Chaster in the chair. The statement of accounts and the report of the Directors for the past year showed that after providing out of profits for interest on the preference shares, £500 of which were paid off at Michaelmas last (taken from the reserve-fund), there remained £820, out of which they recommended a dividend at the rate of 7½ per cent. per annum, free of income-tax, on the ordinary shares. This would absorb £375, leaving a balance of £445, of which they proposed to carry £200 to the reserve-fund and the remainder to the next account. The Directors stated that Mr. John Shute, who had filled the office of

Manager for many years in a most efficient and satisfactory manner, had been compelled from failing health to relinquish his duties, but they had secured the services of Mr. Samuel Samuel, late of the Dowlais Gas-Works, who had had many years experience, and whom they believed fully competent to undertake the duties. They recommended that the price of gas be reduced from 5s. 5d. to 5s. per 1000 feet, from the 25th of March. The report was adopted, and a resolution expressing regret at the resignation of the late Manager, and high appreciation of his 40 years service to this and the previous Company, was put on record.

THE SCOTCH GAS COAL TRADE.—The season for purchasing Scotch canal coal has just commenced for next winter's gas production, and several gas companies or corporations have either made their purchases or are in the market with their orders. The question as to how prices are to go is altogether an open one, for while on the one hand the momentary depression in the iron trade, as also in the demand for ordinary coals, is in favour of the buyers, still the important fact must not be overlooked that during the past winter and in the preceding autumn there was a very unsettled condition of things amongst the Scotch miners, more particularly in Lanarkshire and the adjoining counties, where there is the greatest prevalence of seams of canal coal. The unsettledness referred to had the effect of very materially reducing the output, and the consequence of this is that in many cases the stocks which remained at the collieries have been quite cleared out. We understand that in the Motherwell, Wishaw, and Larkhall districts there has been almost a complete clearance. Then, again, at most of the collieries where canal is worked in the Baillieston district—that from which a large portion of the supply is drafted for the Glasgow Corporation Gas-Works—the "bings" have been very considerably reduced of late. Indeed, it is affirmed on many hands that the stocks of canal coal in hand have not been so small for many months back, if not even for several years, as they are just now; and some anxiety is already entertained as to whether the available supply for next winter will not be so much lessened by reason of reduced stocks and diminished output as to cause very serious inconvenience to the gas companies and corporations. It is reported that the Dundee Gas Commissioners are already out of the market, having made their purchases for the ensuing season on very favourable terms. One large ship, the *Greenock*, has just cleared out from the Clyde with a shipment of about 1800 tons of Scotch gas coal for Rio de Janeiro.

Register of Patents.

APPLICATIONS FOR LETTERS PATENT.

- 1636.—CHIDLEY, J., Cutsdean, Worcester, "An improved apparatus for receiving and discharging water." April 21, 1880.
 1653.—BEECHY, C. G., Nottingham, "Improvements in engines worked by gas and air or other hydrocarbons." April 22, 1880.
 1661.—BECKTON, J. G., Middlesbrough-on-Tees, York, "Improvements in the distillation of coal and other substances, the manufacture of coke, charcoal, and 'patent fuel,' utilizing the gases therefrom, and in apparatus employed therein." April 22, 1880.
 1662.—HARTLEY, F. W., Wandsworth Road, London, "Improvements in gas cooking apparatus." April 22, 1880.
 1683.—MATHEW, T. C., Camden Town, London, "Improvements in water-waste preventers." April 24, 1880.
 1692.—WILLIAMS, H. and MALAM, J., Southport, Lancs, "Improvements in and relating to atmospheric air and gas motor engines." April 24, 1880.
 1713.—WHITEHEAD, J., Lockwood, York, "Improvements in unions for joining pipes." April 27, 1880.

- 1736.—SOMBART, C. M., Magdeburg, Germany, "Improvements in gas-engines." April 28, 1880.
 1745.—MESSENGER, T. G., Loughborough, Leicester, "Improvements in apparatus for regulating the supply of water to water-closets and lavatories and other situations where intermittent supplies are required." April 28, 1880.
 1753.—BOWDEN, S., Southampton Buildings, London, "Improvements in aspirators or exhausters." A communication. April 29, 1880.
 1792.—M'FARLANE, J., Glasgow, "A new or improved construction of water-motor, also applicable as a water-meter." Partly a communication. May 1, 1880.
 1854.—SUGG, W. T., Westminster, "Improvements in gas-regulators." May 6, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

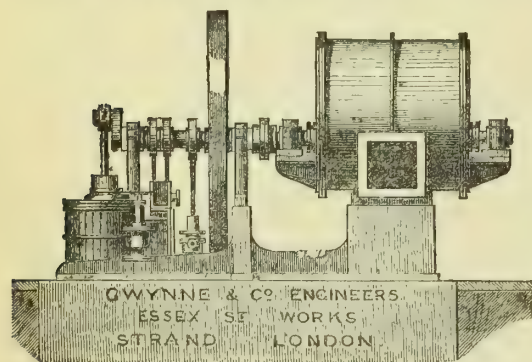
- 4114.—HERON, T. Manchester, "Improvements in gas-burners." Oct. 29, 1879.
 4501.—ROBSON, J., North Shields, Northumberland, "Improvements in gas-engines." Nov. 4, 1879.
 4577.—THORP, T., Whitefield, and TASKER, R., Prestwich, Lancs, "Improvements in apparatus for regulating the supply of gas to burners." Nov. 11, 1879.
 4755.—FOULIS, W., Glasgow, "Improvements in gas-engines." Nov. 21, 1879.
 4968.—SAMPSON, J., Liskeard, Cornwall, "Improvements in apparatus for preventing waste of water from cisterns and other sources, and for preventing the contamination or impregnation of water supply with foul air or gases." Dec. 4, 1879.
 109.—KIDD, J., Saint Bride Street, London, "Improvements in apparatus for carburetting illuminating gas." Jan. 10, 1880.
 463.—BUDENBERG, A., Manchester, "Improvements in apparatus for lifting and forcing water and other fluids." A communication. Feb. 3, 1880.
 521.—HULETT, D., High Holborn, London, "Improvements in or applicable to apparatus for condensing, washing, and purifying gas and other vapours." Feb. 6, 1880.
 545.—WALKER, C. C., Lilleshall, Salop, and WALKER, W. T., Highgate, London, "Improvements in or connected with the purification of coal gas, and in the apparatus employed therein." Feb. 7, 1880.
 569.—ATTRILL, H. Y., and FARMER, W., New York, U.S.A., "Improvements in the manufacture of gas for heating and illuminating purposes, and in the means and apparatus connected therewith." Feb. 10, 1880.
 601.—ADAMS, J., Glasgow, "Improvements in gas-stoves." Feb. 11, 1880.
 728.—CHANDLER, S. and J., Newington Causeway, London, "Improvements in gas apparatus." Feb. 18, 1880.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

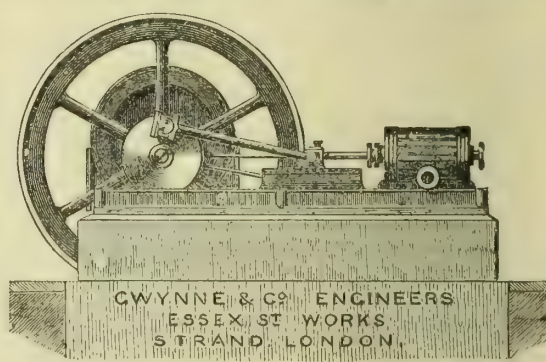
- 1470.—LINFORD, C., "Improvements connected with gas-engines." April 14, 1877.
 1527.—HAY, R., and LONGLEY, J., "Improvements in the utilization of small coal for the manufacture of coke." April 19, 1877.
 1533.—LAKE, W. R., "Improved apparatus for lighting and extinguishing gas." April 19, 1877.
 1592.—NEWTON, J., "Improvements in apparatus for regulating the supply of gas to gas-burners for street-lamps and other purposes." April 24, 1877.
 1626.—PEEBLES, D. B., "Improvements in apparatus for governing or otherwise acting on the flow or pressure of illuminating and other gases or vapours, and in part relating to the testing of gas and gas apparatus." April 26, 1877.

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TO CORRESPONDENTS.

E. M.—A simple stamped receipt is quite sufficient.

A. E.—There are many gas and water works already established, some under companies and others under municipal control. To what town in the colony do you refer?

FIRTH.—Next week.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 18, 1880.

Circular to Gas Companies.

SHORT though the parliamentary session must be which commences its real work this week, it may yet prove of importance to the interests of Gas Companies. A reconsideration of the question of the Water Supply to the Metropolis is for many reasons probable, if not inevitable, and it will hardly be surprising if the subject widens so as to embrace the gas supply also. The present House of Commons, containing as it does so many new members with the proverbial disposition to work hard and thoroughly, is more likely to err in the direction of attempting too much than too little; and the task of reconciling the demands of ratepayers and consumers with the rights of shareholders in Metropolitan Gas and Water Companies has been so often attempted, and has so often failed—it has led to so large an expenditure of time and money and temper—that its accomplishment would be an achievement not unworthy of those "golden hours" from which so much is expected, and there are not wanting signs that the effort will be made. Whether the larger question of the reform of the Municipal Government of London, threatened or promised years ago by Mr. Gladstone, will not absorb and delay these minor matters, which may be regarded as fragments of that great whole, time will show. However this may be, it seems probable, having regard to the character and experience of some of the men now at the head of affairs, that any such inquiry would be conducted with a view to laying down lines that will serve not only to guide the relations of Metropolitan Companies with the Municipal Authorities, but which shall be applicable also in regard to similar questions as they may arise in the towns of the country generally.

As our readers are aware, *The Times* has lately been giving its attention to the question of electric lighting, and has passed through a period of tribulation because of the mis-carriage of certain prophetic ventures as to the future relations of gas and electricity. Perhaps it is partly with the object of showing how baseless were the anticipations then expressed, and the panic which resulted from them, and also with a view to utilizing the information so painfully gained, that what is generally called the "leading journal" has now entered upon an inquiry or argument as to the propriety of the compulsory municipal acquisition of gas and water undertakings, and has treated the question so far without a word of reference to the competition—so formidable a few short weeks ago—of the electric light. Even we were scarcely prepared for such an evidence of the shallow and ephemeral character of the agitation then experienced. A letter signed "A Member of the Council of the Incorporated Law Society," published on the 13th inst., commences with the statement that "There is a well-founded desire and 'growing necessity for Municipal Corporations to possess the 'right of public supply of water and gas within the limits of 'their districts.' Our columns have borne abundant evidence of the truth of a moiety of this statement—viz., the 'desire,' the distinctly 'growing' desire on the part of Municipalities to acquire gas undertakings, provided only that they are sufficiently prosperous. The necessity for such acquisition, and the principles on which the desire is said to be 'well founded,' are not so apparent. The desire may be said to have grown in intensity directly with the profits of the Gas Companies; and this explains a conspicuous anomaly in the proceedings of Municipal Authorities—viz., that it has been the successful and well-conducted Gas Companies which have been the objects of this most determined attack, rather than those where, from any causes, the success has been small, and the field for improvement proportionately larger. We distinctly question the *bona fides* of Corporations generally in this matter, believing that the object avowed—that of securing to the consumers a better and cheaper supply of gas—is, in the vast majority of cases, secondary to the purpose unavowed—of becoming traders with a view to the making of profit, and thus obtaining the advantage of increased revenue without the usual accompaniment of apparent increased taxation. We have repeatedly pointed this opinion by reference to the conduct of gas affairs in Manchester, Birmingham, and other towns similarly placed in this respect. Another illustration occurs to our mind in the case of the opposition offered this session, by the Corporation of Hanley, to the Bill of the British Gaslight Company. Hanley is one of the five or six towns constituting the Staffordshire Potteries, and all of them were at one time supplied with gas by the British Company. One by one these towns have started competing Companies, who have bought out the interest of the British Company, and, after varying periods of independent existence, have transferred their undertakings to the Corporations of their respective towns. But in each of these places the price of gas is maintained at the same amount as that charged by the British Company in Hanley, though each shows a balance sufficient to justify a reduction. The inference is a fair one—that should the Town Council of Hanley also succeed in obtaining possession of the gas-works the price of gas will not be reduced, but will at once be accepted as a fair and equitable one.

In Paris the Municipality are charged only one-half the price paid by private consumers of gas, and, still further, the Gas Company pay to the same authority a large sum annually, being an agreed proportion of the profits in excess of a given amount. This is an arrangement which would be impossible in any town in the United Kingdom. The political intelligence of the inhabitants would protest against so palpable an unfairness to a section of the community, and also against the direct inducement—which might almost be called a bribe—to those who are appointed to watch over the interests of all alike, to permit the overburdening of a part. Impossible as such an arrangement would be with us, where the supply of gas is in the hands of a Company, we fail to see any marked difference in principle between it and the system of municipal management of gas-works as usually conducted, where one section of the ratepayers may urge on a wasteful and oppressive expenditure, knowing that the money to meet that expenditure will have to come from other pockets than their own.

In the special article in which *The Times* deals with its correspondent's letter, and which is written all through in a tone and temper of great fairness, it remarks: "Where the 'Municipality has the control of the water or gas supply, the 'consumers obviously (?) enjoy all the advantages of co-

"operation." The converse of the truth of the matter could hardly have been more clearly stated, for, as we have shown, the profits of the business are distributed, not among the consumers who have contributed them—the true co-operators—but among those who have made no purchases, and whose only interest is to keep up prices, so that the balance of profit may be the larger.

The learned letter-writer makes some strong animadversions upon the conduct of the Private Bill business at Westminster, and supports them by a quotation from the late Mr. J. A. Roebuck, which appears to us greatly exaggerated. He suggests, as a simple method of reducing the expenditure of time and money, that "a general Act be passed authorizing any Municipal Corporation to purchase any private undertaking for the public supply of water or gas within its district, provided that (1) a resolution be carried, at a special meeting of the Corporation, by a prescribed majority of votes; (2) that afterwards such resolution be confirmed by a majority on a poll of the ratepayers. After two such resolutions, let the Corporation become entitled to purchase, and the Company to sell the undertaking; let six months be allowed for negotiation for an amicable transfer, and, failing an agreement within that period, or within an extended time to be granted in a prescribed manner, let the undertaking be taken over on terms to be fixed by reference to a proper tribunal for arbitration." *The Times* mildly remarks upon this outrageous proposal that "it would be a somewhat heroic remedy, and open to the charge of injustice which usually attaches to an *ex post facto* law." It concludes its article, however, as follows:—"The time now seems to have come when Parliament itself should recognize practically, in its work of private legislation, as it has recognized in the abstract by public statutes, that the supply of gas and water, affecting as it does so materially the health and comfort of every community, should, as a general principle, be given to Local Authorities, where these desire to undertake it, and can show that they have the ability and the means to do so. A compulsory purchase clause at the option of the Local Authority should form part of every Act constituting a Gas or Water Company."

Parliament is, of course, at liberty to insist on such a condition in the Act of any Company yet to be incorporated, and it would rest with such Company to say whether they would accept the responsibility of proceeding upon such terms, the Local Authority being at liberty to avail itself of some period when, from any cause, the value of the property was depreciated, to press the purchase; but the proposal to apply such a rule to existing Companies is simply absurd. Gas Companies freely acknowledge their obligations to the public, but they claim also that they do not exist *simply* for the benefit of that public. They have undertaken and performed certain duties of acknowledged value, and have received in return privileges and rights which are theirs to hold absolutely so long as they continue to render faithfully the services they have thus undertaken. *The Times* remarks that while many recent Acts contain clauses providing for the purchase by Municipalities, in the earlier Acts they are very seldom present. The reason for this is so obvious, that we wonder it did not occur to our contemporary. In those earlier days, when difficulties were many and dividends small (if not wanting altogether), there was no inducement to the exercise of that superior management in which Corporations are now confident, and the proposal to become gas manufacturers would have been resisted alike by ratepayers and the Legislature. This explanation is, indeed, given later on in the same article, where it is remarked: "In considering the question of the justice of compulsory purchase, it is impossible to ignore the rights of the proprietors of existing Companies. They have invested their capital with risk of depreciation or of total loss; by dint of economical management they have conducted their enterprise to a point where it begins to be a lucrative concern; and it seems harsh that a municipal body, which would have nothing to do with them in the hour of danger, should swoop down on them in prosperity, and exercise an option of purchase." Such is the view which Parliamentary Committees have taken hitherto, and will, we believe, continue to take, of all such confiscatory proposals as that of *The Times* correspondent; and Companies with whose management reasonable fault cannot be found may rest content that they will not be called upon to part with their property except on terms acceptable to them.

We are surprised that our contemporary seems unacquainted with those important features of modern gas legislation, the auction clauses and the sliding scale, a knowledge of which would probably have satisfied the writer that at any rate in the future "a statutory limitation of the dividends

"of Companies in the public interest" is not likely to be "evaded by unnecessary additions to capital;" but to this point we shall return in our next issue.

While we deplore the growing tendency towards the acquisition of gas undertakings by Municipal Authorities, we do so more in the interest of the consumers than in that of the shareholders. The latter will only surrender a profitable business for an adequate consideration, while the former will have to bear the evils attendant upon a monopoly practically unregulated, and a service wanting in the spirit and vitality which are inseparable from personal interest.

The members of the Southern District Association of Gas Engineers and Managers had a pleasant meeting on Thursday last at the Crystal Palace District Gas-Works, Lower Sydenham, where they were received by Mr. Gandon, the Engineer of the works. Before the regular business of the meeting was begun, the Chairman, Mr. J. Hunter, of Woolwich, performed, on behalf of the members of the Association, a graceful act, in presenting a testimonial to the Secretary, Mr. J. L. Chapman, in recognition of the services which he has rendered in that capacity; and no one who estimates the work of such an office at its proper value will be disposed to cavil at the honourable acknowledgment which Mr. Hunter and his *confères* have made of the appreciation in which they hold Mr. Chapman's manner of discharging his secretarial duties. The business of the meeting consisted solely of a paper by Mr. Gandon on "Condensation," which was followed by a somewhat conflicting discussion, as always happens when this highly interesting but vague question is under consideration. As the condensing arrangements of no two gas-works are precisely alike, or by differences of situation are not comparable one with another, there is always plenty of discordance between the views of Gas Managers respecting them. We would suggest that this matter is further complicated by the assumption so frequently made that the dimensions of all condensing plant are demonstrable in terms of superficial area to amount of gas passing through in a certain time, without reference to the varying conditions under which the work has really to be done. Let it be generally accepted that a condenser cannot fairly be measured, like a gasholder or meter, the value of which is only a question of measurement and nothing more, but must be considered as a machine to be specially designed for the place it has to fill, and a good deal of preliminary mystification would disappear.

The instructive trial of new forms of street-lamps and powerful burners, which has just terminated at Birmingham, and the main results of which were published in our last week's issue, has, we are informed, led to a decision on the part of the Corporation to set up a large number of globular lanterns with Bray's flat-flame burners, for lighting some of the more important open spaces and street crossings in the borough. The competition was conducted on strictly equitable terms for all the lamps engaged, and practical convenience was particularly considered in arriving at a final opinion respecting their relative value. Mr. Hunt, the Engineer to the Corporation, under whose direction the trials took place, deserves the thanks of those interested in the result, for the promptness with which he has placed before the gas world the very valuable series of diagrams we presented to our readers last week, thus permitting free examination of the grounds upon which he formed his own judgment. Nothing can be more valuable in the interests of scientific research than the compilation of data in this independent manner. The diagrams leave nothing to be desired on the score of completeness, but we regret that circumstances prevented Mr. Hunt from going rather more fully into the description of the experiment than he did at the recent meeting of the Midland Association of Gas Managers, which, however, he may have considered sufficiently explained by the action subsequently taken by the Gas Committee of the Corporation.

At the quarterly meeting of the Stafford Town Council, held on the 4th inst., the Gas Committee had a favourable report to present of the works under their control. The price of gas and coke has been reduced during the past year, but the gross profits still amounted to £5413 7s. 9d., and after paying interest due on loans, and income-tax, there remained a net balance of £2056 13s. 4d. Of this, the sum of £1500 has been handed over to the district fund, so far helping the rates, leaving a handsome balance in hand. The only work which was proposed by way of extension was a tar-tank, a considerable amount of main-laying and renewing having been done during the past year. In moving the adoption of the report, Alderman Cox referred in appreciative terms to the good management of their Engineer (Mr. Storer), to whose care is so largely due the gratifying circumstance

that the disposable profits on last year's working were equal to those of the previous year, notwithstanding the reduction in price. Progressing at this rate, it will probably be found that a still further reduction will be possible at no very distant date from the present time.

The Mold Local Board are sorely exercised in mind respecting the quality of the gas supplied to that historic locality, and the price the Company charge for it. It is curious to see, in the utterances of discontented gas consumers or their representatives, how the human mind tends to run in grooves. For instance, in this little Welsh town we find the same belief expressed respecting the nefarious practice of the Gas Company in mixing air with their gas as we invariably find everywhere else, when consumers are dissatisfied with the amount of their gas bills. In this instance an inquiry by a Special Committee was directed to lay bare the sins of the Gas Company, and, we presume, among other things, to discover the air-pump. A speaker referred to the extraordinary fact that a reduction in the price of gas did not always cause a diminution in the amount of the next quarter's gas bill. We might suggest to the gentleman's mind the reflection that if it did, reductions would not be so frequent as they are. This complaint is nothing more than the gas consumers version of the proposition that lowering the price of gas invariably leads to its increased consumption, and this is an ascertained truth which Gas Companies and their consumers ought to congratulate each other upon, and not get to loggerheads about. The Mold Local Board and the Gas Company should come to an amicable understanding about the points in dispute, when, if both parties explain their position in a proper manner, the grievances that are now complained of will probably be found very susceptible of alleviation.

It is not often now-a-days that we find a Gas Company charged with polluting a river with "gas-washings," but this was the cause of trouble between Colonel Stansfield and the Yeadon and Guiseley Gas Company, and which resulted in an action tried at the last Yorkshire Winter Assizes at Leeds, and further reserved for consideration of some points of law. As will be seen from the report in another column, judgment has been given against the Company. Into the merits of the case we will not now enter, but the chief point which Justice Lush had to settle was the true meaning of a clause of the Public Health Act, 1875, which enacts that the penalty provided for fouling water by gas refuse may be recovered "by the person into whose water such washing or other substance is conveyed or flows, or whose water is fouled" thereby. The water fouled was in this case a running stream of which the plaintiff was only riparian proprietor, having property on the banks, but no exclusive right to the stream; and the Gas Company contended that he was consequently not a person "whose water was fouled" in the meaning of the Act; or, if so, every riparian proprietor along a river might proceed against a Gas Company for a single offence. Justice Lush, however, held that the plaintiff was entitled to recover, stating that the first person who took proceedings in such a case of multiplicity of sufferers by a single offence was alone entitled to the penalty. This, as will be seen, is an important precedent affecting Gas Companies, although nothing but accident could be held to palliate the occurrence of such a cause of offence.

Mr. S. Hunter, of Salford, has the courage of his opinions. He has refused a considerable increase of salary, offered him unanimously by the Gas Committee of the Salford Corporation, on the ground that the Committee were not in accord with the entire body of the Town Council in making the offer. It seems almost Quixotic to defer so completely to a minority, some of whom might perhaps find the fact of any course being recommended by some of their colleagues sufficient justification for rejecting it. But Mr. Hunter has followed the same line of conduct on a previous occasion, and in noting his repetition of an act of such self-denial, we may express the hope that his scrupulousness may not be called into action again.

Some few weeks back we stated that the Manchester Corporation had decided on appointing an Engineer-in-Chief over their various works of manufacture and distribution. We have now the pleasure of informing our readers that Mr. J. West, of Maidstone, has been selected to fill the important position. From the peculiar circumstances of the case, the appointment will prove anything but a sinecure; but Mr. West is no stranger to Manchester, where he has already made a reputation by the improvements which he has introduced into the carbonizing department at the Rochdale Road station. The construction of the new works at Bradford Road, now in progress, will naturally offer a wide scope for

Mr. West's energies, in dealing with which, and the other portions of this great undertaking, he will, we have no doubt, further heighten the estimation in which the Gas Committee hold his services. We understand that twenty-one applications for the appointment were received; but that the question at last resolved itself into a choice between four gentlemen—viz., Mr. West; Mr. G. E. Stevenson, of Peterborough; Mr. R. O. Paterson, of Cheltenham; and Mr. W. Romans, of Sheffield.

The Paris season is going to be signalized this year by a competition of three systems of electric lighting in the illumination of the Opera House, within and without. M. Garnier, the Architect, has been charged by the Government with the investigation of the respective qualities of these rival systems, which, we understand, are to be the Jablochkoff, or "candle" arrangement; the Werdermann, which is an incandescent burner; and the Lontin-Mersanne carbon light. We should have thought the French Government had had ample experience of the Jablochkoff light during the prolonged use of it in the Avenue de l'Opéra; but, at all events, they seem to want to subject it to further trial. The Paris Gas Company have worthily stood up for the advantages of gas for producing effective illumination, by lighting the adjoining thoroughfare, the Rue du Quatre Septembre, with their new gas-lamps; but these are not to be admitted into the projected competition, on grounds of which we fail to see the sufficiency. The heat developed in the combustion of so much gas is held to be a fatal objection to its use inside the Opera House; but this is a drawback which ventilation should be competent to reduce to insignificance, or, if found insuperable, it might be allowed a certain value in estimating the comparative merits of gas and electricity, or the peculiar colour of the latter might be set off against the heat of the gas. In any case, it is to be hoped that the Architect will not lose sight of the circumstance that people will not go to the Opera to see a brilliant system of artificial illumination, however grandly it may show up the magnificent decorations of the building which contains it, but to hear and see what is going on around them and on the stage. We have heard it whispered before now that the grandeur of the structure itself, and its architectural embellishments, rather detract from than add to its value for the ostensible purpose for which it was designed, and we hope this complaint will not be uttered still more loudly, if a too refulgent glitter of light in the auditorium causes the modest footlights to "pale their ineffectual fires." Of the three systems indicated for comparison, the Lontin-Mersanne is held in some quarters to be the most reliable; but we shall wait with much interest the publication of M. Garnier's report on the whole subject.

It is with much regret that we announce the death, on Thursday morning last, of a gentleman who has long been connected with the JOURNAL—Mr. W. T. Fewtrell, F.C.S.—and who, in conjunction with Mr. T. Newbigging, edited the first and second volumes of "King's Treatise on Coal Gas." Born at Farnham, in Surrey, in the year 1822, Mr. Fewtrell passed through a very varied experience in the course of his life, and was in many respects a most noteworthy man. His education was commenced under a nephew of the celebrated William Cobbett, and finished by the Rev. William and Cyrus Blandford; after which he went as apprentice to a chemist—a Mr. Lunn—in Aldersgate Street. Before, however, he had completed his term of service, Dr. Pereira obtained for him an appointment as Dispenser at the London Hospital, which position he held for some years. He next was sent out by Government, during the Crimean campaign, as Dispenser at the Smyrna Hospital; but was soon ordered to the seat of war, and was one of those who entered Sebastopol the day after it was taken, on which occasion he had a narrow escape of being killed by a stray shot from the enemy's cannon. On his return to England he went back to the London Hospital as assistant to the late Dr. Letheby, and then commenced his literary pursuits, which he continued to the time of his death. He at one time was sub-editor of the *Chemical News*, but ceased his connection with that paper on commencing his writing for the JOURNAL—having been introduced to the late Mr. T. G. Barlow by his friend Dr. Letheby. On this latter gentleman's death, Mr. Fewtrell acted as Chief Gas Examiner for the Metropolis, pending the appointment of Professor Williamson by the Board of Trade; and he kept up his connection with the gas profession to the very last. Though he had been in an enfeebled state of health for some few months past, his death was quite unexpected, as he was completely laid aside for only three days before his decease, which, as already stated, occurred last Thursday, from congestion of the brain.

Water and Sanitary Notes.

A SIGNIFICANT sign has been made by *The Times* within the last few days. With Mr. Chamberlain in the Cabinet, as President of the Board of Trade, it might be predicated that projects for the transfer of water and gas undertakings from private companies to public authorities would rise into prominence. The influence now at work is shown by a letter in *The Times* of Thursday last, from "A Member of the Council of the Incorporated Law Society," residing at Sheffield. This letter proposes a radical change in the system of Private Bill legislation, which is declared to be, as it now exists, "a scandal to the age." The end proposed is that of giving the Local Authorities greater opportunities for getting the water and gas supply into their own hands. Side by side with this letter was a special article in *The Times*, having all the phraseology of a "leader," though not appearing in the leading columns. The writer of this article, whoever he may have been, though not going so far as the writer of the letter, went far enough to argue that Parliament, in its work of Private Bill legislation, should henceforth act on the principle that the supply of water and gas should, as a general rule, "be given to Local Authorities, where these desire to undertake it, and can show that they have the ability and the means to do so." Thus, we are told, "a compulsory purchase clause at the option of the Local Authority should form part of every future Act constituting a Gas or Water Company." The commencement of *The Times* article is particularly significant, and must be taken as showing its aim. It says: "The question of the Water Supply of the Metropolis, however it may be settled, is only a part, though an important part, of a much wider issue really affecting the whole country." The next sentence states the issue thus: "It has become the business of the Legislature to decide how far it is fair, and how far expedient, to compel Companies which supply the public with necessary commodities like gas and water, to sell their undertakings to local and municipal bodies." The subject is adverted to again in the first leader in *The Times* of Friday, where the question is opened up by referring to the interview between the Commissioners of Sewers of the City of London and the Home Secretary. "As was pointed out yesterday in our columns," says *The Times*, "the absence of any clause in Water and Gas Companies Acts securing the right of purchase, under fixed conditions, for Local and Municipal Authorities, has allowed vested interests to grow up unchecked, and they will continue to grow unless they are extinguished by special legislation." The growth here adverted to is not merely an increase in the number of such Companies, but the development of those that already exist. It was the complaint of the Sheffield writer that the existing Companies possessed statutory powers which enabled them to lay such burdens on the consumers as "threatened to become intolerable." From this point we find *The Times* going on to argue, on the question of purchase, that "five years hence, should the Water Companies of London still retain their chartered privileges, the price to be paid will be found to have increased enormously." The main line of the editorial argument is favourable to Sir Richard Cross's Bill, and it is suggested that if the terms of purchase were settled, as some propose, by arbitration, "the ratepayers may have to pay, under the award, a heavier price than that to which Sir Richard Cross agreed." The fact that the provisional agreements with the Companies are in force until July is strongly insisted upon, and the desirability of something being done in the meantime "to secure an amicable arrangement" is very clearly suggested. But the most important feature of the whole affair is that which shows the commencement of a movement for hastening the transfer both of the gas and the water supply throughout the country from Companies to the Local Authorities.

The Metropolitan Water Question is a perilous subject for some people. Even Sir William Harcourt, as Home Secretary, shivers on the brink of this troublesome controversy. It was the motto of Lord Aberdare, when holding the office now possessed by Sir W. Harcourt, to keep all sorts of difficult subjects "under consideration." The present Home Secretary adopts a different plan, he seeks for "information." It was with this weapon that he parried the approach of the City deputation last Thursday, when the Commissioners of Sewers sought to learn what the Government intended to do with respect to the Water Supply of the Metropolis. To interrogate a new Home Secretary as to the intentions of the

Government with respect to a critical matter, just on the eve of the Royal Speech, would seem a little premature. Sir William had no story to tell, which was not to be wondered at; but neither had the deputation anything to say, which was the more remarkable. They thought the Bill of the late Government was dead and done for, and they had never deemed it worth their while to come to any decision upon it. Evidently the Home Secretary took a different view of the case. He made use of expressions which showed that, in his opinion, the Bill brought in by Sir Richard Cross was one which deserved further consideration. He went so far as to advise the Commissioners to examine the provisions of the Bill, both with regard to the terms of purchase and the constitution of the Water Trust, so that they might come to him with a clear statement of their views on a future occasion. On the whole, Sir W. Harcourt behaved wisely. Being asked whether the Government would introduce a Bill to prevent the charge for water being raised in accordance with the new assessment, he replied: "The Companies, as I understand, have a right to charge for water upon the annual value of a house; but that is a matter of law which does not actually ensue upon the assessment." Not a word of condemnation with respect to Sir R. Cross's Bill fell from the lips of Sir W. Harcourt. "I wish to regard these matters quite impartially," said the Home Secretary, "and neither to adopt nor to condemn any particular scheme for taking over the Water Companies." He suggested that perhaps the Commissioners would prefer that the Companies should be taken by arbitration. "Really," said Sir William, "the responsibility, as it seems to me, rests chiefly with those who are principally interested." The deputation promised to learn their lesson, and say it next time. The next day the City Remembrancer wrote to the papers to say that, in the published account of the interview with the Home Secretary, he was "made to appear to have overlooked the fact that the Corporation of London, and not the Commissioners of Sewers of the City of London, are the Metropolitan Authority for the purposes of the Metropolis Water-Works Act, 1871." The City Remembrancer, of course, means the Water Act, but the meaning of his letter, on the whole, is not quite clear, except it be a roundabout attempt to set matters right on a question of precedence between Gog and Magog.

The following announcement appeared in the *Journal of the Society of Arts* last Friday week:—"The Council have decided to summon a public Conference, to consider the question of supplying London with pure water." This is what might have been expected. But, according to Lord Palmerston, it is the unexpected that comes to pass, and last Friday the Society's hebdomadal organ contained a notification that the Council had resolved "not to summon the conference." It appears that the authorities of the Society "have confidence that the supply of the best water to the Metropolis will be fully considered by Her Majesty's Government at an early period." Hence the conclusion that "no Conference should now be held." Such a "flash of silence" at the Adelphi we cannot do otherwise than look upon as one of the most striking incidents of the water controversy.

The Metropolitan Municipal Association has been holding a meeting of its members to debate sundry important questions, and has appointed Sir Ughtred Kay-Shuttleworth as its President. Mr. Firth, M.P., has been requested to take charge in Parliament of the several reforms advocated by the Association. A series of resolutions on London Government has been agreed to, and copies have been sent to Sir W. V. Harcourt, but it has been judged proper to defer publicity until the Government has had an opportunity of declaring its intentions. It is, however, made known that in the opinion of the Association "it is desirable that the Government should take measures to protect the interests of the ratepayers in respect to the Metropolitan Water Supply, and, while providing for the acquisition of the works and property of the Companies on behalf of the ratepayers, should secure an increased and purer supply." After the meeting of Parliament, it is contemplated to seek an interview with the Home Secretary. "A strong opinion was expressed" at the meeting of the Association "that the Queen's Speech would deal with some of the questions under consideration." Mr. Watherston was elected Chairman of the Executive Committee and Treasurer, and Mr. Beal was requested to continue to act as Honorary Secretary. On Thursday we shall have the pleasure of knowing how far the Queen's Speech is likely to agree with the expectations of Mr. James Beal and his friends.

The Rochdale Corporation Water-Works are as yet a long way from being a paying concern, although the rental shows a steady increase during the past year. The gross amount of

the water-rate for the year was £19,716, as against £18,748 during the year previous. If from these figures the allowances for unoccupied property, &c., be deducted, which amounted to £807 last year, against £434 for the year before, the net increase is shown to be not quite £600. The interest for the year upon works, in progress and completed, amounted to £15,180, and the loss on the year's working was as much as £8600. Up to the 25th of March last, the cost of the Cowm Brook reservoir had been £281,303, and that at the Spring Mill, £121,630. It should be noted that the price of water is the same to consumers within and without the borough, while the former are rated at ninepence in the pound to make up the deficiency.

Among the notable events of the past week has been the delivery of the award of the Arbitrators in the case of the Conservators of the Thames against the Metropolitan Board of Works. It was alleged by the Conservators that the main drainage outfalls at Barking Creek and Crossness Point had created mud-banks obstructive to the navigation, and they required that the Metropolitan Board should be called upon to remove these banks by dredging, or bear the necessary expense. The Metropolitan Board, on their side, denied that the outfalls caused any obstruction, and therefore repudiated all liability with regard to dredging. The dispute has been a costly one, but the result is satisfactory for the rate-payers, seeing that the decision of the Arbitrators, endorsed by the Umpire, is wholly in favour of the Metropolitan Board, thereby setting aside any plea—so far as the navigation is concerned—that a few more millions ought to be spent in order to carry the sewage a greater distance down the river. It will be remembered that the Umpire in this case was Sir Charles Hartley, and the Arbitrators for the Conservators and the Metropolitan Board were respectively Captain Douglas Galton and Mr. F. J. Bramwell. Able counsel appeared on either side, forty-one witnesses were examined, and the case occupied twenty-five days, distributed over several months. The unanimity of the award is certainly contrary to general expectation, especially considering its absolute terms. That Captain Galton should thus exonerate the outfalls, and sign an award which declares that each of the three mud-banks in question “has arisen from the dredging operations carried on by the Conservators or sanctioned by them,” is a remarkable proof that the evidence adduced by the Metropolitan Board was of a most conclusive character. We regret to learn that Mr. Keates, the Consulting Chemist to the Board, whose scientific investigations in connection with this matter were so valuable in themselves as well as in relation to the inquiry, has been seriously indisposed since the close of the proceedings, though now at last convalescent. It remains to be observed that the case brought forward by the Conservators referred solely to navigation, and therefore had no direct reference to sanitary considerations. It is understood, however, that the Metropolitan Board feel quite confident as to their ability to fight the question of pollution as well as that of obstruction.

Influenced by the outcry of grossly defective drainage in connection with West-end mansions, an organization is being set on foot entitled a “Society for the Sanitary Inspection and Construction of Houses, Limited.” It has Dr. Lory Marsh for one of its Directors, and Major Flower, Consulting Engineer to the Lea Conservancy, for its own Consulting Engineer. It is modelled in some degree on the same basis as the Edinburgh Sanitary Association, the members of which pay a small subscription, and this entitles them to have their houses inspected at least twice a year by the Engineer of the Society. The subject, as our readers are doubtless aware, has been made prominent of late by several letters and articles in the *Standard*. But this is not the first time that certain high-class West-end dwellings have been laid under suspicion with regard to their sanitary arrangements.

We share with our contemporary, the *Lancet*, in a feeling of satisfaction at the circumstance that the new President of the Local Government Board has a seat in the Cabinet, thus virtually creating a Ministry of Health. It is pointed out that “in all, some six thousand five hundred members of the medical profession are engaged in scientific work carried out under the authority of the department whose head is now a Cabinet Minister.” The somewhat contradictory views expressed in the House of Commons by the late Home Secretary and his colleague at the Local Government Board will not be likely to find a counterpart when both these high officers of State take part in the deliberations of the Cabinet. The business of the Local Government Board, especially in relation to the passing of Provisional Orders, will also be promoted by this new arrangement.

EFFLUVIUM NUISANCES.

THIRD ARTICLE.

After having described the process of carbonizing coal in the retorts, Dr. Ballard devotes but few words to the description of the condenser and exhauster, as the operation of neither of these important divisions of gas-making apparatus comes within the range of his inquiry. The next process, therefore, to which he gives especial prominence is that of washing or scrubbing the impure gas with water. He briefly summarizes the principal impurities which coal gas contains previous to the commencement of its treatment for purification, some of which, such as the sulphur, ammonia, and the cyanogen compounds, are, as he says, valuable in themselves, and should, if possible, be recovered, although the last impurity has had but little practical attention paid to it. The purifying materials most commonly employed are water, lime, and hydrated oxide of iron, with a few other compounds in limited use. In washing or scrubbing, water only is used. The number of gas-works where the gas is scrubbed is in excess of those where it is washed only, or washed and scrubbed, although Dr. Ballard omits to define the two classes of apparatus with sufficient exactitude. He records a general expression of preference for Mr. G. Anderson's washer, describing its action as making the gas bubble up through a series of shallow trays—a description which would also apply to Mr. G. Livesey's washer, which is not mentioned, and, strangely enough, Anderson's scrubber is also not alluded to. Dr. Ballard mentions Mann's and Livesey's scrubbers as being most generally used, referring also to the occasional use of drain tiles instead of coke or thin boards. Respecting the process itself, however, he notes that the same condition must be maintained in order to secure proper results, whatever system be adopted, which is that the scrubber be not stinted in height, so that plenty of time be given for the solvent action of the water to take effect, the gas being kept in contact with it long enough to part with all that water can possibly take up. An illustration and full description of Kirkham, Hulett, and Chandler's washer is given, and its successful action in several works is commented on. With this Dr. Ballard closes his account of the present state of gas purification by water, and plunges into the greatest question of all, from his point of view—the purification of gas, properly so called, from its sulphur impurities, in connection with which arises the greatest effluvium nuisance that gas-works commonly send forth.

Dr. Ballard commences with a description of the wet lime process of purification, which, although generally abandoned, he found still pursued at the old Nottingham Gas-Works, and he might have said at one or two other old-established works. At Nottingham the cream of lime, after having become foul, is run into subsiding-tanks, the supernatant water from which is evaporated in the furnace ash-pans, while the deposited paste is used for luting the retort-lids. Dry lime and oxide of iron purification are then described in detail, and the chemical action which takes place when foul gas is passed into a lime purifier is explained as a simultaneous combination of the lime with the carbonic acid and sulphuretted hydrogen of the impure gas, the products being carbonate of lime, sulphide of calcium, and water. After a certain time the sulphide of calcium first formed is again decomposed by the carbonic acid of the gas, the sulphuretted hydrogen being disengaged, until all the lime has become a carbonate, and thereafter inert as a purifying material. The sulphuretted hydrogen may be arrested by oxide of iron, and the sulphur remaining in the form of bisulphide of carbon may be taken out of the gas by passing it through sulphide of calcium, with which this last impurity forms a sulphocarbonate. In some works sulphate of iron is used instead of oxide of iron, and this has the advantage of separating ammonia as well as sulphuretted hydrogen; but, of course, the purifier is the wrong place to receive ammonia. Chloride of iron is used with the same object. Sawdust, unmixed with anything else, is used at Edinburgh to retain ammonia, and in some instances the sawdust is previously saturated with strong sulphuric acid, in which state it is known as “ammonia material.” But all these substances, as well as other means of getting rid of ammonia, are quite superfluous when good previous washing or scrubbing is carried out, although Dr. Ballard considers something of the kind as useful to have at hand in case of accident to the scrubber.

And now comes the consideration of that part of the necessary work of purification which must, metaphorically speaking, have made Dr. Ballard straighten himself up for the task before him; we mean the removal or treatment of the spent purifying material, which terminates the investigation as far as gas-works are concerned. When purifiers are situated on the ground floor, the spent material must be thrown out over the side, and wheeled away in barrows; but in many large and newly-constructed gas-works the purifiers stand on an elevated stage which leaves a clear chamber below. The pipes connecting the purifiers pass along the roof of this chamber, and the spent material can be discharged through the ordinary outlet-box or pipe of the purifier when it is shut off by a valve from the general system, an opening being in this case provided in the horizontal outlet-pipe, exactly opposite and below the vertical outlet-box of the purifier. This opening is closed by a blank flange when the purifier is in use, but when required as a shoot for the spent material the flange can be removed, and a clear passage is then given from the interior of the purifier to the floor below. The spent lime is usually heaped up somewhere in the yard to await removal, the foul oxide being subjected to revivification by exposure to air, when it may be used again.

Entering into a statement of the cause of the nuisance arising from emptying purifiers, Dr. Ballard says that when lime has been thoroughly converted into carbonate before removal from the purifier, little or no nuisance can arise from it; but, of course, this is not often

the case, more or less of volatile sulphur compounds are always given off when the lid of a purifier is raised. But the nuisance, such as it is, is likely to be serious only when the previous operations of washing and scrubbing have not been properly performed, or when the lime is thrown out in the form of impure sulphide, as it must be when the removal of bisulphide of carbon from the gas is insisted upon. The nuisance is sometimes spread over regions where it would not otherwise extend, by the careless removal of foul lime in carts. In country works, where oxide purification will satisfy the law or popular demand, and where a single lime tray in the bottom of an oxide purifier will generally suffice to remove all that is necessary of carbonic acid, if the scrubbing is properly done, Dr. Ballard is of opinion that no effluvium perceptible beyond the boundaries of the works themselves can arise from the process of purification. But as lime must in many cases be employed as the chief or sole purifying agent, and as it must in such cases be removed, often in a highly odoriferous condition, after its work is done, it becomes of considerable importance to find out the best method of doing this, so as to confine the nuisance to the smallest possible area.

This question, we are bound to say, Dr. Ballard leaves pretty much as he found it. He says, indeed, that the plan of shooting the foul material down the purifier outlet, transformed for that purpose into a shoot, into closed carts or trucks below—the space between the opening under the purifier and the truck being made good with a channel or funnel of sacking, so that the material is not exposed to the air in its course—appears fairly sufficient to meet all requirements; but following Mr. M'Minn, of the Fulham Gas-Works, he gives a lengthy description, with three photographs, of the system carried out there, which Mr. M'Minn prefers, on the score of its disturbing the material less. In this system the whole surface of the material as it lies in the sieves is first watered with a hose, to prevent the possibility of dust arising from it, and covered with large sheets of sacking. Two workmen then proceed to remove the material, unrolling the sacking cover as they clear the sieves before them, and filling sacks with the foul material, which sacks are carried away by attendant labourers, and their contents shot into iron waggons, provided with sacking covers. These waggons are further sheltered while being loaded by a travelling wooden shed. When loaded the waggons are run out from the shed, and are drawn alongside the wharf, where the barge that is to remove the foul lime lies moored. The barge is loaded regularly, commencing at one end, over which a shed, hinged to the edge of the wharf-wall, is lowered, so as to practically enclose that end of the hold. The waggon to be discharged is drawn up opposite this sheltering shed, and is there covered by an extinguisher-like cover of sacking, while its load is emptied through the bottom, down a shoot into the covered hole of the barge, where, as soon as it reaches the proper level, it is covered with earth, and the barge when loaded is sent down the river to Beckton. Thus the whole process is done under cover, and inoffensively, so far as Dr. Ballard observed.

This complicated system of wooden and sacking covers, sheds, and extinguishers, is doubtless less formidable in reality than Dr. Ballard's minute description of it would lead one to think; and as it appears to satisfy those for whom it was constructed, no one need find fault with it, especially as Dr. Ballard does not say anything as to the advisability of copying it for other places. In short, it probably answers its purpose fairly well in the particular circumstances of the case; but as the essence of the arrangement really lies in the readiness of the means by which the stuff is cleared off the works, the simpler plan before described would appear to work equally well, provided the means of final removal were as convenient.

Dr. Ballard observes the failure of all attempts at deodorizing the foul lime before removal from the purifiers, not so much on account of any difficulties connected with the treatment of the material itself, as from the offensive gases produced in so doing, and the danger of explosions when these gases have been burnt up, which is the only way of finally disposing of them without causing a fresh nuisance. Dr. Ballard does not mention the proposal to revivify spent lime, of which he must, therefore, have been unaware, as he thinks it of importance that the attention of chemists should be directed to the discovery of some other agent than lime for the removal of bisulphide of carbon from gas. In connection with this part of the question, Dr. Ballard merely mentions in passing the process of Mr. Leigh, of Manchester, which consists in the use of gas liquor converted, by a process of distillation or otherwise, into sulphide of ammonium, which, on addition of excess of sulphur, readily absorbs bisulphide of carbon with deposition of the excess of sulphur. But this process was not sufficiently perfect to be continued at the Manchester Gas-Works, where it was attempted to adopt it. Another process mentioned is that of Mr. W. Marriott, of Huddersfield, who uses sulphide of sodium specially prepared, which Dr. Ballard saw in course of trial at the Bromley Gas-Works. So that, respecting the great question of the prevention of nuisance from lime purifiers, Dr. Ballard has no specific remedy to recommend for general adoption, and his advice may be summarized in these words:—Keep the foul lime closely covered and sheltered from wind, empty the purifiers quickly, spill nothing in so doing, and avoid making dust, and get the stuff removed out of the works as soon as possible. And if there is no particular novelty in these recommendations, they are at least such as can readily be subscribed to by all parties concerned in the duties to which they apply.

Respecting the offensive smell sometimes noticeable from oxide of iron undergoing revivification, Dr. Ballard notes that it is due to the evolution of ammonia; any occurrence, therefore, of this kind should direct instant attention to the scrubber. But as at times the best scrubbing arrangements may be accidentally defective, he recommends that the revivifying floor should be elevated above the roofs of any neighbouring houses. As to possible nuisance from tar and

ammoniacal liquor, this may be prevented by keeping all receptacles for these matters closely covered from the air, any necessary openings in them for escape of air being always covered with a box containing trays of oxide of iron. These remarks close that portion of the report which relates to gas-making.

The next portion of the report deals with the manufacture of sulphate of ammonia, with which gas managers are closely concerned, and which has in some quarters attained unenviable notoriety as a particularly offensive business; but this, with some other processes connected with the treatment of some of the residual products of the manufacture of gas, will be considered in our next notice of Dr. Ballard's work.

GAS AND WATER STATISTICS.*—Two publications have recently been issued which are intended to form together a complete catalogue of all gas and water undertakings carrying on operations, or having offices in the United Kingdom. "The Gas and Water Companies Directory" is now in its fourth year of publication, and has consequently attained considerable fulness and accuracy, most of the principal gas and water companies being represented, with the names of their chief officials; the *personnel*, moreover, being included in a separate index, which is a convenient arrangement. For traders especially this work should be useful. "Gas-Works Statistics" is a new venture, intended to supplement the older publication by giving an idea of the extent of the operations of every gas undertaking in the United Kingdom, including the weight of coal carbonized and gas produced annually, with the illuminating power, selling price, rate of payment for public lamps, and rate of dividend for the past twelve months. As might be supposed in a first issue, there are a considerable number of imperfect returns, which may be expected to be diminished in future editions. But still the pamphlet contains much that should be interesting, and, when complete, it is evident that a reliable body of statistics of this nature, in a handy form, would be valuable for purposes of comparison. The success of such a compilation will, of course, depend essentially on the completeness and accuracy to which it can be brought, and for this the willing co-operation of interested persons is of prime necessity.

Communicated Article.

EFFECT OF TEMPERATURE IN THE GAS AND AIR SUPPLY UPON THE ILLUMINATING POWER OF GAS-FLAMES.

By MR. R. H. PATTERSON, F.S.S.

SECOND PART.

The only reasonable motive that there can be for *heating the gas* when supplied to a burner is, that this preliminary heating may enable the gas-flame to acquire a higher temperature, or intensity of combustion, and consequently burn with greater brilliancy. There can be no doubt that an advantage is obtainable from heating ordinary fuel in grates or furnaces. But there is a very great difference between that case and the use of gas for illuminating purposes; because ordinary fuel, such as coal, presents considerable resistance to ignition. A lucifer match, for example, or even a dozen of them, may wholly fail to ignite it; heat or flame in considerable strength or mass is required before ignition is produced. Or, which comes to the same thing dynamically, a small flame must be applied to coal for some length of time before combustion is produced. Here, then, is something to be saved or economized. Either a small amount of heat, or a shorter application of it, will suffice to ignite fuel which has been heated. Also, in a grate or furnace there is always some part of the fuel not actually ignited; and so long as this is the case it is obvious that the higher the temperature of the unignited portion, the less heat will be absorbed from the burning portion to produce combustion in the rest.

Still more clearly is it of advantage to heat fuel which is *about to be added* to a fire or burning furnace; for the first effect of the introduction of cold fuel is necessarily to reduce the temperature of combustion—indeed, any addition of fuel which is not actually burning must operate in this disadvantageous manner. And herein lies the greatest defect in the present system of gas-making. Every four or six hours the retort is emptied of its mass of highly heated coal; its glowing sides become cooled by the inrush of air, and still more by the charge of fresh coal; so that no sooner is the maximum temperature attained than it is suddenly pulled down to too low a point to allow of the distillation being effectively carried on. One way of remedying this (although there are serious practical difficulties in applying it) would be to feed the retort steadily in dribblets by means of small-sized coal in a hopper; and the other is to heat the coal which is about to be supplied to the retort. But to heat coal to any considerable extent means also to vaporize a portion of its combustible and illuminating substance; and unless the valuable vapours thus discharged from the coal by heat are preserved and utilized, more damage may be done to gas-making than is compensated by the intenser combustion produced by this heating process in the retort.

But the obvious advantages obtainable from heating fuel prior to ignition and combustion, are not paralleled when the same process is applied to gas. The more sluggish any combustible matter is—in other words, the more slowly combustion extends from part to part—the more valuable is the effect of prior heating; but when the whole mass springs into a blaze the moment the requisite temperature is applied to any part of it, it is hard to see what advantage

* "Gas-Works Statistics, 1880;" and "The Gas and Water Companies Directory, 1880." London: C. W. Hastings.

prior heating can confer. No one thinks of heating gunpowder in order to intensify its combustion; and coal gas, when employed in jets for illuminating purposes, burns for all practical purposes with not less instantaneousness and spontaneity. It is true that in some of the thicker gas-flames there is a tiny core of gas *not burning*; but this is not owing (as in coal) to what we may call sluggishness of combustion, or resistance to ignition, but merely because that part of the gas is for the moment excluded from the air. When spread out and in contact with air, coal gas, owing to the exceeding minuteness of its combustible atoms, burns all through instantaneously; and, as is well known, even when gas is in bulk an intermixture of air suffices to render it explosive. The mere touch or impact of a lighted lucifer match—even the smallest spark of fire—sets any gas-jet, or the whole hundred jets of the Wigham burner, instantaneously into full combustion, and at as high a temperature as the gas-flame can develop. Thus, in a moment of time, the gas is raised from the ordinary temperature of 60° or 70° Fahr. to about 5000° Fahr. What difference, therefore, can it make whether the unignited gas has a temperature of 60° or 600° Fahr.?

And such a temperature—viz., of 600° Fahr.—will be found, by any one who makes the experiment, an exceedingly troublesome one to produce in gas. Moreover, as is well known, if coal gas be raised to this temperature—at least, by any means hitherto employed—there will be found some deposit of carbon upon the surface of the heating material. Gas cannot possibly be raised to even an ordinarily high temperature unless the tubes or chambers in which it is contained are filled by a mass or network of conducting material—such, for instance, as wire gauze—which conveys the heat from the outer surface of the pipe or chamber inwards to all parts of the gas-stream; and, whatever the material thus employed for conducting the heat, and effectually applying it to the gas, it will be found coated with carbon when the temperature of the gas rises to 600° Fahr., or even less. The gas, in short, begins to suffer from “dissociation,” some of the richer hydrocarbon compounds being broken up, with a deposit of carbon, which is the illuminating substance.

Upon these various grounds, it seems to me that the result which I obtained from the experiments in 1871—viz., that the heating of the gas added nothing to the illuminating power of the gas-flame—is in accordance with general reasoning. And this is my opinion on the question as it at present stands; but no one will be more ready to change it than myself when, or if, further experiments should point to an opposite conclusion. Also these experiments show the necessity for the heat being applied close to the burner, otherwise the gas will return to its ordinary temperature before it reaches the point of ignition.

Temperature of the Burner.

But there is another phase of the question to be considered; and it is entirely distinct from that of heating the gas, although practically it becomes mixed up with it. Although there may be no advantage to be gained by heating the gas, it is manifestly of importance that there should be no withdrawal of heat from the gas-flame. And such an abstraction of heat always does take place, more or less. I have already spoken of the air supply, the heating of which undoubtedly lessens the withdrawal of heat from the flame, or enables the flame to attain a higher state of combustion; and I need not speak further of the cooling effect of the atmospheric surroundings of the flame. But there is another source of heat-absorption—viz., the burner itself. That every gas-burner absorbs heat from the flame is demonstrated to the touch. The burner quickly becomes so hot that it cannot be handled. This is especially the case with the Argand, in which the mass of the burner, and notably the surface in direct contact with the base of the flame, is much larger than in jet burners, both bat's-wings and fishtails. When Mr. Sugg was constructing his new Argands, with the small separate supply-tubes fitted into the bottom of the burner, he found that if the burner was made of metal (brass or iron) it became so hot even at its lowest part that the “soft metal” employed in soldering-on the small tubes was melted; and one, if not the immediate cause of his making the body or cylinder of his Argand of steatite was to obviate this difficulty—the steatite being a comparatively non-conducting substance. Even the steatite Argands become so hot that it is not safe to handle them while the gas is burning; and metal Argands become so hot that Mr. Sugg states their temperature at from 500° to 600° Fahr.

This heat, of course, is entirely obtained from the gas-flame. But this absorption of heat by the burner is somewhat different in character from the other form in which a withdrawal of heat from the flame takes place—viz., by ordinary radiation into the surrounding atmosphere. Air is a bad conductor of heat, whereas metal, like brass or iron, is one of the very best conductors; accordingly, relatively to the extent of radiating surface of the flame exposed to these rival absorbents of heat, more heat will be withdrawn by the metal than by the air. On the other hand, the heat absorbed by the air is more completely or suddenly lost than the portion absorbed by the metal burner; because the former is dissipated at once, carried off instantly into the general atmosphere, whereas the burner retains a portion of the heat which it absorbs. Nevertheless, the burner is constantly parting with its heat to the air; and this radiation prevents the heat accumulating in the burner beyond a certain point; but this accumulated temperature—say 500° Fahr.—is only maintained by the constant absorption of heat from the flame commensurate with the heat which the burner is constantly giving off into the air.

Now, were it possible to keep a burner hot, irrespective of the flame, the hotness of the burner would be of some advantage; and if the burner could in this manner (i.e., by independent means) be kept so hot as altogether to stop its absorbing heat from the flame (in which case the burner would require to be as hot as the flame itself), there would be a considerable advantage. But the case is dif-

ferent when the hotness of the burner is produced by an abstraction of heat from the flame itself. Obviously, it would be better if the heat remained in the flame, instead of passing into the burner. Further, what happens is not merely a transference of heat, but also a loss of it. Were it possible for the burner to retain all the heat which it absorbs from the flame, this abstraction would be of merely momentary disadvantage; for the burner would quickly acquire its highest possible temperature, after which the abstraction of heat from the flame would cease. But, as needs hardly be said, this is not the case; for, although the burner becomes hot, it is constantly losing a part of its heat by radiation, and this lost heat is being constantly made up by an equal absorption of heat from the flame.

Thus the advantage which Leslie and others thought was obtained by the burner becoming hot is an illusion. Undoubtedly, *per se*, the hotter the burner the better, but not when the heat is obtained from the gas-flame itself, and under circumstances where the burner is parting with its heat almost as quickly as it is abstracting it from the flame.

These considerations help—perhaps suffice—to explain what, *prima facie*, is a mystery. It has been found that steatite Argands give a higher light than metal Argands identical in structure. This was certainly a very puzzling phenomenon. Mr. Sugg made the reasonable conjecture that this was owing to the coolness of the gas as it issued from the burner. The steatite being comparatively a non-conductor of heat, the gas in the cylinder of a steatite Argand must unquestionably be cool, at least compared with what it is in a metal Argand. And, in fact, this was, at first sight, the only apparent difference; and therefore it was a natural inference that it was the coolness of the gas which gave to it its higher illuminating power when consumed in a steatite burner.

Effect of Non-Conducting Burners on Illuminating Power.

It is important to observe at the outset how this matter stands. There is no question that the cooler the gas the smaller is its volume, and therefore the heavier it is, containing a larger amount of illuminating substance. But this consideration must be here excluded, because in the experiments in question the gas has the same temperature as it passes *through the meter* whether to the metal burner or to the steatite one; and as the same weight, or quantity of illuminating substance, passes through the meter within any given time (per hour or minute), the same quantity of illuminating substance must simultaneously issue from the burner. Accordingly, the only difference between the two cases is, that in the steatite burner, wherein the gas is less heated and less expanded, the gas will be not only cooler, but will issue with less velocity than from the metal burner. Now, under the circumstances of this case, it cannot possibly be thought that the fact of the gas being hotter would be detrimental to the illuminating power of the gas when it is ignited; so that—if these were all the facts—the lesser light from the metal burner would plainly be owing to the fact that the gas issues from the burner with a higher velocity. And, if this were all, a very slight enlargement of the holes of the metal burner (so as to allow of the gas issuing at the same velocity as from the steatite burner) would suffice to make the metal burner quite as good as the steatite one.

But the considerations previously stated suggest quite a different explanation—namely, that the better light given by the steatite burner has nothing to do with the temperature of the gas, but directly with the different conducting properties of the two burners. The steatite, being “non-conducting,” abstracts less heat from the flame than the metal does, thereby allowing the flame to rise to a somewhat higher temperature of combustion. The difference, in short, is not that the steatite burner keeps the gas cool, but that it *keeps itself cool*. The cause, therefore, does not lie in the consequences of the burner being hot or cool, but in the fact that the burner is hot or cool. It is not the temperature of the gas that makes this difference, but the temperature of the burner—the hotness of which is but another word for the abstraction of heat from the flame.

Doubtless it will seem to many, perhaps to most persons, that I am giving an exaggerated importance to this matter; and at one time I should have shared their opinion. But that the loss of heat in a gas-flame through absorption by the burner must be very considerable may be illustrated by reference to some well-known facts. For example, look at the safety-lamp of Sir Humphry Davy. The combustible “fire-damp” of the coal-mine, entering through the wire-gauze which encloses the lamp, will take fire within; but the flame cannot extend beyond the interior of the lamp, owing to the great reduction of its temperature in passing through the wire-gauze. The metal absorbs so much of its heat that the flame is extinguished—the combustible vapour is cooled down below its temperature of ignition or combustion. Or, as a still closer parallel, take the facts upon which the safety-lamp was devised, and which are usually exhibited by chemical lecturers. Take a piece of wire-gauze containing about 700 meshes to the square inch, hold it close above a gas-jet, and ignite the gas above the gauze; the gauze may then be raised several inches above the jet, and the gas will continue to burn; yet the gas below will not take fire—the gas burning only on the upper side of the wire-gauze. Here it is shown plainly that the metal abstracts so much heat from the burning gas that the flame cannot extend downwards, because in so doing the gas becomes cooled below its temperature of combustion. The abstraction of heat by the metal must, therefore, be very considerable. Now, the top of a metal burner must act in much the same way—withdrawing heat from the flame above it; while the body of the burner being likewise of metal, the heat absorbed by the top (the portion in actual contact with the flame) is being perpetually carried off, and is re-

placed by a fresh and continuous absorption of heat from the flame. In short, a metal burner may be regarded as an ingenious contrivance for reducing the temperature of the flame—the metal acting as a special absorbent of the heat, which thereafter it discharges uselessly into the air.

I may here remark, in passing, that probably the French Bengel burner, which greatly surpassed any other prior to Sugg's standard Argand (beating the Sugg-Letheby in the proportion of 112 to 100), owes a considerable part of its merits to the material of which it is made—the cylinder or body of the Argand being made of porcelain, and very broad or thick. Indeed, looking at the mere structure of the Bengel, apart from its material, it is hard to see why it gives the unusually high illuminating power from the gas. Like the steatite Argand, the comparatively non-conducting material of the Bengel will withdraw less heat from the gas-flame; and, as Herr F. Siemens remarks, even a comparatively small increase of the temperature of a flame must give an appreciable increase in the light which it emits.

Accordingly, as it seems to me, the fact that a steatite Argand gives a better light than a metal one does not prove there is no advantage in heating the gas; but merely that there is no advantage in this when the prior heating is made by, and at the expense of the gas-flame, and in such manner that the heat imparted to the gas is only a small part of the heat abstracted by the burner from the flame—the larger part being lost by radiation from the entire surface (both inner and outer) of the Argand.

Heating the Burner.

But the case would stand very differently if the gas were heated independently of the gas-flame. As a question between hot gas and cold, it will hardly be doubted that the former is more favourable to its combustion. Although, as already said, it seems to me that no temperature can, as a practical matter, be imparted to the gas sufficient to make appreciable differences in its illuminating power when ignited—the mere ignition raising the gas instantly to a temperature of 5000° Fahr.—still, whatever extra heat be imparted to the gas before ignition must, *per se*, tend towards favouring combustion.

But there is one way in which a prior heating of the gas may make itself perceptible as an improvement—viz., by heating the burner, and thereby lessening the burner's abstraction of heat from the flame. Indeed, if the explanation above given of the superior light from a steatite burner compared with a metal one be correct—viz., that the former abstracts less heat from the flame—then it follows, beyond question, that anything which lessens the burner's abstraction of heat from the flame will be advantageous. And if you heat the gas (by independent means, and not from the gas-flame itself), you will also heat the burner; and thereby, its temperature being raised, the burner will absorb less heat from the gas-flame.

Conclusions as to Heating the Gas.

The conclusion of the whole matter, then, seems to be—(1) That any prior heating of the gas must be (*per se*) favourable to its combustion; but that, owing to the remarkable combustibility of coal gas, which, when ignited instantaneously, possesses a temperature of about 5000° Fahr., a mere heating of the gas to 500° Fahr. (which is very difficult) is not enough to make the slightest perceptible difference in the intensity of combustion and luminosity of the flame. (2) That, besides the difficulty of heating so tenuous a vapour as coal gas, it is impossible practically to raise its temperature above 500° or 600° Fahr. without producing a deposit of carbon, and loss of illuminating power. (3) That there is not only no advantage (as Leslie and others thought), but a positive disadvantage, when the gas is heated by, and at the expense of the gas-flame; in other words, by means of the heat conveyed to it from the flame through the burner, a still larger portion of this heat being simultaneously lost by radiation into the air. (4) That the heating of the gas is, and can be, only advantageous when it is made independently of the gas-flame—from some other source than from the ignited gas itself; but, as with furnaces, this other source may be supplied from the heated products of combustion. (5) That the gas so rapidly loses any heat which may be imparted to it, that the heating, while made from some other source than the gas-flame, must be applied close to the point of ignition—to the burner itself, or the tubes immediately supplying it. And, lastly, as seems to me (and bearing in mind No. 1), the only appreciable advantage from heating the gas will be that the hot gas will heat the burner, and thereby lessen the burner's abstraction of heat from the flame.

(To be concluded next week.)

We notice that Mr. Frederick Colyer, M. Inst. C. E., having retired from the firm of Messrs. G. Waller and Co., gas and water engineers, with whom he was so long connected, announces that his consulting practice in all matters connected with gas and water works will be continued at 18, Great George Street, Westminster.

We understand that the Rustless and General Iron Company (Messrs. James E. and Samuel Spencer) have heard from their agent at the Sydney Exhibition that a gold medal has been awarded to them for "anti-corrodo tubes and fittings," treated by Professor Barff's rustless process. They have already supplied goods to fifty or sixty of the leading gas and water companies, and have had numerous repeat orders.

The Downson Economic Gas Company, Limited.—Among the new companies recently registered is one with the above title. The Company proposes, upon terms of an agreement of the 6th ult., to purchase and work the patent granted to Mr. J. E. Dowson for "Improvements in Apparatus for the Manufacture of Gas." It was registered on the 21st ult., with a capital of £8000 in £50 shares. The purchase consideration is £6000 in fully paid shares.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

PUMPING GAS AT BECKTON.

SIR,—The letter of Messrs. Gwynne and Co. in your last week's issue is one to which I am bound to reply, as the object of their communication is to discredit my statement, and to make it appear that we are indebted to them for the laying out of our pumping machinery; inasmuch as the arrangement carried out corresponds exactly with the drawing which accompanied their tender. By such arrangement, I presume, they mean the coupling of two exhausters on to one engine, with the slides of the former at right angles to each other. But they are not ingenuous enough to tell you that it could not very well be otherwise, inasmuch as the specification (the original of which I send you) on which both Messrs. Donkin and Co. and Messrs. Gwynne and Co. tendered was the same, and the date of the specification—Jan. 28, 1879—prior to the date of the letters they refer to. On reference to this specification, you will find the following:—

"Each engine to be coupled direct to a pair of exhausters, and the couplings to be formed so as to admit of being readily disconnected so as to drive a single exhauster. In coupling together each pair of exhausters care must be taken that the flaps of each exhauster are at right angles one to the other, so that little or no oscillation is produced in working."

As your readers will see, any two or more firms tendering for machinery on these and other conditions, their accompanying plan, with the exception of details, must be the same. So they were; and the tender of Messrs. Donkin and Co., being the lowest, was accepted. And let me here remark that I do not pretend, nor am I fool enough to claim the slightest novelty for the arrangement specified, as it is just what any engineer would stipulate for, considering the circumstances of the case.

Now, if I understand Messrs. Gwynne and Co.'s contention, it is that the arrangement which I have quoted, and which we have in use, is the patent arrangement which they specified in December, 1871. Allow me to say, in reply, that if this is the novelty in the patent, it would appear that Messrs. Gwynne and Co., like a good many other patentees, by taking out and maintaining such a patent, have simply added to Her Majesty's Exchequer; for supposing it to be granted, for the sake of argument, that such a patent (assuming the thing not to have been done before) would be valid, what is to be said of it in the face of the publication of the information in January, 1857, in Mr. John Beale's patent, No. 2090, page 4, line 31, as follows:—

"When a more equable action is required than can be obtained from one engine, two of these engines, having their sliding pistons working at right angles to one another, may be employed as indicated at Fig. 1; the sliding position of the second engine being shown by dotted lines."

Although it is here spoken of as an engine, it refers to the original form of Beale's exhauster; and, in giving this quotation, I must do Mr. Beale the justice to state that it formed no part of his claim, and it does not appear that he considered it a novelty.

I have been informed that another type of exhauster has been working in the same manner at our Bow Common works many years before the date of the so-called patent.

G. C. TREWBY.

The Gaslight and Coke Company,
Beckton, North Woolwich, May 17, 1880.

THE RECENT LANTERN TRIALS AT BIRMINGHAM.

SIR,—On reading over your report of the recent meeting of the Midland Association of Gas Managers, it has occurred to me that some observations of mine, although quite correctly reported, are likely to give rise to a little misapprehension. When speaking of the possibly shadowless effect of the clear glass circular lantern, I had in my mind chiefly the triple arrangement with which I had been experimenting, and the effect of which is all that can be desired. When, however, the lanterns are used singly, and at a moderate distance apart, undoubtedly a greater difficulty is experienced in obtaining a shadowless effect—corresponding, in fact, to the amount of obstruction placed at the bottom portion of the lantern, and rendering the employment of some sort of reflector almost unavoidable. I am not, however, without hope that this may be reduced to a very small matter indeed.

Birmingham, May 15, 1880.

CHARLES HUNT.

THE BRAY LANTERN AND BURNER, AND MR. SUGG.

SIR,—I have read Mr. Bray's long letter appearing in your issue of last Tuesday, and have carefully examined the various drawings referred to therein; but as this matter is now assuming a shape which cannot be of interest to your readers—viz., a personal dispute between two manufacturers—I do not propose to trouble you with any observations in detail, nor to write any further letter to you in continuation of the recent correspondence, whether Mr. Bray answers me or not.

At the same time, before finally leaving the subject, I would point out to you that, however ingenious and complete Mr. Bray's answers may be so far as he has gone, he has avoided one, the main point, altogether; for if you read his letters, you will see that he does not dispute my position—that in all points in which our lanterns are similar, either I or some other person has anticipated him.

I enclose with this a declaration of Mr. John Goodson, who made the model for the first hollow-top burner. On searching through my books, I find that the date of the production of this model is proved to be 1868 and not 1872.

Vincent Works, Westminster, S.W., May 15, 1880.

WILLIAM SUGG.

[ENCLOSURE.]

May 10, 1880.

I, John Goodson, of 3, Ashgrove Villas, Mortlake, declare that, on or about the month of January, 1868, I being then in the employ of Mr. William Sugg, of Vincent Works, Vincent Street, Westminster, did, under his direction, make a model for a hollow-top steatite burner for reproduction in steatite. [Shape of model given.] I have still by me the tool I made to hollow out the head of the burner.

(Signed) JOHN GOODSON.

Witness to signature,
C. F. Just, 93, Disraeli Road, Putney, S.W.

MR. PATTERSON ON THE EFFECTS OF HEAT IN RAREFYING GAS IN BURNERS.

SIR,—Without endorsing all else that Mr. Patterson says in his interesting article in your last issue, my unsophisticated mind refuses assent to the proposition contained in the second paragraph on the "Effects of Heat in Rarefying the Gas," viz.:—"This expansion of the gas would tend to impel the gas at a quicker rate through the orifices of the burner. The pressure behind remaining the same, while the gas within the burner increased in bulk, the tendency would be for the gas to be driven through the orifices more rapidly than before."

Now, it appears to me that if the pressure in the burner is greater than the pressure of the gas entering the burner, no more cold gas can enter till the pressure in the burner is reduced to the normal point, and that the exit pressure can in no case exceed the inlet pressure.

Perhaps Mr. Patterson or some other gentleman of "light and leading" will enlighten one who is

Manchester, May 12, 1880.

WILLING TO LEARN.

CONVEYING GAS ACROSS SMALL NAVIGABLE RIVERS.

SIR,—In reply to your correspondent, "D. W.," I may state that the Hampton Court Gas Company's Engineer (Mr. E. Price) consulted me, about two years ago, in reference to a main he wished to cross the Thames at Moulsey; and, seeing no difficulty in the matter, a contract was entered into between the Company and Messrs. James Oakes and Co. to lay them a 14-inch main in the bed of the river, averaging 11 feet deep, by dredging and a diver. This main was completed, and has been at work for more than eighteen months.

Having carried out this work, I can give "D. W." any information he wishes if he will write me.

In reply to his questions:—

1. Condensation is so little that it need not be considered. Mr. Price would give the actual amount of condensation.
2. The river being impregnated with salt water, a cast-iron main should be laid, not a wrought-iron one.
3. The hose across the bridge is objectionable and costly, requiring constant attention.
4. I should recommend a 6-inch pipe, not a 4-inch one.

21, Wharf Road, City Road, N., May 14, 1880. CHARLES HORSLEY.

SIR,—Last autumn, having to cross a rapid tidal river about 150 feet wide with a new 5-inch main-pipe, where there was no permanent bridge, and then, immediately after, carry my main 100 feet under a tidal canal, I adopted the following plan, which would meet the inquiry of "D. W." in the last issue, as far as the immersion of the pipe under water is concerned:—Having a depth of 11 feet of water to contend with, I increased the pipe to 6 inches diameter, and had my pipes cast with flanges strongly supported with fillets; and faced each flange, as well as the connections of the syphon. I then, with great care and exactness, bolted all together with thin canvas washers well coated with red lead; and had same lowered into its place, using every precaution so as to prevent any undue strain on the flanged joints. An expansion-joint was attached above ground, so as to regulate the strain consequent on expansion and contraction of the pipes, and I would recommend "D. W." to adopt the same.

Although my pipes have been laid since December last, up to this date I have not been obliged to pump my syphon; indeed, there has not gathered 1-10th of an inch of water, and I am supplying gas daily.

I would not advise the use of a hose, because the expenses attendant on changes, and consequent loss, &c., would be great. I had intended to put a similar appliance in my case, but abandoned it; and no loss or trouble has been experienced since my pipes were laid as they have been.

Gas-Works, Galway, May 15, 1880.

ANDREW GIBB.

LEAKY GASHOLDER-TANKS.

SIR,—If "W. S. M.G." will try a quantity of horse litter, I think he will get his tank practically sound. The dung should not be too compact, for in that case it will all settle to the bottom of the tank; but should be of such a consistency that it will float about when agitated; it will then wash into the crevices. The extent of fracture, &c., must decide the quantity and compactness of the litter.

May 13, 1880.

H. T.

NORWOOD (MIDDLESEX) WATER-WORKS.—The first stone of these works was laid on Tuesday last, at the pumping-station, which is situated close to the Southall station on the Great Western Railway. The business is in the hands of a limited liability company, the Chairman of which, Sir George Innes, performed the inaugural ceremony in the presence of numerous spectators. The intention of the promoters of the undertaking is to exercise an exclusive right conferred upon them for supplying the populous and increasing districts of Southall, Southall Green, North Hyde, Frogmore Green, and Norwood with water, and also, if possible, to extend the mains of the Company through the towns and districts of East Bedfont, Cranford, Feltham, and Hanworth. The Company are now sinking a shaft through the chalk formation, from which their supply of water will be obtained, and they hope to get a pressure that will enable them to give an adequate supply at the highest level in the district, which is now chiefly dependent on shallow surface wells and streams for its water.

FYLDE WATER-WORKS COMPANY.—The report of the Directors presented at the half-yearly meeting of the above Company, recently held, stated that the expenditure on capital account had been increased during the six months ending Feb. 29, 1880, to £177,813 19s. 11d. The amount of water-rates for all purposes, and of profits on fittings during the half year, was £7039 2s. 4d.; less interest on loans and commission, £783 5s. 11d.; working expenses, including rents, rates, and taxes, £1735 13s. 5d.; and allowances for empty houses and bad debts, £282 12s. 5d.; leaving a balance of £4237 10s. 7d. The number of consumers had increased by 92, and amounted to 7187. The Directors recommended a dividend on the subscribed stock of the Company at the rate of $\frac{1}{2}$ per cent. per annum, free of income-tax, and that the balance remaining, after making such payments—about £900—be carried to the reserve-fund. The restoration of the Grizedale reservoir was being vigorously proceeded with, and the staff had been increased by the appointment of Mr. T. Duncanson as General Manager. The report was adopted, and the dividend therein recommended declared.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

THURSDAY, MAY 13.

(Before Vice-Chancellor MALINS.)

Buenos Ayres Gas Company, Limited, and Dower C. Wilde.

Mr. HIGGINS, Q.C. (with him Mr. BRADFORD), moved on behalf of the plaintiffs to commit the defendant for contempt of Court, in having published an advertisement warning holders of debentures that they could not resort to the assets of the Buenos Ayres Gas Company represented by the defendant, in breach of an undertaking given by him to discontinue the issue of advertisements calculated to injure or disparage the credit of the plaintiff Company; or, in the alternative, for an injunction restraining the issue of such advertisements, and for the costs of the motion. On the 15th of April the plaintiffs applied for an injunction to restrain the defendant issuing advertisements headed "Caution," and an undertaking was then given not to issue any further advertisements; but the defendant had adopted means, notwithstanding such undertaking, of repeating the injury.

The VICE-CHANCELLOR asked what the terms of the undertaking were.

Mr. HIGGINS said the undertaking was not to insert any of the advertisements until the motion was disposed of, but immediately after an advertisement appeared in a London newspaper stating that the defendant had been restrained from issuing the advertisement headed "Caution," and setting out the objectionable advertisement. If the former advertisement was objectionable, the latter one was clearly so, because it was a repetition of the old offence.

Affidavits in support of the plaintiffs case having been read to the Court, proving the publication of the new advertisement.

The VICE-CHANCELLOR said he did not see why the defendant wanted to issue any advertisement. It was not usual for a person to advertise a defeat.

Mr. HIGGINS said it was admitted that the advertisement had been inserted by the defendant. The rule of the Court was perfectly clear that proceedings upon interlocutory applications must not be made use of for the purpose of injuring either party. That had been decided by the cases of *Coleman v. West Hartlepool Railway Company* (8 Weekly Reporter, 734) *The Cheltenham and Scaunsey Railway Company* (8 Equity, 580), and *Bowden v. Russell* (Weekly Notes for 1877, page 55).

The VICE-CHANCELLOR said the question was whether this was virtually a repetition of the former advertisement.

Mr. HIGGINS said it was a breach of the injunction, for which the defendant was liable to be committed to prison. Even if there had been no undertaking, it would be a contempt of Court, and would come within the rule of the authorities to which he had referred, because it was not a fair representation of what took place in Court. If his lordship thought it was not a contempt of Court, he should ask for an injunction to prevent the insertion of any advertisement which was calculated to disparage the credit of the plaintiff Company.

Mr. GLASSE, Q.C. (with him Mr. RUSSELL ROBERTS), who appeared for the defendant, said it was hardly possible to conceive a more impudent motion. The advertisement had been sent to the paper in question, and the Editor had, upon his own responsibility, put it in large type, and without any authority from the defendant. The defendant in his affidavit stated that he had no intention to commit any contempt of Court in any shape or form. The original writ was issued on Dec. 5; on the following day the defendant withdrew the advertisements, and it was not until the 8th of March that the notice of motion was given. The report being true in every particular, the authorities which had been referred to had no application.

Mr. HIGGINS having replied upon the whole case,

The VICE-CHANCELLOR, in giving judgment, said this was a motion to commit the defendant for breach of an undertaking given by his counsel on April 15, and the whole litigation between the parties arose from the fact that the plaintiff Company were about to raise money upon debentures. The defendant, who represented the Buenos Ayres Gas Company, seemed to have been needlessly anxious to caution the public that the money being raised by the Limited Company was not to be a burden upon the unlimited Company, and thereupon he inserted the "Caution" in several newspapers. Upon a motion being made to restrain these advertisements, an undertaking was given not to repeat the "Caution." An inaccurate report of what took place having appeared in a daily paper, the defendant sent an account of what had taken place to the paper which had been referred to, and from what had been said he was quite unable to make out that there was anything inaccurate in the account so sent. As he understood the law, a report of proceedings in a court of justice might be published, provided it was an accurate report. Although he thought it would have been as well for the defendant to have abstained from issuing further advertisements; still, he thought the motion for commitment could not be sustained, and therefore it would be refused, but without costs. In dismissing the motion, he did so with the intimation that it would be better not to insert any further advertisements.

QUEEN'S BENCH DIVISION.—FRIDAY, MAY 7.

(Before Justice LUSH.)

STANSFIELD v. THE YEADON AND GUISELEY GAS COMPANY.

This was an action tried before Justice Lush at the Yorkshire Winter Assizes, at Leeds, in February [see ante, p. 204], when a verdict was given for the plaintiff. On that occasion some points of law were reserved, and they now came on for further consideration.

Mr. WILLS, Q.C., and Mr. LOCKWOOD appeared for the plaintiff; Mr. CAVE, Q.C., and Mr. FORBES were for the Gas Company.

Mr. WILLS said the action was brought by Colonel Stansfield, of Esholt Hall, against the Yeadon and Guiseley Gas Company, to recover damages for a nuisance caused to his premises by the fouling by the Company of the water of a stream of which he was riparian owner, and also to recover a penalty under the Public Health Act, 1875. The 68th section of this Act provided that "any person engaged in the manufacture of gas who causes or suffers to be brought, or to flow into any stream . . . any washing or other substance produced in making or supplying gas, or wilfully does any act connected with the making or supplying of gas whereby the water in any such stream is fouled, shall forfeit for every such offence the sum of £200, and after the expiration of 24 hours notice from the local authority, or the person to whom the water belongs, in that behalf, a further sum of £20 for every day during which the offence is continued, or during the continuance of the act whereby the water is fouled. Every such penalty may be recovered, . . . in the case of water belonging to or under the control of the local authority, by the local authority, and in any other case by the person into whose water such washing or other substance is conveyed or flows, or whose water is fouled by any such act as aforesaid." The facts were these: The plaintiff's property was some distance from the gas-works, and land belonging to other people intervened; but where the stream passed through his park the land was his on both sides. What doubt there could be that he was the person whose water was fouled by the act of the Gas Company he (Mr.

Wills) could not understand. The jury at the trial found that the plaintiff's water was fouled, that a nuisance was caused there, and that the water was contaminated, and they gave a verdict for £100 damages. It was then contended by the Gas Company that the words "person into whose water such washing or other substance is conveyed or flows" must mean the person along the stream into whose water the contamination first flowed. He had good hope of convincing his lordship that the words could not receive that limited construction, for if it were so, all that the Gas Company would have to do would be to buy the land on both sides of the stream where their pipes issued, and then no one could bring an action against them for causing a nuisance. It was immaterial, however, to discuss this, because there were the larger words, "or whose water is fouled by any such act as aforesaid;" and there could be no doubt that the plaintiff's water was fouled. He did not see what more there was to be said about it.

Justice LUSH said the other question was whether the amount to be recovered was cumulative—whether the person injured could recover both damages and the penalty.

Mr. WILLS said this suggestion was made, but he did not know on what authority such a restriction could rest.

Mr. CAVE said he did not think he could maintain this. It was clear upon the statute that both damages and the penalty could be recovered.

Justice LUSH said he thought so too.

Mr. WILLS said inasmuch as he really did not quite know what he had to meet, he would reserve anything further till he had heard his friend.

Mr. CAVE said his contention was that, as this was a penalty, the Act must be construed strictly, and if it was construed in the sense in which it was sought to be construed by the plaintiff, every riparian proprietor down the stream might bring an action to recover a penalty of £200. There was no limitation. It did not say whoever sued first, but "every such penalty may be recovered by the person into whose water such washing or other substance is conveyed." In this case who was the person into whose water such washing was conveyed? It was conveyed into a stream. Who was the person? Surely not some particular riparian proprietor some distance down the stream from the works. If the "person" meant anybody at all in connection with the stream, it must mean the whole of the riparian proprietors as a body.

Justice LUSH: Whose intervening land is it?

Mr. CAVE said the Gas Company were the owners of the land on one side at the point where the pipe entered the stream, and the Vicar was the owner on the other side. A Mr. Barwick was then the owner, and next came Colonel Stansfield about 200 yards down.

Justice LUSH said it must be admitted that at common law every riparian owner all the way down, whose water was fouled, would have cause of action.

Mr. CAVE said that was so; but then this was, of course, as an injury to his riparian rights, and was one reason why there was no necessity to extend the penalty for the purpose of compensating him. Colonel Stansfield had, in fact, recovered £100 in this case; but he also sought to recover a penalty, and in order to do that he must show that he was clearly the person pointed out by the Act. The words of the Act were, "the person into whose water," not "any person into whose water." In the case of a stream of this kind, there was no person who answered to the description at all. If the stream had been purchased by any individual for the purpose of water-works or otherwise, then it might be said that the stream belonged to him, and it would be his in a sense extremely different from that in which it could be said to belong to a riparian proprietor. The water did not belong to Colonel Stansfield at the moment it was fouled, and it did not belong to him after it had passed his premises. He was not able to deal with the water even while it was passing through his property, except in a certain limited way. He might take it by the mouths of his cattle, or for ordinary domestic purposes; but he could not take it, for instance, to supply another parish with water.

Justice LUSH said it was his water in the sense used here, because it was water which he was at liberty to use for domestic or other purposes.

Mr. CAVE said he should contend it was not so.

Justice LUSH: Do you mean that this section does not apply to any running stream, only to pent-up water?

Mr. CAVE said he thought it must come to that. It was a case for a penalty, and therefore the Court must see that the meaning did come within the Act. It took from him no right; it imposed a penalty upon the Company, and still left the plaintiff able to obtain full compensation for the whole of the wrong that was done him. The question was whether the Legislature had unmistakably expressed its intention that in addition to compensation a riparian proprietor could obtain a penalty.

Justice LUSH said this argument would be just the same if it was applied to the case of the owner of a reservoir. It was admitted that the penalty might apply; surely he could bring an action also. The penalty was a punishment to the Gas Company in order to repress the practice, quite irrespective of the damage sustained.

Mr. CAVE: Undoubtedly; but the punishment surely must be measured out with some reference to the offence which was committed. This punishment might be inflicted upon them quite irrespective of any wrongdoing upon their parts. Although they might have taken every possible care, yet if the stuff complained of escaped into an adjoining well, then undoubtedly they were responsible.

Justice LUSH: Because they could prevent it with due care.

Mr. CAVE: Looking at the section, it would seem that the Company were liable, although they could not prevent it.

Justice LUSH: If by exercising the greatest care they could stop it, then they must stop it.

Mr. CAVE said, with regard to the riparian proprietors below them, the Company had no control whatever over the number. There might be hundreds, or it might be that the riparian proprietorship rested mainly in the hands of two or three persons. Although the effect produced was substantially the same, yet in the one case there would be 40 or 50 riparian proprietors, each entitled to bring an action for £200, and in the other case only one or two. That would appear to involve an inequality far in excess of what one could suppose the Legislature would seek to impose. He could understand their saying to the Company, "You have let this stuff escape; consequently you must pay a penalty of £200 to the man whose water you have injured;" but to say, "You shall pay £200 to every proprietor all the way down," was to say that the Company should pay a sum which would depend in amount, not in the least degree upon the damage done, but upon whether the property below them happened to be in the hands of one proprietor only, or to have been cut up into a number of small properties.

Mr. WILLS said there was only one penalty for one act of escape.

Mr. CAVE said he found nothing of the kind. The Act said "the person whose water is fouled" may sue. How was Colonel Stansfield "the person"? If it had been "any person," undoubtedly every riparian proprietor, assuming that it might be said to be his water, would fall within the word "any," but it was "the," and how did Colonel Stansfield make himself "the person," unless it was because he was a riparian proprietor? and if he was entitled to sue because he was a riparian proprietor, and

was therefore "the person," he was not more "the person" than any other riparian proprietor.

Mr. WILLS said there was only one penalty, and if one person recovered it no other person could do so.

Justice LUSH: The person who first sues is the person to recover the penalty.

Mr. CAVE said the statute did not say that. If the statute said "the person who first sues," clearly the act of suing would indicate who was the person to whom the penalty became payable. The statute indicated no such thing as that. The person to whom the penalty was to become payable was the person who fulfilled the description—the person whose water was fouled. There was no other mode of ascertaining who he was, and that was not ascertained by bringing an action. If any riparian proprietor was the person whose water was fouled, every riparian proprietor must be in the same condition, and it could not matter that one of them was a little quicker in getting out his writ than another. He (Mr. Cave) was not aware that there was any authority upon the point. It was, of course, a case of the greatest importance to gas companies, because if his learned friend's contention was right, he did not see how he could stop short of saying that every proprietor must be entitled to sue. On these grounds he (Mr. Cave) submitted that the plaintiff did not come within the words "the person whose water is fouled." If they supposed it to be confined to the case of ponds, aqueducts, reservoirs, or streams, which belonged to a man in the sense that he could take the water and do what he liked with it, then "the person whose water is fouled" was a definite person. He was the person to whom the water belonged that was fouled. They had only to look at the aqueduct, reservoir, pond, or well, and ascertain whose property it was, and that was the man whose water was fouled. The same reasoning would apply if the man had full control over a stream; but with an ordinary stream, in which people had only rights as riparian proprietors, he could not see how any one could possibly say who was the person whose water was fouled. The only way in which he could possibly conceive this to be brought about would be by taking the whole together, but this again seemed impracticable, and therefore the word "stream" must be read as being only applicable when it was in the same position as a reservoir, aqueduct, or pond—that was, when it absolutely belonged to some person. If this interpretation were put upon the word "stream," the words of the Act would then be found to be entirely applicable to it.

Justice LUSH: What state of things can you suppose which would give a man a right in a running stream similar to what he would have in a reservoir?

Mr. CAVE: A water-works company might have such a right by Act of Parliament.

Justice LUSH: You cannot suppose that this is confined to cases of that kind, which are very rare indeed?

Mr. CAVE: I do not know why it should not be.

Justice LUSH: Because it would not be giving effect to the general terms of the Act. It expressly distinguishes between a stream which is running water and a reservoir which is standing water.

Mr. CAVE: That assumes, of course, that you are to take the word "stream" in its full extent. I say you may understand it in another sense, in which it is still a stream, but in which the water in the stream is in the same position as the water in a pond or aqueduct.

Justice LUSH: You mean that the riparian proprietor cannot say that the water is his?

Mr. CAVE could not contend that he was the person whose water was fouled, because the water was not his alone. It was his to use to a certain extent, in common with a number of other persons. If there was any one at all who could be said to answer to the language of the Act—"the person"—it must be the person into whose water the pollution first came, and the fact that it went down the stream did not give the separate riparian proprietors the right to sue for this penalty. Another point taken at the trial was that the intent of the Act was to protect water which was in a wholesome state, and capable of being used for domestic purposes—that the penalty was not meant to apply where the water was not previously pure.

Mr. FORBES followed on the same side, and contended that by the Act of Parliament the local authority would not be able to take any action in the matter until they had given notice to every riparian proprietor down the stream, and they had all refused to take proceedings.

Mr. WILLS said his contention was that though there could be only one penalty recovered, but all riparian owners were entitled to sue. There was one offence committed and one penalty. When the Brighton Aquarium was opened on Sundays, there was one offence committed and one penalty imposed, but there were three millions of people entitled to sue. The way in which it worked out was that the person who first obtained judgment exhausted the penalty.

Justice LUSH: It is the case of a penalty which may be sued for by a common informant. The man who first gets *bonâ fide* judgment has the penalty.

Mr. WILLS said there was no practical difficulty in working it out. The person who first obtained judgment exhausted the penalty, and there was an end of it. There was an alternative given. Supposing any one of these persons did not feel disposed to sue, the local authority might take his place, but only on condition that they gave notice to him.

Justice LUSH: Which of them?

Mr. WILLS said whichever they chose. They must distinguish between the offence and the person entitled to sue. The offence was complete when the fouling substance was sent into the stream; the person entitled to sue was ascertained by seeing whose water was fouled. Take the present case. Colonel Stansfield's water had been fouled. Assuming that he did not choose to sue, the local authority, after giving notice to him, might step into his place, and might sue because his water was fouled. They might not sue because Mr. Barwick's water was fouled, unless they gave notice to Mr. Barwick; they might not sue because the Vicar's water was fouled, unless they gave the Vicar notice. It was only substituting the local authority for the particular person, and to speak of the necessity of giving notice to them all was a perfect fallacy. As to the first proposition—namely, that a stream was not covered by the Act—he thought it unnecessary to say anything. He pointed out at the trial that the words "water belonging to" a person were loosely used, because flowing water, strictly speaking, did not belong to anybody; it belonged to a person when it was caught or impounded. In the popular language used in the Act, however, it was perfectly clear that the person who had the right to the use of the water was meant. Upon these grounds he submitted that the plaintiff was entitled to judgment.

Justice LUSH said the clause was not framed with so much precision as it might have been, but he thought he was giving to it the effect which the statute intended when he held that Colonel Stansfield was a person entitled to sue for this penalty. He agreed that there could be but one penalty. It was not a penalty to be recovered by every person whose water was fouled; it was one penalty only, and this, like every other penalty, was to be recovered by the person who first sued, and followed up the case to judgment. That would form a complete answer by the Gas Company to any other action brought by any other person. It was objected,

in the first place, that the clause did not apply to a running stream. He could not at all follow Mr. Cave in that contention. The object of the clause was to protect flowing water from being impregnated with these noxious substances, and the first matter in the mind of the Legislature was a flowing stream. It then provided for the care of reservoirs, aqueducts, ponds, or other places for water. Clearly the intention was to prevent any water which might be used for public purposes being impregnated with these noxious substances, the "stream" being the very first subject matter mentioned, because it was very important that a stream should be kept free. He therefore could not at all agree that this meant a stream in the nature of a reservoir—something which did not run—nor could he agree in the next contention, that it must mean a stream the water of which was wholly vested in some particular person or company. The offence was clear. The foul water flowed from a pipe directly into the stream, but at a part of the stream which was owned, one moiety of it by the Gas Company, and the other moiety by the Vicar. Then it proceeded through the land of Mr. Barwick, and so on to the land of Colonel Stansfield, who was the owner of the soil on both sides of the stream; therefore the entire flow of water was his riparian property. The next objection was that the words "wilfully does any act connected with the making or supplying of gas whereby the water in any such stream . . . is fouled" could not apply to mere riparian proprietors, but could only be applicable where the entire water of the stream was vested by Act of Parliament in some individual. It clearly was an offence if the gas-washing was suffered to flow into any running stream, no matter to whom it belonged. Then as to the persons who were entitled to sue. Mr. Cave contended that the words "whose water is fouled" applied to absolute ownership, and must be restricted to cases where the company or individual happened by some prerogative or parliamentary power to be the absolute owner. He did not think this was the sense in which the words were used in the clause. It was a popular mode of speaking of the riparian proprietor who had the sole use of the water of a flowing stream as it ran through his premises, and who was entitled to use as much of it as he reasonably required without infringing on the rights of any of the riparian proprietors below. They were the persons here denoted by the words "whose water." The water was fouled. It first belonged to the Vicar, next to Mr. Barwick, and then to Colonel Stansfield, and each of these persons was a person designated by the words "whose water is fouled." The consequence of this would be that unless the matter were restricted to one of these riparian proprietors, every one of the riparian proprietors whose water was fouled would be entitled to sue for the penalty. He could not help thinking this was the meaning of the clause. It was quite clear that every one of these proprietors was entitled to his common law action for damage done to his water. The words "the person" really meant any person. It first pointed to the owner of the water at the spot where the fouling substance was conveyed into the stream, next "the person"—if it was not conveyed directly into his water—"into whose water such substance is conveyed or flows, or whose water is fouled by any such act as aforesaid." That would give to either of the riparian proprietors the right to sue for the penalty which was undoubtedly assumed to have been incurred when the act was committed, causing this noxious matter to run into the stream. This case must follow the principle of ordinary cases where a penalty was inflicted, and where the first person who sued for it became entitled to sue. The Gas Company would, after judgment had been given in favour of that person, be protected from being sued for the penalty by any other person. For the reasons given he was of opinion that Colonel Stansfield was entitled to recover the penalty as well as the £100 damages. He must, therefore, give judgment for £300 and costs.

Mr. WILLS asked for an injunction.

Justice LUSH: Has the nuisance been discontinued?

Mr. CAVE: Yes.

Justice LUSH said there was no need for an injunction. On the other point he remained of the same opinion as at the trial—that the clause was not confined to water which was already in a pure state, because then it would be very difficult to say in what cases the Act of Parliament would have any application at all. It was quite enough that the Company made the water in question more foul than it was before.

Mr. CAVE asked his lordship to stay execution if within a certain time notice of appeal was given.

Mr. WILLS said there was no reason why the £100 and costs should not be paid.

Justice LUSH said all but the £200 should be paid, and as to this he would stay execution for a week.

MARKET BOSWORTH PETTY SESSIONS.—WEDNESDAY, MAY 5. (Before the Hon. and Rev. A. BYRON, Chairman, and a Bench of Magistrates.)

THE PAYMENT OF RATES UNDER THE LIGHTING ACT.

An important decision was this day given in a case in which the Overseers of Ibstock claimed £2 12s. 5½d. from Mr. W. Haywood, a farmer, as his contribution to a lighting rate made in December last.

Mr. DEWES, who appeared for the Overseers, said the case came before the Bench on the 14th of April, when the rate was declared invalid. This was in consequence of the way in which it was placed before the Bench. It was a serious matter for the parish, and if Mr. Bland, who appeared for the defendant, would consent to submit a case for counsel's opinion to test the validity of the rate, they would bear the expense of the same.

Mr. BLAND objected to this course on the ground that he was there prepared to meet the case.

Mr. DEWES said he could not go on further with the case, as he was not in a position to prove the adoption of the Act.

The BENCH decided that, as this was so, they must refuse to issue a distress warrant.

BURTON-ON-TRENT CORPORATION GAS SUPPLY.—It was stated by the Chairman of the Gas Committee at the last meeting of the Burton Town Council, that the make of gas had increased 38 per cent. during the past five years. It was 34 per cent. more last year than in 1876, and last year the increase was 11½ per cent. more than in the previous year.

MIDDLETON AND TONGE IMPROVEMENT COMMISSIONERS GAS SUPPLY.—At the last meeting of the above-named Commissioners, in reply to a question, the Chairman of the Gas Committee (Mr. Hilton) stated that the gross profits on the past year's operations at the gas-works were £3916, as against £3192 the previous year, being £724 in favour of last year. The net profit of the past year, after paying annuities and interest, was £275. There was no depreciation allowed, nor anything towards the sinking-fund required by the Local Government Board. The loss the year before last, after paying annuities and interest, was £501; and instead of that there was now a profit of £275, showing a saving, comparing the two years, of £776. The leakage had been decreased from 22½ to 16½ per cent., showing a decreased leakage of 6 per cent. These results had been obtained with a sale of 2½ million feet less gas than in the previous twelve months. He considered all this very satisfactory, and with an increased consumption they might look forward to make considerable profit.

Miscellaneous News.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

A Meeting of the Members of this Association took place on Thursday last, at the Crystal Palace District Gas-Works, Lower Sydenham. The weather proved everything that could be desired for a day's excursion, and a large number of the members assembled at about half-past one. Having made the tour of the works and partaken of the hospitality of Mr. Gandon, the members proceeded to the board-room, where the chair was taken by Mr. J. HUNTER, of Woolwich, the President of the Association.

The CHAIRMAN, in opening the proceedings, said a very pleasant and somewhat unusual duty devolved upon him—viz., to present, in the name of the members, a testimonial which had been subscribed for by them all—a testimonial to their worthy and much respected Secretary, Mr. J. L. CHAPMAN. It was not necessary for him (the Chairman) to say much, for they all knew the Secretary as well as he did himself, and there could be no question that he was the right man in the right place. The progress of the Association since its foundation was very much due to his exertions, for however anxious the various members might be to promote its interests, they must all agree that Mr. Chapman was very much in the position of the engineer of a gas-works; and as very little could be done without a good engineer, so little could be done without a good secretary. He had much pleasure, therefore, in the name of the Association, in presenting the testimonial to Mr. Chapman, wishing him every prosperity, and that time might last with him as long as time was recorded on the face of the clock.

[The testimonial consisted of a very handsome marble timepiece, surmounted by a bronze figure. The clock bore the inscription: "Presented to J. L. Chapman, Esq., A.M.I.C.E., by the members of the Southern District Association of Gas Engineers and Managers, in recognition of his untiring services as Secretary of the Association. May, 1880."]

Mr. ELDRIDGE said he must, as a member of the Testimonial Committee, interpose for one minute between Mr. Chapman and the meeting. The Chairman had alluded not only to his kindness, but to his ability as Secretary, and he was sure the members must all have been struck with the very able manner in which the business had been conducted by him. They very often had meetings which were quite of a conversational character, and yet at the following meeting, when the Chairman called for the minutes to be read, he had been astonished at the marvellously correct manner in which the result of the conversation had been reproduced. With regard to the testimonial, they all knew that Mr. Hunter, in his inaugural address, alluded to Mr. Chapman's very able services, and suggested something ought to be done in recognition of them. He was quite sure they all felt the force of the President's remarks, and there was only one word more he wished to say. Being appointed Treasurer of this matter, he had received letters on the subject from most of the members, every one of which was couched in terms of the greatest kindness, and expressing satisfaction that such a step was about to be taken. He should feel it right to hand those letters over to Mr. Chapman, for really if he had been in his position he hardly knew which he should have felt most gratified at—the testimonial itself, or these letters in regard to it. He would only repeat what the Chairman had said, that he trusted Mr. Chapman might long live to have the testimonial before him as a mark of their interest.

Mr. GANDON said he certainly took the initiative in carrying out the project, and in so doing endeavoured to impress upon all to whom he applied for subscriptions that the object was not to make a return to Mr. Chapman for his services, but simply to offer him a friendly recognition of them. The clock, although handsome enough in its way, was by no means a sufficient remuneration for all the trouble Mr. Chapman had taken; but he was glad to say that there was a universal response to the proposal, which showed a most friendly feeling. He could only hope that Mr. Chapman would long continue to give the Association the benefit of his services.

Mr. BROADBERRY said Mr. Gandon and Mr. Eldridge had mentioned all that he could state, except that, as a member of the Testimonial Committee, he wished to bear witness to the services rendered by Mr. Gandon in carrying out the matter. For himself, he had felt much pleasure in co-operating in it, for he had always respected Mr. Chapman, and, indeed, no one could come in contact with him, either at these meetings or on business matters, without being impressed by his kindness and affability. He could only say that the matter was taken up very warmly, and he felt sure that if it was necessary they would do the same again.

Mr. J. L. CHAPMAN, in responding, said he felt that the splendid present the members had made him was far beyond his deserts, and he was very pleased to hear from all his friends that it was intended as a mark of friendship, and not as a reward for his services, because these would bear no comparison with it. He was sure all the members must have joined together to make so splendid a present, and it was a source of great satisfaction to him to know that they, as a body, felt he had done his best for the interests of the Association. It was only that morning he was thinking how the Association began. He met his friend Mr. Eldridge coming from the meeting of the British Association at Leeds. He did not know him beforehand, but on speaking to him in the railway carriage the question came up of starting such an Association; and so it arose. A few of them met together at Mr. Eldridge's house, and it was very satisfactory to know that they had now on the books 62 members. It was a great pleasure to belong to anything that succeeded. If a man had his feelings in the right place, especially when working for others, he liked the thing to be a success, and he felt in this Association, whilst Presidents had come and gone, he had been Secretary all the time, and he had been very pleased to see the Association go forward as it had. When he was a boy at school, on the fronts of the prizes that were given was put "*Jucundi acti labores*," and it was pleasant to recollect difficulties overcome. He thanked the members very much for their present, which would remind him always of the Association, even if he were inclined to forget it, and perhaps enable him to work with more zeal in its favour. As he heard the timepiece strike out the hour each day, he had no doubt it would help him to remember always that time was short, and that therefore he should do good as long as he had the opportunity.

Mr. WEST said it was only right to thank the Committee for their kindness in carrying out the wishes of the members so admirably. They all knew it was a labour of love.

A vote of thanks to the Committee was proposed and carried unanimously.

The CHAIRMAN said he did not know whether it was proper for him to reply, being an *ex officio* member of the Committee; but he could only say that the work had been principally in the hands of Mr. Eldridge, Mr. Gandon, and Mr. Broadberry.

Mr. GANDON said it had been a great pleasure to them all, and he was only pleased they had brought it to so successful a result.

The SECRETARY then read the minutes of the last meeting, explaining

why the present meeting was held at Sydenham, instead of at Tunbridge Wells, as appeared by the minutes had been resolved upon. The minutes were confirmed.

NEW MEMBERS.

Mr. Sowood, of Gravesend, and Mr. Eldridge, of Oxford, were unanimously elected Members.

Mr. C. GANDON, the Engineer of the Crystal Palace District Gas Company, then read the following paper on

CONDENSATION.

In introducing the subject of condensation to you to-day, I am afraid I can offer no new matter or theories for discussion. When undertaking to prepare this paper, I had not read the excellent articles contributed by Mr. R. H. Patterson to the JOURNAL OF GAS LIGHTING in October and November last, or I should have hesitated to bring forward what may appear but a repetition of his views. My attention had, however, previously been drawn to the subject by reading the Rev. W. R. Bowditch's book on "The Analysis, Technical Valuation, Purification, and Use of Coal Gas," in which views are expressed much at variance with the present very general practice of condensation.

Mr. Bowditch says: "Hitherto principles of science seem to have had but little connection with condensation; but, if the gas were reduced to the proper temperature before it passed on to the scrubbers or purifiers, the true object of purification has generally been considered as accomplished. An engineer has thus expressed the general aim and opinion: 'Still further to separate all condensable vapours before allowing the gas to pass to the purifiers, a set of condensers, or coolers, is provided, through which the gas is made to circulate until it is reduced to a temperature bearing some approximation to the surrounding atmosphere.' There could be no more mistaken practice than the one commonly adopted, for it is in the power of most engineers to make a considerable difference in the illuminating power of all the gas they manufacture, by the adoption of a better mode of condensation." Mr. Bowditch continues: "The proper object of condensation is the removal from gas of substances produced in the distillation, which, for some reason, are not useful for the purpose of illumination, and the retention in the gas of all the substances which are useful as illuminants, and can be distributed with the gas." Farther on Mr. Bowditch says: "At present most manufacturers of gas take the best means with which we are acquainted for removing hydrocarbon vapours from gas. They cool their gas and hydrocarbon vapours down to 60° or 70° Fahr. (and in some cases lower) as quickly as they can, and the form of condenser which will do this most quickly and certainly is the one generally preferred. No suspicion seems to cross their minds that they are enabling the tar (*i.e.*, the heavier oils) to dissolve out from the gas, and carry down with it the vapours of light hydrocarbons which they ought to retain in their gas with the utmost sedulity."

I have quoted thus at length from Mr. Bowditch's work because his remarks appear to me to describe the process of condensation as it is still very generally understood and applied. He points out the necessity of separating the gas from the tar as quickly as possible, whereas, and particularly of late years, the practice of keeping the two in contact with the gas as long as possible, with the view of enriching the gas and preventing the deposition of naphthaline, has found much favour. It would appear easy to determine by experiment which of these two theories is correct; but if, as I think, the truth lies between the two, it is by no means so easy to arrive at the most favourable conditions. It seems certain that the attractions which the gas or the tar possesses for the volatile hydrocarbons are so nearly balanced, that very slight changes of condition suffice to cause them to be transferred from the one to the other. So far as the hydrocarbon, naphthaline, is concerned, it is much to be doubted whether its permanent retention in the gas is possible.

In a paper read by Mr. James Watson before the British Association of Gas Managers in 1874, in which he advocates prolonged contact between the tar and the gas, he says that "naphthaline can be retained in the gas in the shape of vapour, and delivered at the consumers burners as a valuable light-giving constituent." This, I venture to think, is a mistake. Experiments have convinced me that if naphthaline exists in the gas beyond a certain amount, it will be deposited somewhere in the solid form before the consumers burners are reached. Whether it is caught by the tar, deposited in the apparatus or connections on the works, or carried forward into the district, may be a question of the treatment of the gas during the processes of condensation and purification; but if the gas is super-saturated with naphthaline, it will, I believe, be deposited somewhere before it reaches the consumers burners. A gas of high illuminating power—that is, rich in volatile hydrocarbons—will retain a comparatively large quantity of naphthaline in suspension or combination, but any excess beyond the saturating point will be deposited somewhere; and it seems that, with our present knowledge of the subject, the object should be, not to keep the naphthaline in the gas, but to remove the excess of it with the least inconvenience. For this purpose the prolonged contact between the tar and the gas may be useful, as the tar takes up the naphthaline and removes it from the apparatus instead of its being deposited therein in crystals; but, unfortunately, the tar seems to have the objectionable habit of abstracting from the gas many of the other more volatile light-giving hydrocarbons. The prolonged contact between the tar and the gas seems, however, only partially successful in removing naphthaline, for at the Crystal Palace District Gas-Works, where considerable trouble is taken to ensure this contact, deposits of naphthaline are found in other parts of the works and in the district; but it must also be admitted that the tar is found heavily charged with naphthaline, a part of which would probably be otherwise deposited if the tar were sooner removed.

Mr. Bowditch's experiments seem clearly to prove that the contact, at low temperatures, between heavy tars and gas is injurious to the illuminating power of the latter. He says: "I have passed gas through heated heavy coal oil boiling at about 400° Fahr., and have found its illuminating power identical with its illuminating power before it was passed through the oils. It gave up nothing to them, and it took up nothing from them. I have also passed gas through the same kind of oil at ordinary temperatures, and have had its illuminating power reduced to less than one candle for a consumption of 5 feet per hour; whereas before passing the gas through the oil it had an illuminating power of 13 candles." Of this I have also satisfied myself by passing gas through tar taken from the hydraulic main, when the illuminating power has been invariably reduced thereby. Experiments made with the lighter tars taken from the condenser and washers have not, however, given me conclusive results. In some instances the gas has appeared slightly improved, but at least in no instance has it been deteriorated by the lighter tars. These results point to the necessity of the early separation of the gas from the tar condensed at high temperatures; but whether it may be beneficial to prolong the contact with the lighter tars does not appear to me quite certain.

From these considerations it is evident that the condensation of gas is not a simple question of reducing it to a given temperature, and indeed it is doubtful how far the actual cooling is necessary for the separation of the tarry vapours. I do not mean to infer that the cooling of the gas to a temperature approaching that of the atmosphere is not necessary for other purposes, for this has an important bearing upon the subsequent washing

or scrubbing processes, as the amount of sulphuretted hydrogen and carbonic acid which the liquor or water used therein will take up depends greatly upon the temperature both of the gas and the liquor; indeed, above certain temperatures, the liquor will, as is well known, give off these impurities instead of absorbing them; but, so far as the tar is concerned, my experience is that no amount of cooling will remove all traces of it from the gas. It has been supposed that globules of gas surrounded by a thin film of tar remain floating in the gas, and that for the removal of this tar the globules must be broken up. Upon this principle the condenser of MM. Pelouze and Audouin is designed. The gas is forced through a series of finely perforated plates, and impinges upon each one in succession. In this way it is forcibly broken up into fine streams, and the tar is most effectually removed. It has been thought that the illuminating power of the gas would suffer under this rough treatment; but French engineers state that such is not the case. Livesey's washer acts upon the gas in a similar manner, by splitting it up into fine streams, and it is found that, however efficiently the gas may have been cooled, considerable quantities of tar are removed in the washer, and I have certainly not found it to have any injurious effect upon the illuminating power.

To determine what amount of condenser power is necessary, it must first be decided what duties this apparatus has to perform, and it seems that these duties have been very generally over-estimated, in the vain endeavour to remove all traces of tar by simply cooling the gas. Attention may here be drawn to the comparatively small amount of cooling action which the condenser proper exerts upon the gas. The temperature within the retorts may be taken at from 1800° to 2000° Fahr., and yet in the hydraulic main the temperature will be found to be only 140° to 180° Fahr., while at the inlet of the condenser it is reduced to, say, 110° to 120° Fahr. Various authorities have given an air surface of 6 to 10 square feet for every 1000 feet of maximum daily make of gas. The lower quantity will, I think, be ample for cooling the gas down to 50° or 60° Fahr. at the condenser outlet. At the Crystal Palace District Gas-Works the maximum daily make during the past winter was 2½ million cubic feet. The required condenser area for this, at the rate of 6 feet super. per 1000 cubic feet of gas, would be 15,000 feet super.; but the actual condensing surface was as follows:—

Horizontal mains round retort-houses	6,700 ft. super.
Underground main to condenser	4,000 "
Condenser proper	5,000 "

Total 15,700 ft. super.

With this the gas was easily kept at a temperature of about 60° Fahr. at the condenser outlet. The underground main of 4000 feet area might almost be left out of the calculation, as it exercises but little cooling power.

Much has been written and said as to the advantages of different forms of condensers; but, regarded simply as *coolers*, it would seem to matter little whether they be horizontal or vertical, annular, cylindrical, or of any other shape or design. Sufficient surface must be provided to reduce the gas to a temperature approaching that of the atmosphere, and this may be obtained by any of the forms introduced. It may be said that greater economy of construction is attained by some; but, if this is a matter of primary importance, the ordinary pipe condenser, vertical or horizontal, will perhaps obtain preference. Other forms may do the same amount of work, occupying less space, or with less surface area, but the making and fitting of the parts will be more expensive. Wrought-iron annular condensers have been approved of by some, as, from their thinness, they transmit the heat more readily than cast-iron ones; but it is doubtful whether, for a given amount of work, their construction is more economical, and they are certainly more liable to decay.

Messrs. C. and W. Walker have an excellent design for a wrought-iron annular condenser which combines the most recent improvements, and forms a compact and neat-looking apparatus. By an arrangement of side pipes, the gas is made to *descend* all the annular pipes in succession, instead of circulating alternately up and down them, and it thus meets the ascending currents of air in the inner tubes. A throttle-valve is also fixed at the bottom of each inner tube, by closing which, to prevent the circulation of the air, the power of the condenser may be varied. In the latest forms of this condenser Messrs. Walker have added a pipe or pipes fitted with perforated discs or trays for splitting up the gas into fine streams for removing the last traces of tar by an action similar to that of the French condenser or Livesey's washer, and this furnishes another proof of the necessity for other means than mere cooling of the gas for the complete removal of the tar.

There is one point connected with condensation which merits attention, and that is *slow-speed condensation*. This is best illustrated in Cleland's slow-speed condenser, as described in "King's Treatise on Coal Gas." It consists mainly of an ordinary vertical condenser, but instead of the gas circulating through each pipe in succession, the pipes are connected by a box on the top, and the gas descends simultaneously through the whole, thus moving at a very slow speed. The lower part of each of the vertical pipes is made to do duty as a scrubber by being filled with a series of wooden discs or arms; but this seems to be no part of the slow-speed principle, and it is doubtful whether the scrubbing operation could not be more conveniently performed in a separate apparatus. I am not aware whether this form of condenser has been much adopted, but it appears to be a simple and efficient means of applying the slow-speed principle, which is advantageous not only in the condenser but in all the purifying apparatus.

Whatever form of condenser may be adopted, means should be provided for putting some portions out of use, so as to accommodate its power to the ever-varying conditions of temperature and volume of gas to be operated upon. This may easily be effected, and thermometers should be provided for ascertaining the temperature at different parts.

Assuming that contact between the gas and heavy tars at comparatively low temperatures is injurious to the illuminating power, it will be seen that it is desirable to separate the gas as soon as possible, at least from the first condensed portions of the tar, before the temperature of either is too much reduced. This may be effected either by the total abolition of the hydraulic main, or by speedily withdrawing the tar from it, and supplying its place by liquor. Whether it may be necessary to provide further means for separating the tar from the gas before the condenser, does not seem quite so evident; but it may be safe to conclude that all contact between the tar and the gas, except, perhaps, the lightest portions of the latter, is liable to injure the illuminating power. It also seems desirable to abandon the attempt to entirely remove the tar by simple cooling, and to adopt some other means for that purpose. If the French condenser could be used while the gas is hot, there is reason to think that it would be very efficient; but there seem to be difficulties in so applying it, as the gas should be *forced* through it, which could not be conveniently done except by the use of a jet exhauster. Breeze scrubbers, of course, serve this purpose; but they become easily choked if the gas contains much tar, and their efficiency is thereby greatly impaired, so that after a time tar will find its way into the purifiers.

The desirability of abolishing the hydraulic main is at present occupy-

ing much attention, but no efficient means seem to have been as yet devised by which it can be satisfactorily dispensed with. It is generally admitted that the pulsations caused by the dip-pipes in the hydraulic main are injurious; but they perform so important a service in preventing the back-flow of gas and the entry of air, that one is reluctant to give them up until some other equally simple and efficient means for the same purpose can be substituted, and most of the plans at present devised have the objection of not being self-acting. Much of the inconvenience attending the use of dip-pipes is due to the accumulation of thick tar in the hydraulic main. If this is removed and replaced by liquor, the double object of shortening the contact between the gas and the tar, and of decreasing the pulsations caused by the dips, will be attained. The injurious effect of the gas having to force its way through the thick tar in the hydraulic may easily be seen by fixing a pressure-gauge to the mouthpiece or the ascension-pipe of a retort in action, when it will be found that with a practically steady gauge on the hydraulic there will be an oscillation of 4 or 5 inches, or even more, in the gauge in the ascension-pipe. This may be obviated by keeping the hydraulic charged with liquor, and making the seal as shallow as possible, and perhaps under these conditions it may be wise to retain our old friend the hydraulic main, if not constantly in action, at least for use when necessary—that is to say, to have an arrangement for working with or without dips at pleasure. Having this in view, I last year tried at the Crystal Palace District Gas-Works an arrangement consisting mainly of a double bridge or dip-pipe, one end of which acted as an ordinary dip, while the other end, terminating at the top of the hydraulic, allowed the gas to enter without passing through the seal. This latter was closed or opened by a heavy ball-valve, worked by a lever in connection with the cross-bar of the mouthpiece. When the retort is closed and in action, the valve is open; but while being charged it is closed, and the retort is thus sealed in the ordinary manner, and should the valve by any neglect be left closed after charging, the gas continues to pass through the dip. Of the working of this arrangement I cannot as yet speak with certainty. For some months, during which it was exclusively used and the results carefully observed, the average make of gas was visibly increased, and the deposit of carbon in the retorts was less than usual; but it must be said that these improvements were in part due to the retorts being new. Much trouble was also encountered with stopped ascension-pipes, owing to higher heats than usual, particularly in the front parts of the retorts, which led also to very thick tar in the hydraulic, and consequent clogging of the valve at times.

These remarks upon the hydraulic main may not appear to belong to the subject of condensation; but if the early separation of the tar and gas bears a part in the operation to follow, I think that condensation may be assumed to take place largely in the hydraulic main, so long as it is retained in use, and I have referred to it in order to point out more strongly the desirability of the early removal of the tar. The whole subject, from its apparent simplicity, seems to have been somewhat overlooked; and although this paper may not contribute much to the information already possessed, I trust it will lead to a discussion from which practical and important information may be obtained.

Discussion.

Mr. G. E. STEVENSON (Peterborough) thought they were all indebted to Mr. Gandon for the very exhaustive paper he had just read. He must have devoted considerable time to the preparation of it, and there was a good deal of matter in it for discussion. It had become somewhat the fashion lately to depreciate the knowledge of gas engineers on this subject, and to say they had neglected to follow it out from a scientific point of view. At a meeting of gas managers he attended a little while ago a paper was read on the subject, and, after several speakers had expressed their views, in the course of discussion one gentleman said that up to the present time they knew nothing whatever about it, and they had made no progress in their knowledge of it. He hoped this would not be found to be the case now. The reason why they were not able to arrive at any very definite opinion as to the best process of condensation resulted, he thought, from the fact that hitherto it had been regarded simply as the act of cooling the gas. Now it must be apparent to every one who considered MM. Pelouze and Audouin's condenser that in the minds of those gentlemen condensation did not mean cooling, but apparently separating the tarry impurities from the gas. Whether it was best that this should be done while the gas was hot or cold, was a secondary consideration. The question of keeping the gas in contact with tar seemed to be the point on which everything turned, and he thought they were now coming to see that it was a mistake to keep the tar too long in contact with the gas. The reason for this notion was that they did not understand how naphthalene was to be removed, or how it was the deposit of it occurred. Those who proposed keeping the gas and tar in contact with one another imagined that the naphthalene alone was absorbed by the tar, without the absorption of the lighter hydrocarbons; but they now found this was not the case. Where the heavy hydrocarbons were absorbed by the tarry liquid, the lighter ones were absorbed also, and in this way the illuminating power of the gas was reduced. They would all agree that the deposit of naphthalene in the main-pipes and connections chiefly occurred with gas of high illuminating power, and where it was of lower power very little trouble was experienced. If this was so—he would not say for certain that it was, and he saw some gentlemen shaking their heads—the explanation might be that the lighter hydrocarbons were absorbed at the same time as the heavy ones. He thought it was a fact that heavy hydrocarbons, especially naphthalene, could not remain in suspension in the gas, except in connection with a certain proportion of light hydrocarbons, and that where the light hydrocarbons were either not present in sufficient proportion, such as the benzole vapours, or were absorbed by long contact with tar, the heavy hydrocarbons would also follow. But if the light hydrocarbons were absorbed by contact with tar, the heavy ones followed at the same time, and there was no deposit to speak of; but the gas was of comparatively low illuminating power. If the gas were separated from the tar immediately, and were of rich quality, it depended then on the proportion of light hydrocarbons to heavy ones whether they could be held in suspension or not. This was only a theory which he could not prove by experiment; but it appeared to him probable for this reason—they were all homologues of the radical CH_2 , and it appeared to him that possibly the light hydrocarbon vapours became condensed by cooling, and altered their condition, and heavier ones were formed. It did not appear that they had any reason to suppose the gas remained exactly in the same state as it was in when it left the hydraulic main or the retorts during the whole of the cooling process. In distilling tarry matters, first of all the light hydrocarbons were obtained, and then the heavy ones; but if all of them were mixed together again and allowed to cool, most probably some dissociation or association would take place which would alter the proportionate quantities of those vapours. He thought, therefore, that instead of keeping the gas in contact with the tar, they should attempt to retain these vapours by slow condensation rather than by rapid cooling, which tended to deposit naphthalene. He had just been designing a means of doing away with the hydraulic main altogether, and substituting for it a dry receiving-main with a separate tar-main. In this arrangement the heavier portion

of the tar was separated from the gas immediately on leaving the ascension-pipes, and in connection with it there was a self-acting valve-seal, which shut off the connection between the receiving-main of the retort when the latter was opened. The only question as to this valve was whether it would stand the test of practical work.

Mr. A. F. WILSON said it seemed to him there was no fixed principle in condensation, but a great deal of variability. The atmosphere was varying, and they were always encountering a different degree of temperature; but he thought it was generally understood that certain bodies were volatile at a certain temperature, and given the fact that the temperature was reduced below that degree, those bodies became condensed into a different form to that which they occupied previously; they might become a heavier vapour, or a liquid, or ultimately a solid. There were so many things about this matter that they did not know, that its discussion could not but be useful. One point which seemed often overlooked was the possibility of latent heat existing in a body. Mr. Gandon had told them that the temperature in the furnaces was about 2000° Fahr., and the effluent gas about 180° Fahr. Now, they could not understand how the gases were so much under the temperature of the furnaces, and this point was worth inquiry. They all knew there was such a thing as latent heat—that water could be brought up to 212°; but he thought it was a very interesting point to study, and if they knew more about it they might possibly know more how gas should be condensed. Another point Mr. Stevenson had very properly brought forward was that gas really contained naphthalene when it left the retort, or this deposit gathered in some respects in its passage through the pipes. They all knew that naphthalene was a hydrocarbon, but was it formed in its passage through the pipes, or was it a distinct body produced by the distillation of coal? This was a point he did not know much about, but he had always observed that naphthalene was very apt to condense in bends and corners where it encountered a sudden gust of cold wind, and of course it must exist somewhere before it was deposited there. He fancied that in coming to these corners in the passage of the gas through the pipes there was a certain crowding together of the molecules of the gas, and possibly heat was evolved, and that other combinations might take place, and consequently naphthalene might really be formed in its passage through those points. There was no doubt that condensation was a most important question, and that naphthalene was a most disagreeable thing to deal with.

Mr. ELDRIDGE said he was rather struck with Mr. Stevenson's remark about the richer gas producing naphthalene, and the poorer gas not doing so. He would not go into the chemistry of the question, but as a matter of experience he would say that when they used to make gas of 11 or 12 candle power, about every day they had to blow out the inlets and outlets; but ever since they were compelled to make their gas of 15-candle power they had never been troubled with naphthalene.

Mr. STEVENSON said he believed he was wrong in stating that the richer gas created a greater deposition of naphthalene than the poorer. He had learnt so at one time, but he found he was wrong, because in the richer gas there were more of the lighter hydrocarbon vapours; there was more of the benzole vapour, and it was chiefly from benzole vapour and the acetylene which was in gas that it obtained its light-giving properties. The point he wished to bring out was the power of the lighter hydrocarbon vapours, especially benzole, to hold in suspension the heavier vapours and others. If this were true, it would explain the fact that richer gas did not deposit naphthalene so much as poorer.

Mr. G. LIVESSEY regretted he was not in time to hear the whole of the paper, and was not, therefore, in a position to discuss it, though he was quite certain, from hearing the latter part, that it was a very good one. With regard to the question of condensation, his own experience was simply this, that sudden cooling was eminently productive of naphthalene. Some years ago the late Mr. Young, of Birmingham, in going over the South Metropolitan Company's works, and seeing the water condenser with the pipes under water, observed what a capital means of condensing he (Mr. Livessey) had. Mr. Young told him he could not condense too much, and, having an unlimited supply of water, asked why he did not turn the valve on full, and let the water flow through, and keep the condenser thoroughly cold. He did so, and in a fortnight every pipe under the purifiers was so filled with naphthalene that he had to cut them in all directions to clear them. Of course he never tried the experiment again, but he attributed the effect to the sudden cooling of the gas. What was wanted in condensers was the power of controlling the condensing or cooling action. Many condensers were defective in this respect, as they might be too cold in winter, and too hot in summer. Certainly for effective condensation water was wanted as well as air. The pipes might be exposed to air round the retort-house, or the gas might go through an annular condenser; but the process should finish with water. His plan had been to have a tank with pipes going backwards and forwards, with seal-cups at the lower end, and the water travelling in the opposite direction to the gas. The result was that as the gas entered the condenser it came in contact with warm water, and this could be had as warm as was wished for by regulating the quantity. If very little water were allowed to flow through, it would be nearly the temperature of the gas where the gas entered, whereas at the other end it would be the ordinary temperature of the water as it came from the supply. This gave efficient means of controlling it. His experience had accorded with that of Mr. Eldridge, that if they had a quantity of naphthalene, the best way to get rid of it was to improve the quality of the gas. He could not say that he had much faith in the theories put forth as to the action of hydrocarbons. Gas managers were very much in the dark on this point, and the theories he had seen propounded generally turned out to be wrong. The first he had heard of the absorption of naphthalene by tar was by a man named Thompson, some thirty or more years ago. He found that tar under certain conditions absorbed naphthalene from the gas, and he recommended that all gas should be allowed to flow with the tar for this purpose. Of course, in those days, nothing was known about hydrocarbons. It was very necessary to condense slowly, and to avoid all sudden cooling of the gas. As to separating the tar and other things from it, he adopted a plan some years ago which he found of great use. The main from the condenser had a rise up to the exhaustor, and the tar which accumulated in this main had to fall against the current of gas. It was an 18-inch main, and he found they had to increase the vacuum of the exhaustor very largely, and they could not at all make out the cause of it, until one night the exhaustor stopped, and on opening it they found it full of tar. On examining the main between the condenser and the exhaustor, they found it also was full of tar, all but a little segment of 3 or 4 inches deep, and how the gas got through at all was an enigma. From that time he thought they might adopt some means of separating the heavier part of the tar from the gas as it left the condenser. Mr. Stevenson was quite right; a mere cooling did not separate the tar effectually. He (Mr. Livessey) had a series of five tubes 4 feet in diameter and 20 feet long arranged in such a manner that the gas passed simultaneously through them after leaving the condenser proper. In this way it was brought almost to a state of rest. The exhaustors had worked without giving the slightest trouble ever since this plan was introduced. Any one might put his ear to this apparatus, and hear the tar falling like rain. It

separated just sufficient of the tar to prevent its clogging or injuring the exhauster, and yet left a sufficient quantity to lubricate it. If it were all removed before it reached the exhauster, in the course of a short time the exhauster would become clogged with some compound of the gas or oil, and a great deal more oil would be required for lubrication. This was Mr. Corbet Woodall's experience as well as his own. He had now a balanced gasholder, 80 feet in diameter and 15 feet deep, between the condenser and the exhauster, which produced a double effect; it allowed the tar time to separate from the gas, and it entirely annihilated the oscillation caused by the exhauster, so that at the retort there was no oscillation whatever, except that due to the dip-pipes.

Mr. MORTON said the last speaker had referred to one very objectionable thing in gas-works—namely, bringing the liquid products, such as tar and liquor, against the stream of gas. This had been under his attention considerably of late, and he thought the habit they had recently acquired of increasing the height of the ascension-pipes rather tended to perpetuate it. He thought if contact of the gas with the tar was objectionable, they were going in the wrong direction, and it appeared to him that if it was desirable to separate the tar from the gas as soon as possible, they should turn their attention to descending ascension-pipes, if he might use such a term. The gas in the present ascension-pipes was continually coming in contact with a very much larger quantity of tar than if the tar and gas were carried away together. Perhaps some one who had a new retort-house to plan would see if this could be done. No doubt there were difficulties in the way, but he did not think they were insuperable.

Mr. WEST said that he for one believed in the gradual condensation of gas, and at the same time in removing the tar as soon as possible, he was going to say from the hydraulic main, but he did not believe now in the hydraulic main. He should like to see a pipe simply to carry off the tar as soon as it was condensed immediately it left the ascension-pipes, which would probably in future be shorter than they had lately been putting up. When the members of the Association were at the Maidstone Gas-Works some time ago, they saw that it was impossible to remove the whole of the tar by condensation. The former idea used to be that the object of condensation was really for the removal of the tar; but they saw there that when he was passing the gas, as it was being manufactured, from the new works to the old ones, although there was double and perhaps treble the length of pipe necessary for condensation, still there was a retention of tar in the gas. For this purpose he found Mr. Livesey's washer very useful, and he considered it more valuable than Pelouze and Audouin's condenser, because it not only removed the tar, but also performed the office of purification, and removed a great portion of the carbonic acid and sulphuretted hydrogen. He also agreed with Mr. Livesey as regarded the means of cooling by water. He had one of Morris and Cutler's condensers arranged, and he found the temperature could be controlled very readily by adjusting the water supply. He also purposed covering these condensers, and in fact he had arranged the whole of his condensing and scrubbing power, so that eventually they might cover them, because there ought to be the means of preventing the extreme heat of the sun in summer weather, and the extreme cold of winter.

Mr. PRICE (Hampton Wick) said he could bear testimony to the fact that by condensation tar could not be absolutely removed from gas. Assuming that the temperature of the gas, when it left the retorts, was as had been stated by Mr. Gandon, and that it was gradually reduced to, say, 76° Fahr. at the inlet of the condenser, yet at the outlet, the condensation being never so effective, tar would be found. The plan he had adopted was to carry a large main round the retort-house, and this main extended a great distance before it reached the condenser; and by the time the gas arrived there the temperature was about 70° or 76° Fahr., whilst at the outlet the temperature was reduced to about 60° Fahr., or lower, according to the weather. He had recently erected a powerful condenser, also a new scrubber; and he thought that by this condenser he should be able effectually to separate the tar from the gas, but he found at the outlet of the scrubber he had almost as much tar as from the outlet of the condenser. With regard to naphthaline, he was very little troubled with it, though he had heard a great deal about it. Nor was he troubled with stopped ascension-pipes. About once or twice in the year he had found naphthaline in the inlet of the gasholder; but this was easily removed by sluicing it with cold water. He was very pleased to hear that, by means of Mr. Livesey's washer, tar could be effectually removed from gas; and he hoped soon to adopt it.

Mr. F. LIVESEY desired to say one word about Mr. Morton's descending ascension-pipe. The idea had occurred to them at the South Metropolitan works. They had tried it, and it was not successful; but from what he recollected he thought it failed because they had not properly tried it. The whole of the gas was taken off from one end of the retort, and he supposed that this was the reason of the descending-pipe becoming stopped up. The waste tar on the mouthpiece had often been a source of great annoyance, especially when the heat was rather low. It was a matter he had often thought about, and he was glad that other people had also turned their attention to it. Perhaps they might now arrive at some conclusion. Mr. Gandon seemed to imply that there was always a certain quantity of naphthaline left in the gas. Now, many people must have noticed the difference between the illuminating power of gas in summer and in winter. In winter it required, as a rule, much more candle coal to keep up a fixed illuminating power than in summer. Was not this, he asked, due to the naphthaline being burnt in the summer time in the form of vapour? Another point about naphthaline was that it was not only deposited in the pipes and converted into vapour in the hotter seasons of the year, but it was also capable of retaining sulphur compounds. If there were a testing-station that was connected by a pipe which became coated with naphthaline, this naphthaline would hold a certain quantity of sulphur compounds, and, if very hot weather arrived, the naphthaline vanished, and the sulphur compounds came with a rush. He thought probably this was the reason why gas managers experienced those sudden rushes of sulphur which were sometimes heard of, and could not be accounted for.

Mr. BRETT thought they were all agreed that gas should be brought down to the lowest temperature it was likely to come in contact with. He found that sometimes condensers were coloured with tar, and this was a matter of importance in the summer. He could not give the difference of temperature between one coloured with tar and one coloured white, but it would be many degrees, and he thought it was putting too great a strain on condensers to paint them black, and then expect to find the gas properly cooled.

Mr. ELDRIDGE said some twelve months ago Mr. West suggested a plan which he thought would offer a complete relief to the thick tar in the hydraulic main, but since then he believed he had abandoned it. He, however, had found it answer very well. The idea was to fix a 2-inch pipe from the bottom of the hydraulic main to the outlet of the hydraulic, between the square valve and the hydraulic. Before doing this they had been always troubled with thick tar accumulating at the bottom of the dip-pipe, and on opening the cap of the dip they found a cone of thick tar gradually forming. However, since they had adopted this plan of a 2-inch syphon, they had found the hydraulic perfectly free from tar.

Mr. G. LIVESEY asked if Mr. Eldridge had a deep hydraulic main.

Mr. ELDRIDGE said it was an ordinary square main, with a shallow bottom. At any time the cap over the dip-pipe might be taken off, and nothing would be found but liquor.

Mr. HAMMOND said if any gentleman would like to try a plan for getting the tar from the bottom of the main first, before the liquor, a simple way was to lap a strip of lead, say, 2 inches from the bottom of the hydraulic, fasten it on to the side bolts of the valve, with pieces of iron at the back to cement it up to the inside end of the hydraulic. This was a very simple plan, but very effective. The gas would go over the top of the lead, while the tar would be driven by the weight of the liquor under the bottom, and pass away at the outlet. The position of the lead could be altered at any time by a simple wire inserted through a plug-hole, if necessary while the main was in action.

Mr. ELDRIDGE thought the plan he had described was much better. The plug had only to be taken out, and the tar would run away at once.

The CHAIRMAN said the paper deserved the greatest possible attention, and he should have liked to say something upon it; but so much passed through his mind during the meeting that he hardly knew where to begin. One important point on which they might all agree was the necessity for cooling gas slowly. There was no doubt that in the past they had been in error in cooling too rapidly—in fact, if the object were to cool the gas as rapidly as possible, they ought simply to plunge it into cold water; but the illuminating power would then be much reduced. Condensation ought to be prolonged as far as possible. Gas would not give off its tar except under very peculiar circumstances, and fortunately Mr. Livesey and the French gas engineers who had been named had been able to hit on the right method of removing it. To cool the gas, and that slowly, was one of the most important points. One of the reasons for exposing gas to contact with tar was this. As Mr. Livesey had said, the idea was due to Mr. Thompson, who thought that the tar removed the naphthaline. Unquestionably it did so to a certain extent; but there was no doubt that it had often been carried to too great an extent. With reference to the formation of naphthaline, years ago, when gas in London was much lower in quality than at present, most of the Companies were troubled with naphthaline in their mains, sometimes to a very serious extent. Indeed, on one occasion he brought his whole works to a standstill through the accumulation of naphthaline, by attempting to wash it with hot water. But since the quality of the gas had been raised from 12 to 16 candles, he found he had much less trouble with naphthaline than formerly; and indeed they scarcely ever saw it in the heavy dense state—nothing beyond a slight coating inside the pipe, perhaps 1-inch thick, and only a little in the district unless a very sudden change of temperature occurred, and then in a slight form, which a man could get rid of by disconnecting the meter and blowing it with his breath. He would only say, in conclusion, that Mr. Gandon deserved their best thanks for his admirable paper.

Mr. GANDON, in reply to the observations that had been made, said he need not detain the meeting long, for most of the speakers had agreed with his remarks. He quite concurred with Mr. Stevenson that cooling, rather than condensing, was the proper term to use. As to the question whether the naphthaline was increased or decreased in proportion to the illuminating power of the gas, his own experience was that the higher the illuminating power the more naphthaline it would retain. He had made several experiments upon this subject, but he could not say they were conclusive. Mr. Eldridge also agreed with this view. As to his plan for removing tar from the hydraulic main, he had not taken it out by a pipe, but he was about to make several alterations in the apparatus, one of which included a similar plan to that described, for he felt sure it was very desirable to remove tar at once from the hydraulic main. Some one spoke of having the exhauster before the condenser, and he remembered the time when Mr. Beale's agents, in issuing instructions as to fixing the exhauster, recommended that it should be erected before the condenser. He tried that plan once, but he made a vow that he would never do so again. All the tar possible ought to be got out of the gas before it passed into the exhauster. Mr. West said he did not believe in the hydraulic main, and, though he (Mr. Gandon) had not reached so far as this, he must say he should like to get rid of it; but he first wanted some one to show him a good substitute for it. Mr. Price spoke of a pipe all round the retort-house, and they had an example of it at his works, that he was not much in favour of it; at any rate if it was used for keeping the gas and tar in contact for a long time. It did not matter much how the pipe was arranged, so that the gas and tar were not kept in contact longer than could be helped. With regard to the painting of condensers, they all knew that white colour would reflect heat better than black; but if they had too much condensing power they might very well paint the pipes black. Mr. Hammond described a kind of disc in the hydraulic main for compelling the tar to go under it and then escape, so as to prevent the liquor coming off first. They had taken two or three such things out of their hydraulic main, and he had strong reason to believe they were put in with the idea of compelling the thicker portion of the tar to flow away first; but he believed the result was that underneath these discs the main became completely stopped up, and instead of the thicker tar going away they had raised the level of the water in the hydraulic by about 2 inches. He should not recommend any one to try them.

A vote of thanks having been passed to Mr. Gandon for his paper,

Mr. J. CHAPMAN, sen., moved a vote of thanks to the Chairman, which was carried.

Mr. WILSON then asked permission to bring before the next meeting the results of Mr. Hislop's process for the revivification of waste lime, and to put on the table samples of the lime after it had been treated under the process.

The CHAIRMAN said the proper way would be to refer the question to the Committee, who would, no doubt, agree to Mr. Wilson's proposal.

Mr. WOOD (Hastings) said they should not separate without giving a vote of thanks to Mr. Gandon for the hospitality he had afforded them that day.

Mr. MORTON seconded the motion, and it was carried unanimously.

The proceedings then terminated.

WEST OF SCOTLAND GAS MANAGERS ASSOCIATION.

(Continued from p. 718.)

At the conclusion of the President's address, given in last week's number, the following business was proceeded with:—

ALTERATION OF RULES.

Mr. J. M'GILCHRIST (Dumbarton), in terms of the motion of which he had given notice at the meeting of the Association at Coatbridge, moved—"That a Committee be appointed to revise the rules, and at the same time to see that an arrangement is made whereby three of the eldest members of Committee should retire annually, and that the three retiring members should be balloted for in the same way as is done at the meeting of the North British Association of Gas Managers." In doing so he said: I may state that my reason for moving the adoption of this motion is that a good deal of our time at the yearly meetings has been taken up in arranging Committees. Besides, I think it is altogether desirable that the members of the Association, as a body, should say

whom they wish to represent them on the Committee, and I think the adoption of my motion will lead to the appointment of a thoroughly representative Committee. I may say that the Committee that has been appointed to-day appears to me to be a very suitable body to revise the rules of the Association, with particular attention to Rule 3, which bears on the mode of appointing the General Committee.

Mr. CARLOW (Port Glasgow), in seconding the motion, said he thought the rules should be revised, as there were certain clauses in them requiring modification and alteration.

Mr. M'GILCHRIST: I should like the members present to say whether or not the proposed change would be satisfactory. The purport of the change is that the Committee shall, previous to the annual meeting each year, prepare a list of members whom they nominate as suitable for the offices of President, Vice-President, Treasurer, and Secretary for the ensuing year; that the list shall contain the names of at least twelve members; that a copy of this list shall be forwarded to every member of the Association before the annual general meeting; that each member shall be at liberty to make an exception to the list, and substitute the name or names of any other member or members for each respective office; and that the number of names so selected or substituted shall not in any case exceed the number to be elected to the respective offices.

The motion was agreed to.

ADMISSION OF NEW MEMBERS.

Messrs. J. Cummings (Milnthorpe, Cumberland), J. Fullerton, jun. (Motherwell), John Marshall (Bellshill), John Robertson (Holytown), and D. S. Baillie (Mossend), were admitted members of the Association.

AMALGAMATION OF THE WEST OF SCOTLAND AND NORTH BRITISH ASSOCIATIONS.

The PRESIDENT: There has been some discussion on the proposal that the West of Scotland Association should unite with the North British Association, and the first point we have to consider is whether this Association feels inclined to change its present position.

Mr. M'GILCHRIST: I think it scarcely necessary to propose that the two Associations should amalgamate, because at the present time there is a feeling amongst a great many of the members of the West of Scotland Association that this Association should remain as it is. While such a feeling remains, I think it useless to consider the subject.

Mr. D. M. NELSON (Glasgow): I think many of the members present, like myself, do not understand the proposal. My impression was that this matter was shelved six months ago. If it is to come up at this meeting, we should have something before us. We might hear what proposal has been made, and on that the meeting would be able to express an opinion.

The PRESIDENT: The Secretary will read the minutes of the Joint Committee on the subject.

Mr. DALZIEL then read the minutes of the meeting of the Joint Committee held in Glasgow on Aug. 29 last year. There were present from the North British Association, Messrs. Robb, Terrace, Watson, Myers, and Mackenzie; and from the West of Scotland Association, Messrs. Mitchell, Stewart, Carlow, M'Gilchrist, Renfrew, Jeffrey, Fullerton, Young, and Johnston. The Committee of the North British Association "were unanimously of opinion, and recommended that amalgamation should take place." A proposal to this effect was moved by Mr. Robb, and on it a discussion arose. Eventually, it was proposed by Mr. Stewart, and seconded by Mr. Dalziel, that instead of an amalgamation of the two Associations, district Associations be arranged; that a Central Association be formed of which members of district Associations would be members; and that this Central Association be supported from the funds of district Associations. It was agreed that this motion should be laid before the meeting of the West of Scotland Association held at Bridge of Allan on the 18th of September last, for their consideration; and that the same be brought up at the meeting the following April, for decision.

The PRESIDENT: I think it would be a pity if the matter were fixed either one way or the other without having the whole subject clearly drawn out, and, as the question is important, I ask members to express their opinions.

Mr. D. M. NELSON: As a member of both Associations, I have no personal feeling in the matter; but, viewed on the broad principle of union, I think there is a great deal to be gained by amalgamation. I spoke to Mr. Stewart, and various members of both societies, about a year ago on the subject. I do not believe in merging the two Associations into one, because where the districts are scattered, and members live far apart, the Association not only becomes unwieldy, but it does not serve the purpose in view. In my opinion, if there is to be union it should be of the kind suggested by the Committee—that there should be a Central Association made up of members from various localities, and that there should be district Associations. These district Associations could meet yearly or half yearly to promote the mutual benefit and interests of the members, and the parent or Central Association could then hold meetings at such stated intervals as might be agreed upon, and as many as possible from all parts of Scotland could attend these large, influential, and important gatherings. These would be important in this sense, that you would have there the outcome of all the various district Associations. Supposing Scotland were to be divided into four parts. You would have the large Central Association to begin with; then you would have an Association in Forfarshire, taking in Aberdeenshire. Another in Inverness-shire; a third covering the ground of the Waverley Association; and a fourth the districts represented by the West of Scotland Association. From these districts the best members could be drawn to the Central Association, which might meet once a year. Such a subdivision of the country would be the means of adding greatly to the mutual improvement of managers, and would at the same time tend to reduce the expenses which must necessarily be incurred at present by travelling over great distances, and sometimes at great inconvenience. But union is strength in connection with every other undertaking, and it ought to lead to good results where the combination is one of gas managers. When I came to this meeting I had not the remotest idea of saying a word upon the subject, because I thought six months ago that the matter had met with the approbation of both parties. I shall be surprised if members can be found opposed to such an amalgamation as has been suggested.

Mr. NIVEN (Dunoon): Did the North British Association, as such, appoint a Committee to confer with the West of Scotland Association?

The PRESIDENT: I think we were invited to amalgamate with the North British Association. Have you any information on the point, Mr. Robb?

Mr. ROBB (President of the North British Association): The matter being left exclusively to the members of this Association, I do not think it right to say a word about it. You know what has been done in the North British Association. The subject was referred to a Committee to meet with a Committee of your Association, and the result of the meeting has been well detailed in Mr. Dalziel's minute.

Mr. HOGE: It was stated that it was thought advisable to amalgamate, but there was no discussion except what has been reported.

The PRESIDENT: I think that this matter is irregular, and that we shall have to wait until the subject has been discussed by the members of the

North British Association, and until they send in a formal way asking us to amalgamate.

Mr. M'GILCHRIST: I do not think we should stand on the order of our going. If amalgamation is a good thing for the Association, we should agree to it; and if it is a bad thing, we should have nothing whatever to do with it. It is not proper to allow the subject to stand over any longer, and I think we ought to have the opinion of this Association one way or the other.

Mr. RENFREW (Langbank): As I understand the case, we have merely heard from the North British Association that they wish to amalgamate, and we do not know that they will fall in with it, and agree to district Associations in addition to the central meeting.

Mr. NIVEN: It is essential that this matter should be formally discussed by the members of the North British Association, in order that we may see what amount of heartiness there is on their side on the question of amalgamation.

Mr. DALZIEL: This has only been before the Committee of the North British Association. It ought to come before the Association itself before anything can be done.

Mr. NELSON: I think we ought to accept the proposal that the question remain over until the North British Association have had their meeting, and see how that meeting receives the report of their Committee.

Mr. ADAMSON (Airdrie): Seeing that the North British Association are going to have their meeting in July next, I think we ought to appoint a small Committee, leaving that Association to act in the same manner if they think proper. These two Committees could meet and prepare a statement pointing out the merits and demerits of the proposed amalgamation, and this could be printed and issued to the members prior to next meeting. If that were done, members could come up fully prepared to deal with the question at issue.

The PRESIDENT: As I understand it, the motion is that the matter be left over till the members of the North British Association express a desire for amalgamation, and the amendment is that a Committee be appointed to confer with a Sub-Committee of the North British Association to take the matter into consideration, and to prepare a report to be submitted to the members. The amendment has not been seconded.

Mr. NIVEN (Airdrie) seconded the amendment.

Mr. NELSON thereupon withdrew his motion, and Mr. Adamson's proposal was adopted.

Mr. M'GILCHRIST proposed that the Committee consist of the President, Vice-President, and Secretary of the Association.

Mr. DONALDSON (Edinburgh): I think at the North British meeting I proposed that the office-bearers should form a Committee to meet the Committee of the West of Scotland Association.

Mr. M'GILCHRIST: I recollect the circumstances. The Committee of the North British were instructed by the meeting held in Edinburgh last July to confer with a Committee of the West of Scotland Association with regard to amalgamation. These Committees have met, and we know the result. The Committee of the North British unanimously agreed to go in for amalgamation, and by a large majority the West of Scotland resolved to remain as they were. As I said before, an amalgamation that is not unanimous can never be successful.

Mr. WILSON (Saltcoats): Then I will move that this Association remain as it is.

Mr. RENFREW seconded this motion, and it was carried.

[The reading of papers was then proceeded with, the first one being by Mr. D. C. Niven, entitled "The Elaborate and Tedious Thermometric and Barometric Calculations relative to Coal Gas simplified." This and the subsequent ones we hope to give next week.]

MUNICIPAL CORPORATIONS AND WATER AND GAS SUPPLY.

Last Thursday there appeared in *The Times* a lengthy letter with the above heading, dated from Sheffield, and signed, "A Member of the Council of the Incorporated Law Society;" and this was accompanied by an article, the importance of which, looking at the possible source of its inspiration, warrants us in placing the full text of it before our readers.

The writer of the letter commences by stating that "there is a well-founded desire and growing necessity for municipal corporations to possess the right of public supply of water and gas within the limits of their districts;" and that there have from time to time been "spasmodic attempts on the part of corporations to obtain compulsory powers of purchase of private undertakings for the supply of water and gas." He points out that vast sums of money have been spent in applications to Parliament for special Acts for compulsory purchase, some of which have failed; others have succeeded, sometimes after repeated applications; but in all cases there has been an expenditure of money in parliamentary costs, fees to counsel, surveyors, and witnesses, and legal expenses of a most wasteful and unproductive character, "accompanied frequently by the creation of bitter local feeling wholly uncalled for and injurious to the community." As an instance, he cites the case of Wakefield, the Bills for the abortive schemes for a new supply of water to the town, and that for the ultimate purchase of the Water Company, having cost, according to his estimate, "more than £60,000," the whole of which expenditure went for nothing, and was wholly unproductive. He expresses the hope that, "now Sir W. Vernon Harcourt, with his accumulated knowledge of private Bill legislation, is at the Home Office, and Mr. Chamberlain, with all his practical experience, gained by long and active service in the Municipality of Birmingham and his warfare with water and gas monopolies, is in the Cabinet, some vigorous effort will be made to relieve Parliament in the matter of private Bill legislation, thereby setting free many of our legislators for work they are more competent to perform, and effecting a yearly saving to the country of vast sums of money now extravagantly and uselessly wasted;" and he concludes his letter in these terms: "I would suggest that as a beginning a general Act be passed authorizing any municipal corporation to purchase any private undertaking for the public supply of water or gas within its district, provided that (1) a resolution be carried, at a special meeting of the corporation, by a prescribed majority of votes; (2) that afterwards such resolution be confirmed by a majority on a poll of the ratepayers. After two such resolutions, let the corporation become entitled to purchase and the company to sell the undertaking; let six months be allowed for negotiations for an amicable transfer, and failing an agreement within that period, or within an extended time to be granted in a prescribed manner, let the undertaking be taken over on terms to be fixed by reference to a proper tribunal for arbitration—say the Railway Commissioners, who do not appear to be much overworked—and let the costs of such arbitration be borne in such manner as the tribunal shall adjudge. This provision as to costs would have a salutary effect in inducing the parties to exhaust all reasonable efforts to come to terms, and be a check upon exorbitant demands on either side."

The article, which appeared in the same issue of *The Times* as the letter, was as follows:—

The question of the Water Supply of the Metropolis, however it may be settled, is only a part, though an important part, of a much wider issue really affecting the whole country. It has become the business of the

Legislature to decide how far it is fair and how far expedient to compel companies which supply the public with necessary commodities like gas and water to sell their undertakings to local and municipal bodies. It is true that by the provisions of the Gas and Water Facilities Acts, 1870 and 1873, and the Public Health Act, 1875, local authorities have acquired certain rights of starting new or of buying up existing undertakings. But, on the one hand, the greater part of the field of operations is already occupied by the older companies; on the other, it is most difficult to obtain the assent of these companies to being bought out. A useful lever towards obtaining this consent has often been found in a clause providing for purchase by agreement by the municipality, to be inserted in the private Act conferring parliamentary powers on a company. Lately, as a correspondent elsewhere shows, owing rather to the watchfulness of local authorities than to the policy of the Legislature, such clauses have sometimes been insisted upon. But in the earlier Acts they are seldom present. When, therefore, the purchase of a gas or water company's undertaking is thought advantageous in the interest of consumers, the municipality, in the case of one class of undertakings, may use this power to purchase with considerable effect. It may brandish the clause in the face of any company when it seeks to obtain additional powers, and challenge the company to sell to a body who are prepared to give a more economical supply. In the absence of such a clause a corporation finds a well-armed antagonist in possession, ready to spend immense sums in defending his rights before a Parliamentary Committee, and always able in the end to recoup himself for this expenditure, however extravagant, out of the pockets of the ratepayers—the very people, in short, with whom he is in conflict. In default of an amicable arrangement—an event of rare occurrence—a private Act is the only weapon with which companies in this independent position can be brought to terms. Many municipalities, as those of Glasgow, Dundee, and Leeds, have succeeded in persuading Parliament to transfer gas or water undertakings into the hands of the consumers. But in these cases the enormous expenses of parliamentary litigation must be added to the price paid to the Companies, while where failure has been the result of the application to Parliament a dead loss results to the unfortunate consumers, who thus bear the brunt of the battle in either event. The public may have reason to think that better gas or water might be distributed at a far cheaper rate than that which they are paying; but they have no remedy except one attended by excessive risk to themselves. Naturally, therefore, it is a remedy which many local authorities shrink from attempting. Nor is the evil allowed to right itself by competition. Practically, where one water or gas company, armed with statutory powers, has occupied the field with its complete system of works and pipes, it has as complete a monopoly as any of those so common 300 or 400 years ago. Possession in such a case is really the proverbial nine points of the law.

In considering the question of the justice of compulsory purchase, it is impossible to ignore the rights of the proprietors of existing companies. They have invested their capital, with risk of depreciation or of total loss; by dint of economical management they have conducted their enterprise to a point where it begins to be a lucrative concern, and it seems harsh that a municipal body (which would naturally have nothing to do with them in the hour of danger) should swoop down on them in prosperity and exercise an option of purchase. It might be argued, at all events in the early history of such undertakings, that private investment and private enterprise in providing gas and water would be checked altogether by the admission of the principle that undertakings were liable at any moment to be bought up; but the almost certain advantage of such investments is now well assured, and the fair answer is that, while no one would wish investors to suffer loss on their investments (but, on the contrary, most people would be willing to leave them a handsome margin of profit), the time has now come when, in granting statutory rights of this nature to new companies, or fresh rights to existing companies, they should be treated as subject to the reasonable interests of the consumers, for whose primary benefit these rights were conferred. The capitalists who embark in these enterprises give no adequate consideration for the practical monopolies which they seek, and the very valuable proprietary rights which are granted to them. Thus, in the case of the water companies, the right is conceded of impounding and diverting water which was previously the property of the public, on the sole condition of distribution, and of appropriating streams and watersheds which afterwards are treated as belonging exclusively to the particular company. It is only fair to infer that, in conferring such powers and rights, Parliament has some other object in view than mere bounty towards private adventurers, to whom it is under no obligation; and that that object is the public welfare. The expediency in such cases of authorizing purchase by the public in certain cases is no less obvious than the right. There is a well-grounded doubt as to the propriety of the taking over of railways by the Government; but it has come to be recognized in the case of many large communities throughout the country that such a doubt does not beset the purchase of gas and water undertakings. Even a statutory limitation of the dividends of companies in the public interest is often evaded by unnecessary additions to capital, and consumers are the last to feel the benefits of increased revenues. On the other hand, where the municipality has the control of the water or gas supply, the consumers obviously enjoy all the advantages of co-operation.

In a letter which we publish this morning, from "A Member of the Council of the Incorporated Law Society," it is suggested that a general Act should be passed, authorizing the purchase of gas or water companies by the local bodies, subject to certain conditions as to the assent of ratepayers and the method of arbitration. This would be a somewhat heroic remedy, and open to the charge of injustice which usually attaches to an *ex post facto* law. There is greater reason in the complaint that it has not devolved upon some public department to protect the public interest in the case of applications by private companies for the grant of *privilegia*, nominally for the public benefit in the particular locality, but too often resulting in the imposition there of a most grievous public burden. It is no use crying over spilt milk; but the reflection must inevitably occur that much of the trouble and the bitterness now occasioned in London and many provincial communities, by existing monopolies in gas and water, and the rates charged for these necessities of life, might have been obviated by an opportune attention to the future interests of the ratepayers as each Bill came before Parliament. The Board of Trade and Local Government Board have already devoted considerable time and care to the consideration of private Bills; but they have generally left the ratepayers helpless in the hands of the companies. Local authorities, too, have been daunted by the expense of appearing in the lobbies in defence of the interests of their respective communities; and their hands have been tied by the prospect, actually fulfilled in some cases, of having to pay the costs of litigation out of their own pockets. Hence the ratepayers have been in times past, and still remain, under considerable disadvantages in the battles fought before Parliamentary Committees. The time now seems to have come when Parliament itself should recognize practically in its work of private legislation, as it has recognized in the abstract by public statutes, that

the supply of water and gas, affecting as it does so materially the health and comfort of every community, should, as a general principle, be given to local authorities where these desire to undertake it, and can show that they have the ability and the means to do so. A compulsory purchase clause, at the option of the local authority, should form part of every future Act constituting a gas or water company.

METROPOLIS WATER SUPPLY.

DEPUTATION TO THE HOME SECRETARY.

On Thursday last a deputation from the Commissioners of Sewers of the City of London had an interview with the Home Secretary (with whom was Mr. Dodson, President of the Local Government Board), as to the course that would be pursued with respect to the Water Supply of London, and to ask whether the Government intended to prevent any increase in the charge made to the ratepayers for water.

Mr. ROBERTS (the City Remembrancer), in introducing the deputation, said they represented the Commissioners of Sewers of the City of London, who thought it was time to take action with reference to the water supply. They would like to ask whether or not the Government would deal with this as a general question, or whether they would legislate to prevent an increase of the water-rates charged to the ratepayers with regard to the new assessment.

The HOME SECRETARY said he would answer that question by asking another, and it was this. He understood the deputation represented the City Authorities, as contrasted with the Metropolitan Board of Works, with reference to this question.

Mr. RUDKIN: Not in opposition.

The HOME SECRETARY: Oh, no; but I take you as representing the City of London with respect to the water question. Of course, it became part of your duty to examine the proposals that were brought before the last Parliament. Did you examine the agreements that were entered into as the basis of the Metropolitan Water-Works Purchase Bill?

Mr. RUDKIN: We did not.

Mr. ROBERTS: When we found that Parliament decided not to proceed with the Bill we did not go into the inquiry.

The HOME SECRETARY said it was rather important. He would like to know whether they formed a favourable or unfavourable opinion of the proposals then made.

Mr. RUDKIN said they had not considered them with a view to express an opinion.

The HOME SECRETARY: But you are probably aware that there are certain agreements provisionally entered into, which may or may not be determined, between the Water Companies and other parties—in point of fact, the Government, as it was then represented. With reference to the purchase of the undertakings, do I understand from you that you have never formed an opinion either adverse or favourable to this Bill?

Mr. RUDKIN: We have not met for the purpose, owing to the fact that we understood the Bill was withdrawn, or would not be proceeded with.

The HOME SECRETARY: The course which the Government will take will depend upon the views of persons and bodies like yourselves who represent the ratepayers and the public at large. It would be of very great assistance to us if we knew your opinion upon the water question. It has been very largely debated and very strongly expressed on one side and the other, and it would be a great assistance to Mr. Dodson and myself, in considering this matter, if we could have had the advantage of your opinion on the subject.

Mr. RUDKIN: Must Parliament adopt the terms of purchase as they stand, or simply reject them? Can Parliament deal with them—can there be any modification by Parliament of the terms?

The HOME SECRETARY said there could not without the consent of those concerned. Parliament, of course, had great power in reserve, and if the terms were found entirely unreasonable it might be assumed that Parliament would not accept them. Probably Parliament would find some method of getting terms that were reasonable; but the first thing he might draw their attention to would be that they should examine these matters, and form their own opinion upon them—whether they wished or did not wish to entertain them. If they made up their mind to examine them, the next point was the question of the constitution of the Trust. If they assumed for a moment that the terms had been settled satisfactorily in some form or other, then the question was as to the body that was to administer the water supply. As far as he could see, the question resolved itself into this—there was the City, there was the Metropolitan Board of Works, and there was a considerable number of districts outside, and in one form or another the interest of these bodies would have to be considered. This was in itself a very complicated question. They might ultimately desire to purchase the undertakings of the Water Companies, and instead of making any bargain or agreement with them, they might go to arbitration. The question was whether they considered that they would do better by that form of proceeding than under the form of proceeding which had been adopted. But really the responsibility seemed to him to rest entirely with the parties who were principally interested. There were these agreements; they would have to take them or leave them as they pleased; and if they left them, they would have to consider whether they would be better off or worse off. These seemed to him to be the elements of consideration, and he could give them no definite answer as to the course the Government were going to take, because the Government, coming fresh to the question, had to collect from all sources their information as to what would be the most advantageous course for them to take, and one consistent with justice to the Companies. It was only from gentlemen like those present that they could derive the necessary information as to the feeling of the public upon these matters. The Government wanted to know, first of all, whether they thought it to be of great importance that the water-works should be bought; secondly, whether they thought the terms which had been offered were fair or unfair terms; and, thirdly, whether they approved of the proposed constitution of the Trust. These were matters on which they could assist the Government more than the Government could assist them.

Mr. RUDKIN asked whether, assuming that no action should be taken during the present session with a view to purchase, or of any public body taking the control of the water supply, any action would be taken to prevent an increase of rates in consequence of the increased rateable value under the new assessment.

The HOME SECRETARY said that there again he should like some practical information. The Companies, as he understood the matter, legally had the right to charge on the value of the houses, but he should like to know what their actual practice was. Supposing a house at £100 a year were charged £2 for water; if the rent was raised to £150, would the Companies charge £3? He had heard very opposite statements with reference to this point.

Mr. SHAW said, according to his experience, that was not the case.

Mr. RUDKIN said he thought they should be able to give information upon inquiry.

The HOME SECRETARY said he rather asked them for information, for being, as he need not tell them, new to the position, he came fresh to the question, and he wished to deal with it impartially, and wished neither

to adopt nor to condemn any scheme. He wished to have information from those capable of forming an opinion as to the principal evidence on this complicated question.

Mr. RUBIN said they would take care that the Commissioners should attend to the request.

The deputation then withdrew.

THE SOCIETY OF ARTS CONFERENCE ABANDONED.—As we announced last week, the Council of the Society of Arts had under consideration the question of holding a public conference on the subject of the London Water Supply, and appointed a Committee to consider and report thereon. This Committee having met several times, and given full attention to the expediency of the Society holding such a conference at the present time, and having confidence that the subject will be fully considered by Her Majesty's Government at an early period, reported that they were of opinion that no conference should now be held. The Council have accordingly resolved not to take any further steps in the matter.

The Registrar-General publishes the following table in reference to the water supply of London during April. According to the returns furnished to him by the Metropolitan Water Companies, 135,710,884 gallons, or 616,597 cubic metres of water (equal to about as many tons by measure, tons by weight), were supplied daily; or 234 gallons (106·3 decalitres), rather more than a ton by weight, to each house, and 32·9 gallons (14·9 decalitres) to each person, against 32·3 gallons during April, 1879.

COMPANIES.	Number of Houses, &c., supplied in		Aver. Daily Supply of Water in Gallons* during	
	Apr. 1879.	Apr. 1880.	April, 1879.	April, 1880.
Total supply	559,464	581,017	128,493,479	135,710,884
From Thames	265,071	278,690	65,170,526	69,665,251
„ Lea and other Sources	294,393	302,327	63,322,933	66,045,633
THAMES.				
Chelsea	29,700	30,071	7,912,300	8,330,100
West Middlesex	51,920	54,062	10,176,801	10,882,759
Southwark and Vauxhall	82,965	89,493	23,369,642	23,098,920
Grand Junction	39,648	41,352	11,054,883	12,376,272
Lambeth	60,838	63,706	12,656,900	14,777,200
LEA AND OTHER SOURCES.				
New River	128,024	130,121	26,831,000	26,808,000
East London	118,910	122,746	28,795,000	30,989,900
Kent	47,459	49,460	7,696,953	8,247,733

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for April, 1880, as compared with that for the corresponding month of 1879, shows an increase of 21,553 houses, and of 7,217,405 gallons of water supplied daily.

The following is Dr. Frankland's report on his analyses of the water supplied to London during April:—"Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies, and by the Tottenham Local Board of Health, was—Tottenham, 1·4; Colne Valley, 1·4; Kent, 1·7; West Middlesex, 3·3; Chelsea, 3·5; Grand Junction, 3·7; New River, 4·3; East London, 4·5; Lambeth, 6·5; Southwark, 6·5. The Thames water supplied by the West Middlesex, Chelsea, and Grand Junction Companies was of fairly good quality, but that of the last-named Company was turbid, and contained moving organisms. The Southwark and Lambeth Companies sent out water of very objectionable quality, containing a very large proportion of organic matter. The Lambeth Company's water was also inefficiently filtered. The Lea water, delivered by the New River and East London Companies, was inferior to the better samples of Thames water, but was efficiently filtered before delivery. The deep-well water supplied by the Kent and Colne Valley Companies and by the Tottenham Local Board of Health was of its usual excellent quality for dietetic purposes, and that sent out by the Colne Valley Company was suitable for all domestic purposes, having been softened before delivery. Seen through a stratum two feet deep, the waters presented the following appearances:—Kent, Colne Valley, and Tottenham, clear and colourless; Chelsea, West Middlesex, New River, and East London, clear, pale yellow; Southwark, clear, yellow; Lambeth, slightly turbid, yellow; Grand Junction, turbid, pale yellow."

Results of Analyses expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Mat- ters.	Or- ganic Car- bon.	Or- ganic Nitro- gen.	Ammonia.	Nitrogen, as Ni- trates and Nitrites.	Total combined Nitro- gen.	Chlo- rine.	Total Hard- ness.
<i>Inner Circle.</i>								
Thames—								
Chelsea	25·72	·169	·036	0	·169	·205	1·5	19·5
West Middlesex	26·26	·152	·045	·004	·182	·230	1·5	19·8
Southwark	28·72	·342	·044	0	·196	·240	1·5	20·6
Grand Junction	26·80	·169	·048	·003	·196	·247	1·5	19·1
Lambeth	29·30	·332	·034	0	·198	·252	1·5	19·1
<i>Lea—</i>								
New River	27·20	·211	·044	0	·207	·251	1·5	19·4
East London	29·98	·225	·046	0	·214	·260	1·8	20·3
Deep wells—Kent	42·32	·093	·011	0	·469	·480	2·5	26·0
<i>Outer Circle.</i>								
Colne Valley	11·84	·066	·015	0	·345	·360	1·5	8·7
Tottenham Local Board	40·06	·068	·013	·084	·034	·116	2·8	20·8
Corporation of Birm- ingham*	28·68	·120	·057	·004	·209	·269	1·7	14·2
Corporation of Glasgow†	2·88	·137	·018	0	·006	·024	·61	·95

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
† Analyzed by Dr. E. J. Mills, F.R.S., of Anderson's College, Glasgow.

Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

BURNLEY CORPORATION WATER SUPPLY AND SEWERAGE WORKS.—At the last meeting of the Burnley Town Council, the Town Clerk reported that the Local Government Board had issued their Order sanctioning the application of the Council to ultimately borrow a sum not exceeding £80,000 for the extension of their water-works, £14,000 for sewerage works, and £7000 for permanent works, which they had no power to borrow under their local Act.

THE FORTHCOMING EXHIBITION OF GAS APPARATUS, Etc., AT GLASGOW.

Following up the brief notice which appeared in our issue a fortnight ago upon this subject, we have now to say that the movement has been so well launched that there is every probability that it will eventually result in a degree of success that has not yet been equalled in any other town in the kingdom. The Council of the Philosophical Society of Glasgow, by whom the initiative was taken, have the uncontrolled use of the fund resulting from an Exhibition of Science, Arts, and Industry held in the winter of 1846-47, and which, amounting to nearly £1200, is to be made available as a guarantee-fund. Being assured of the use of this fund, they at once appointed a General Committee, consisting of upwards of one hundred gentlemen who might be considered likely to take an active interest in the movement, and amongst whom, we are glad to say, there are included Mr. Foulis and the Managers of the district stations of the Glasgow Gas-Works, as also the Managers of the Gas-Works at Greenock, Paisley, Maryhill, Port Glasgow, Dumbarton, and Coatbridge. A meeting of the members of this Committee was held on Tuesday of last week, presided over by Dr. Fergus, President of the Philosophical Society, who stated briefly what it was proposed to embrace in the exhibition, remarking that the Council had thought that while its main feature should be a collection of a very complete character to illustrate everything connected with the manufacture and use of gas in the fullest sense of those terms, there should also be exhibited apparatus to illustrate other more or less cognate subjects; and in exemplification of his remarks he quoted the list of subjects mentioned in our issue of the 4th inst. He expected that the exhibition would be very popular and useful, and that there would be no loss, and consequently no call upon the guarantee-fund. The promoters of the scheme had been met in a very kindly and cordial manner by the Town Council, and the Gas Committee of the Corporation had also agreed to supply them with gas gratis; for all which they felt deeply indebted, as it gave them encouragement to hope the exhibition would be successful, and that it would interest the public as well.

Dr. William Wallace then submitted a motion for the election of an Executive Committee, with Dr. Fergus as Chairman, Mr. William Foulis and Dr. Wallace as Vice-Chairmen, and Mr. John Mann, C.A., as Secretary and Treasurer. This was seconded by Dr. Henry Muirhead, Vice-President of the Philosophical Society; but before it was voted on, the question arose as to the propriety of persons who were likely to be exhibitors being placed on the Committee. Some discussion took place upon it, the chief speakers being Mr. D. M. Nelson and Mr. P. Watt, both of whom thought that the practical experience of such persons might be of much use to the Committee, but that in the event of awards of any kind being given they should have no voice in any of the classes in which they were themselves exhibitors. Eventually the question was decided in favour of not appointing any prospective exhibitors to act on the Committee, and the motion as proposed by Dr. Wallace was carried.

Subsequently there was some discussion on the question of awards of merit, in the course of which it was mentioned that such awards had been given in connection with several gas apparatus exhibitions in England; and a general recommendation was arrived at in favour of awards—whether medals or certificates, or both, to be afterwards resolved upon. Several members of the Committee also spoke on the question of the best place for holding the exhibition; but the decision on this point was left with the Executive Committee.

A well-attended meeting of the Executive Committee was held last Friday, Dr. Fergus again presiding. Mr. Mann (the Secretary) reported that he had collected a great deal of information, which he was ready to place at the service of the Committee, regarding exhibitions of a more or less similar sort held in other towns. Business was at once entered upon. After some discussion as to the most suitable time for holding the exhibition, it was resolved to prepare for opening it on Tuesday, the 28th of September, and that it should remain open for four weeks. Various other subjects were considered at some length, and two Sub-Committees were appointed to proceed with matters remitted to them, the first and most important being the selection of a suitable building, or a vacant space on which to erect a temporary building of the necessary capacity, and with the desired conveniences. We understand that a very full prospectus will soon be prepared for issue, so as to guide intending exhibitors in proceeding to make their arrangements.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The better classes of round coal for house-fire purposes are still very bad to sell, and the inferior descriptions for iron-making and steam purposes are quite a drug. For house-fire coals the prices at the pit mouth range from 7s. 6d. to 8s. for best, and 6s. to 6s. 6d. for seconds, with common round coals quoted at from 5s. to 5s. 6d. per ton, but there is a good deal of very low selling to secure orders. For gas-making coals there is an increasing number of inquiries in the market, but as consumers in a great many cases are already covered, so far as next season's requirements are concerned, the majority of these are for deliveries over the next couple of years. Although sellers in some cases decline to quote for more than one year, there does not seem to be much difficulty in getting tenders for extended deliveries, and here and there sellers are to be found willing to contract over three years. For cannel, prices seem to be generally maintained at the figures ruling last summer, but ordinary gas coals are offered at very low prices, owing to the abundance of round coal generally in the market; 5s. 9d. to 6s. per ton for unscreened, and 7s. for good screened gas coal at the pit being, as I mentioned last week, above an average figure. Engine classes of fuel still move off steadily at late prices, good burgy fetching about 4s. to 4s. 6d., and good slack 3s. 6d. to 4s. per ton at the pit mouth; but there is less pressure for supplies, and a continuance of the strike in the cotton trade would inevitably tend to throw a good deal of burgy and slack upon the market.

The shipping trade is extremely quiet, and the reports from Liverpool are that there is an almost entire absence of inquiry in the market, whilst the prices quoted to secure orders are exceedingly low; Lancashire steam coal delivered at the High Level being offered at 6s. 3d. to 6s. 6d. per ton.

The iron trade is in a very depressed condition, with scarcely any inquiry in the market for actual consumption. Lancashire makers of pig iron who do not seem inclined to go below 52s. 6d., less 2½ for delivery into the Manchester district, are selling little or nothing, and stocks are accumulating. In the finished iron trade very few new orders are being given out, and although many of the makers are still tolerably well sold, they cannot get in specifications. Bars delivered into the Manchester district are offered at £6 17s. 6d. to £7, and puddled bars at about £4 per ton.

THE SOUTH STAFFORDSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The increased state of activity which has been noticeable in the coal trade of this district since the opening of the year, has within the last few weeks greatly subsided, and though the output is still large, the demand is not nearly so great. The attributable cause is found in the fact that the iron trade, which at the commencement of the year was

brisk, is now somewhat depressed and sluggish. During the last week, however, a slight improvement has been reported, and there is a more decided and hopeful aspect apparent. A decline in the quotations has been looked for all round, but it is now considered doubtful that it will take place just at present, and the quantity being consumed by the blast furnaces is still great. House coal is in fair request, particularly best qualities, and in the neighbourhood of Cannock Chase all the collieries are producing large quantities for immediate shipment. For gas coal there is a good inquiry, and business in this branch is looking as well as it has done at any time of late. Several good contracts are open to the market, amongst them being the requirements of the Shrewsbury Gaslight Company for the next three years supply, and which enumerate some 24,000 tons. The export trade is less brisk, and stocks are slowly increasing. In the whole of the South Staffordshire district there is a feeling of discontent amongst the miners, and notice to rescind the sliding scale has been given. Coke is in fair request, and is being delivered in the district at about the following prices:—South Wales, 20s. to 21s. 6d.; Durham, 20s. to 23s. 6d.; Derbyshire, 18s. 6d. to 22s.

The iron trade shows anything but a satisfactory condition at the present time. There are in this district about 50 furnaces in blast, as compared with 67 a month ago. During last week or nine days as many as ten furnaces have either been damped down or put out, and it is stated that within the next fortnight a dozen or fifteen more will be added to the list, unless a better outlook presents itself on the expiration of the holidays. Several makers are either damping down or putting out for the purpose of repairs, and in the hope that a reaction will set in. The influx of orders from America which were booked to makers in this locality at the beginning of the year have, for the most part, been executed, and though a few yet remain to be completed, they are not of such a character as will occupy smelters for any considerable time. There has, too, been but a limited inquiry for the American market for the last six weeks, and opinion is divided as to the probability of any great demand originating from that quarter for some time to come. Stocks of pig iron are again accumulating, and though best marked bars still maintain their quotations as fixed at quarter-day, yet in all other sorts there is a material reduction. Unbranded bars, in fact, are being offered at exceedingly low rates. Hoops and bars are most inquired after; the former realizing £8 to £8 15s., and the latter £9 to £9 10s. The last week's market showed a little more firmness for both hoops and bars than was reported in the preceding week. Most of the heavy ironfounders are doing a fair trade at present. Angles, tees, girders, and most other kinds of bridge ironwork, are being made extensively in the district. The trade, however, in these branches is chiefly confined to colonial requirements and Government contracts.

THE YORKSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The most important feature in connection with the coal trade of this district is the pending contracts for gas and steam coal for forward supplies. The trade in almost all departments is in a wretched state, and some of the largest collieries in the county are only making three and four days per week. As was intimated in my last notice, it was understood that the tenders sent in for gas and steam coal, at least by the South Yorkshire proprietors, would be in advance of those of the last half year. It is stated that tenders have been placed during the week for gas coal at rates as low as, if not lower, than those at which the existing contracts are being supplied. A large colliery firm working the Silkstone and Flockton seams near Barnsley, who were successful last year, tendered at the same price for gas coal, but were cut out by another district colliery. Prices of house coal are low, and at present they seem likely to continue so. The demand for London and the south is not large, and, as an evidence of the mischievous action of the high tonnage rates, it may be stated that whilst in the month of April there was a larger tonnage of coal sent from the inland districts to the Metropolis, there was a marked falling off in both Silkstones and the Barnsley thick seam coal. Nine of the largest pits working the former seam sent 16,200 tons by the Great Northern line during the month of March, but in April the same collieries only supplied 10,800 tons by the same route.

The steam coal trade is looking up, a larger tonnage being forwarded from the southern part of the coal-field to Hull and Grimsby for exportation. The West Riding coalowners are doing a good business with Goole and Hull, the former port being a very advantageous one for the distant collieries. Prices during the past fortnight have not varied a great deal, and, although future contracts are looked upon as likely to be placed at higher rates, this is exceedingly doubtful, as the output is much in excess of the demand, whilst the production is far lower than it need be.

The coke trade is still active, considering the vast output which is going on daily. In addition to the new ovens noticed last week, there are a large number contracted for. The Barrow Hematite Steel and Iron Company have erected a long range at their new colliery at Worsborough, where they intend erecting 120 ovens. Contracts for excavations and the erection of 61 new ovens at the Carton Wood Colliery have been signed, and it is said will cost between £5000 and £6000.

There is very little change to note with respect to the finished iron and steel trade of Yorkshire. There is a fair demand for heavy castings for gas and water purposes, but as a rule the local foundries, which are chiefly dependent upon colliery work, are not so well off. The make of pig iron is fully an average one, there being as yet no falling off in the output, although slight stocks are here and there accumulating.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the counties of Durham and Northumberland continues to be in a dull and, at the steam collieries, something approaching a depressed state. The demand is very moderate. The pitmen of Durham had a proposal submitted to them to restrict the outputs, but they outvoted the proposition. It is pretty certain, however, that the production at the collieries is likely to be in excess of the consumption this summer. Under these circumstances, prices continue to be depressed. Steam coals were lower in price last week than they were in April.

The shipments of gas coals overseas have reached the usual average. The demand for steam tonnage to load gas coals for Cronstadt and the Russian ports was pretty active last week. A number of steamers were engaged to load this class of coals thence. Contractors have been much disappointed that they have been unable to procure steamers to load gas coals at a less sum than 7s. 1½d. for Cronstadt. This is owing to the impossibility of getting profitable cargoes home. There is an improvement to note in the shipments of gas coals to the Italian ports; but the largest quantities sent away by steamers are for London and other ports at home. Coke has sold better for shipping purposes, especially for over sea. The recent fall in prices seems to have attracted customers. The household coal trade, which was bad all the winter, has fallen into the usual summer business; but it is exceptionally quiet and dull. May, with the first opening of the great ports in the Upper Baltic, is, as a rule, an exceptionally busy month in the steam coal trade; but this year shows an

extremely bad business, with prices falling rather than improving. The local demand for manufacturing coals is good, but not excessively so.

The coal ports are well supplied with tonnage for coasting purposes. In fact, sailing ships keep in excess of the requirements of shippers, however few arrive. Under these conditions, the freight quotations to London, the East Coast, and the English Channel, register a low level. Steamers were engaged last week to load coals for London at 3s. 10½d. per ton, and sailing ships at 4s. 7½d. Sailing vessels were chartered to load for Poole at 5s. 6d. and 6s.; Dublin, 6s. 6d.; Newhaven and Cowes, 5s. 9d.; Littlehampton, 6s.; and the ports in the North of France in proportion.

The Newcastle chemical market does not show any signs of revival. Business was very disappointing last week. Prices fell. Outside the operations of "bears," the demand for chemicals for shipment was much less than an average. Very few orders come forward. Generally speaking, the tone of this trade, from whatever cause or complexity of circumstances, has disappointed all the hopes of an improvement which were so much indulged in in the early period of the year. They led to a good deal of speculative buying, and heavy losses have been incurred by those who ventured upon it. The shipments of fire-bricks and fire-clay goods last week were fully up to those of April. The manufactured iron trade is unchanged. The shipments of gas, water, and sanitary pipes are upon a moderate scale. Lead is lower in price. The wood merchants have endeavoured in the spring to adjust the imports to the demand; but, though the price of timber is pretty steady, they have failed to secure much of an advance.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

Good news was communicated to the Police Commissioners of Stirling at a statutory meeting held on Monday, the 10th inst., and through that body to the gas consumers of the town generally. It was embodied in a letter from the Gas Company, which stated that the Directors had resolved to reduce the price of gas from 4s. 2d. to 3s. 11d. per 1000 cubic feet, and that a reduction of 3s. per lamp per annum would be made in the charge for supplying the public lamps. On the motion of Mr. Thomson, the Commissioners did a very creditable thing, which was to award a vote of thanks to the Directors. It was stated that the reductions announced would amount to £440 per annum on the burgh and the hospitals under municipal authority. This is important to a town like Stirling.

The Perth Corporation Gas Commissioners, at a meeting held last week, resolved, on the solicitation of their Manager, Mr. Whimster, to provide a new exhaustor for the gas-works, at an estimated cost of about £200.

I regret to say that the movement for putting the old and new towns of Markinch, Fifeshire, under the provisions of the General Police and Improvement (Scotland) Act, 1862, has been frustrated, in consequence of which the question of the statutory powers for the public lighting of the streets must remain in abeyance for at least twelve months. There was a large majority in favour of remaining "as you were."

In moving the adoption of the Gas Committee's minutes at last week's meeting of the Town Council of Rothesay, Bailie McMillan, the Convener, stated that in accordance with a remit from a preceding meeting, a thorough inspection of the gas-works had been made, and it was considered by the Manager that, by the addition of a small engine, the present works would be quite sufficient to meet the wants of the community for many years to come. It was, therefore, suggested that a Committee be appointed to see other works where such engines were in use.

On Wednesday last the Shareholders of the Aberfeldy Gaslight Company held their annual meeting, at which a dividend of 5 per cent. was declared, and a gas-rate of 7s. 4d. per 1000 feet was fixed, being the same as that of the past year.

One of the novelties on board the far-famed Clyde saloon passenger steamer *Iona* this season is Muller's gas-making machine. It is not expected that it will be largely called into service during the summer, as the runs of the *Iona* rarely encroach on twilight; but it is thought that it may so far serve the purpose of an experiment as to determine the policy of the system being extended to the deep-sea steamers on Mr. MacBrayne's Highland service.

At a meeting of the Pier and Gas Corporation of Dumbarton, held last Wednesday, Treasurer Brown reported that the deficiency requiring to be made up in the pier funds for the current year was £546. That deficiency was, of course, in terms of a previous resolution, to be made up by the Gas Corporation. It came first from the gas, then went into the "Common Good," and thence to the pier. Provost Babbie, in speaking on the subject, pointed out that if the sum given to the pier had not been required, the charge for gas could have been reduced by 9d. per 1000 cubic feet; so that as the present price is 4s. 7d. per 1000 feet, it might have become reduced to 3s. 10d. at this time but for the circumstance just mentioned. It should be borne in mind also that the meters used by the consumers are given free of charge.

Business was done in the shares of the Edinburgh and Leith Gas Company on Monday week; at £30 per share.

The Town Council of Falkirk held a meeting last Thursday, when the Clerk submitted and read a letter from the Falkirk Lighting Company, answering the Town Clerk's letter of the 14th ult., from which it appeared that the Manager (Mr. Scott) had been instructed to intimate that the Company would be quite prepared to pay one-half of the expense of any properly qualified gas analyst from either Edinburgh or Glasgow; and, further, rather than see the ratepayers put to any expense, as far as testing went, the Company would be glad to place their gas-testing apparatus at the disposal of such analyst, on the understanding that the periodical testing of their gas be published in the *Falkirk Herald*. Mr. Coutts moved that the letter be allowed to lie on the table for a month, and this was unanimously agreed to, the meeting expressing its satisfaction with the terms of the communication.

The past week's pig iron market was comparatively steady, and the fluctuations in price were within much narrower limits. There is still a desire to invest in pig iron. The closing prices on Friday were 46s. 3d. cash and 46s. 4½d. one month for buyers, and sellers very near.

No new features have presented themselves in the coal market. Business keeps dull, and orders for all descriptions are scarce.

SALE OF SHARES IN THE CHATHAM AND ROCHESTER WATER-WORKS COMPANY.—On Monday last week there were offered for sale by auction 42 shares in the above-named Company. The prices realized were as follows:—25 at £10 16s. each, 14 at £10 17s., and 3 at £10 18s. The total amount of the sale was £454 12s.

THE PARIS GAS COMPANY'S NEW WORKS AT CLICHY.—In the report presented by the Board of Direction of the Paris Gas Company at the annual general meeting of the Shareholders on the 25th of March, a translation of which appeared in the *Journal* of the 27th ult., reference was made to the necessity under which the Company found themselves, in consequence of the increased demand made upon them for gas, to commence the construction of entirely new works at Clichy. At the time the report was prepared considerable progress had, we believe, been made with the work; but we now learn, from our contemporary *Le Gaz*, that the gasholder-tanks are already finished, and that most of the working

plant is in course of erection. The works have been planned for a daily production of 500,000 cubic metres, or about 18 million cubic feet of gas; and it is believed they will be ready to commence operations in the course of October next. The mere fact that works of such magnitude as this are urgently called for to meet the ever-growing requirements of the gas supply in Paris, is a striking proof, if any were needed, that the more extended employment of this well-trying and reliable source of light is in no way interfered with by the ephemeral popularity of more dazzling though less trustworthy illuminants.

BIDEFORD GAS AND COKE COMPANY, LIMITED.—The annual meeting of this Company was held last Wednesday, when the Secretary (Mr. James Joco) read the notice of meeting, after which the Directors report was adopted. This stated that during the year ending March 31 the Directors had effected several improvements and extensions of the works of the Company. A capacious building had been erected in which had been placed a set of four new purifiers, a station-meter, and a governor, the need of which had for some time past been experienced. The total outlay on new works and extensions had been £1300. Of this amount there had been received for calls on the new shares £892; the balance of capital account was £137 14s. 6d.; and the balance—viz., £330 5s. 6d.—was paid out of the current account. The balance-sheet showed the amount at disposal to be £1085 16s., exclusive of £330 5s. 6d. paid on capital account. A dividend at the rate of 10 per cent., which the Directors recommended, amounted to £557, leaving a balance of £528 16s. to be carried forward. The reserve-fund amounted to £304 10s. 9d., and this the Directors recommended should be increased to £350. The capital of the Company consists of 615 £10 shares fully paid, while there are 85 shares still to issue. The receipts for the twelve months from gas and meter rental amounted to £2165 13s. 3d.; from residuals, to £368 4s. 1d.; and from fitting and labour accounts, to £134 16s. 1d. Miscellaneous receipts brought the total to £2682 7s. 1d., of which the expenses absorbed £1990 14s. 7d., leaving £691 12s. 6d. as the balance of revenue account.

Register of Patents.

APPLICATIONS FOR LETTERS PATENT.

- 967.—CLIFT, S., Conway, North Wales, "Improvements in the manufacture of certain coal-tar products. March 5, 1880."
1876.—SAMPSON, J. L., London, "Improvements in or connected with apparatus for lighting or illuminating with gas." May 7, 1880.

- 1886.—HICKMAN, H. T., Stourbridge, Worcester, "A new or improved composition for the manufacture of fire bricks and blocks, gas-retorts, and other articles in which great infusibility is required." May 8, 1880.
1895.—HOWAT, A., Manchester, "An improved method of and apparatus for holding glasses, globes, or shades for gas and other lights." May 8, 1880.
1901.—DANN, J. T., Brixton, London, "Improvements in the construction of apparatus for lighting and extinguishing gas-burners by automatic means." A communication. May 10, 1880.
1938.—PRESTON, F. P., PRESTIGE, J. T., and PRESTON, E. J., Deptford, Kent, "Improvements in apparatus for regulating and controlling the flow of water and other liquids, and preventing waste of same." May 11, 1880.
1959.—HARDMAN, J., Manchester, "Improvements in the production of anthracene from gas tar." May 13, 1880.
1969.—HAIGH, W. B., and NUTTALL, J., Oldham, Lancs, "Improvements in gas-engines." May 13, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

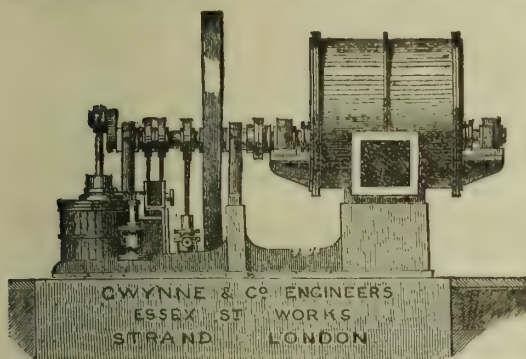
- 4704.—LIVSEY, G. T., Old Kent Road, London, "Improvements in apparatus used in the manufacture of gas." Nov. 19, 1879.
5051.—CLARK, A. M., Chancery Lane, London, "Improvements in apparatus used in the manufacture of gas." A communication. Dec. 10, 1877.
5239.—JOHNSON, J. H., Lincoln's Inn Fields, London, "Improvements in valves for steam, gas, and air engines." A communication. Dec. 22, 1879.
117.—ROBINSON, H., Manchester, "Improvements in gas motor engines." Jan. 10, 1880.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

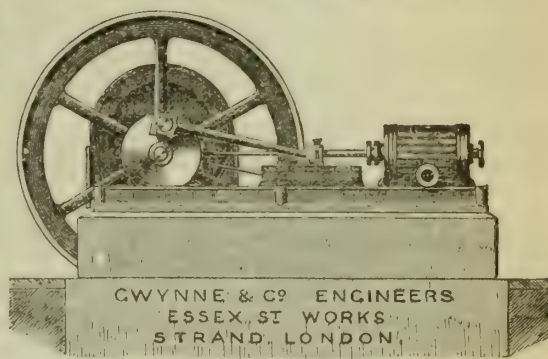
- 1632.—WEATHERHOOD, G. W., "Improvements in apparatus for carburetted atmospheric air." April 26, 1877.
1644.—CUTLER, S., "Improvements in apparatus used in the purification of gas." April 27, 1877.
1769.—HEARSON, C. E., "Improvements in lamps and lamp-burners." May 7, 1880.
1774.—BURBIDGE, T., "Improvements in valves for regulating or controlling the supply and discharge of water or other fluids." May 7, 1877.

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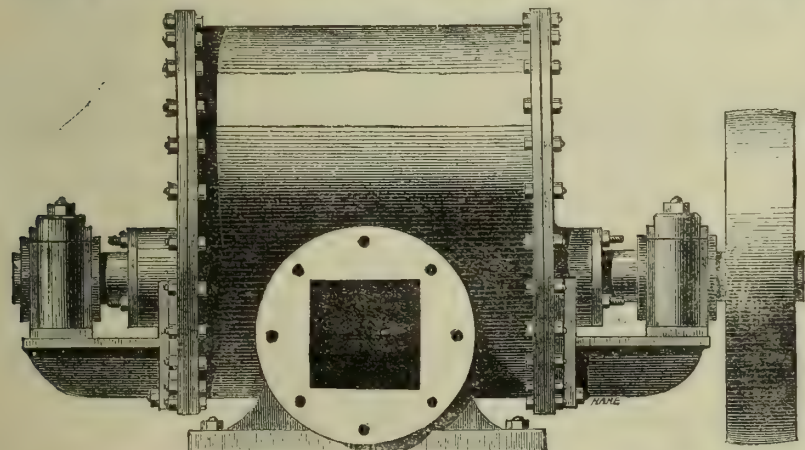
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upon.

Candidates are requested to forward written applications,
stating amount of salary required, and accompanied with
testimonials, addressed to me at the Office of the Company,
5, Derby Road, Watford, not later than May 28, 1880.

WILLIAM ROWELL, Secretary.

WANTED, to Lease a small Gas-Works,
by a Practical Gas Engineer.
Address No. 654, care of Mr. King, 11, Bolt Court,
FLEET STREET, E.C.

FOR SALE—A Second-hand Square
STATION-METER, to pass 40,000 cubic feet per
hour. Erected about 12 years. Made by Messrs. J. and
J. Braddock, Oldham. Now in use at the Plymouth Gas-
Works. To be removed to make place for a larger sized
Meter. To be sold a bargain.
For price and particulars apply to W. W. ANDREWS, 238,
Kingsland Road, London.

A BARGAIN.

FOR IMMEDIATE SALE—A Round
STATION-METER, capable of passing 2500 cubic
feet per hour (clock in centre), 2-in. Bends, and one 5-in.
Four-way Valve, which have been taken down to make
room for a larger one.
Apply to Mr. W. C. DAWSON, Gas-Works, ARUNDEL.

EXHAUSTER FOR SALE.

THE Malton Gas Company have for
Disposal an **EXHAUSTER** and **ENGINE**, erected
by Messrs. Dempster in 1873, capable of passing 7000 cubic
feet per hour.
It may be seen in operation, and further particulars
obtained on application to the undersigned.
HENRY TORRY, Secretary.

THE Sheffield United Gaslight Company
OFFER for SALE the following lots of Retort-
House **FITTINGS**, which they are now taking down at
two of their Stations:—

- 54 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft.
6 in. by 18 in. by 18 in.
- 16 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft.
6 in. by 18 in. by 15 in.
- 4 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft.
6 in. by 16 in. by 15 in.
- 320 Cast-Iron Mouthpieces, D-shaped, 21 in. by 15 in.
- 160 Lengths 4-in. Cast-Iron Ascension-Pipes, straight,
7 ft. 6 in. long.
- 215 Lengths 4-in. Cast-Iron Ascension-Pipes, straight,
5 ft. 6 in. long.
- 50 Lengths 4-in. Cast-Iron Ascension-Pipes, curved,
5 ft. 6 in. long.
- 60 Lengths 4-in. Cast-Iron Ascension-Pipes, curved,
2 ft. 8 in.
- 37 Lengths 4-in. Cast-Iron Ascension-Pipes, curved,
10 ft. 2 in.
- 40 Lengths 4-in. Cast-Iron Ascension-Pipes, straight,
5 ft. 10 in.
- 17 Lengths 4-in. Cast-Iron Ascension-Pipes, straight,
5 ft. 5 in.
- 481 Lengths 4-in. Cast-Iron H-Pipes.
- 506 Lengths 4-in. Cast-Iron Dip-Pipes.

The above apparatus has been in use up to a recent date,
and is adapted for re-erection.

The Company will be prepared to receive an offer for
the whole or any portion of the above. Price £4 per ton,
loaded into trucks at Sheffield.

Applications to be addressed to the undersigned,
THOS. ROBERTS, Manager.
Gas Office, Sheffield, March 25, 1880.

TAR FOR SALE.

THE Directors of the Dronfield Gaslight
and Coke Company are open to receive **TENDERS**
for the Purchase of the Surplus **TAR** produced at their
Works for Six months from July 1, 1880.
Tenders, stating price per ton at the Works, or delivered
in casks at Dronfield Railway Station, to be sent to the
undersigned not later than the 31st inst.

The Directors do not bind themselves to accept the
highest or any tender.

C. THORPE, Secretary.

Chesterfield, May 6, 1880.

THE Broadstairs Gas Company have for

SALE—

- One 6-in. Station Governor.
- Two 7 ft. 6 in. Lengths of 15-in. Round Hydraulic
Main.
- One 15-in. Round Mouthpiece.
- Fifteen 14-in. Round Mouthpieces.
- Fifteen 4-in. Ascension-Pipes.
- Fifteen 4-in. H-Pipes.
- Fifteen 4-in. Dip-Pipes.
- Nineteen Round Retort-Lids.
- Fifteen Retort Screws.

All in good condition. Removed to make room for
larger.

For particulars and price, apply to

W. J. LATCHFORD, Manager.

Gas-Works, Broadstairs, April 27, 1880.

GAS PLANT FOR SALE.

THE Coventry Gas Company have for

SALE—

SCRUBBERS.—One 5 ft. 6 in. diameter, 15 ft. high. One
5 ft. diameter, 20 ft. high; with or without 8-in. Connec-
tions and Valves.

GASHOLDER.—One Telescopic, 40 ft. diameter and 34 ft.
high, in two lifts; Cast-iron Tank for same, 41 ft. 6 in.
diameter, 18 ft. high.

STEAM-JET VENTILATOR.—One No. 2 Körting's
Patent Jet Ventilator, with Chest. One No. 3½ Körting's
Patent Jet Blower.

VALVE.—One 12-in. Cathels's Four-way Valve.

The above are being replaced by larger apparatus, and can
be removed at once. Also a 100-light Gas Apparatus
(Porter's make); this includes a Gasholder, 14 ft. diameter
and 10 ft. high, which could be sold separately.

For particulars and prices apply to

W. L. ROBINSON, Manager.

Gas-Works, Coventry, April 17, 1880.

GAS PLANT FOR SALE.

THE Maidstone Gas Company having
enlarged their Works, offer the following Apparatus
for Sale in good condition:—

SCRUBBERS.—One Tower Scrubber 30 ft. high by 10 ft.
diameter, with Distributor, and partly fitted with Livesey's
boards.

CONDENSERS.—One Set of Annular Condensers, con-
sisting of 9 Pipes 17 ft. high, outer diameter 2 ft. 6 in.,
fitted with 12-in. Valves complete.

ENGINES.—Two 12-Horse Power Horizontal Engines
in very good condition.

STATION-METERS.—One Station-Meter, with Valves
and Bye-pass for 20,000 per hour, in ornamental case
(Milne); one Station-Meter, with Valves and Bye-pass for
6000 per hour, in cylindrical case.

HYDRAULIC MAIN.—Six 8 ft. by 18 in. Hydraulic
Main D wrought iron; 24 8 ft. 9 in. by 18 in. Hydraulic
Main D wrought iron. Nearly new.

BRIDGE AND ASCENSION PIPES.—90 6 in. by 4 in.
Bridge-Pipes, and a quantity of 6-in. Ascension-Pipes and
Bends.

For further particulars and price apply to

JOHN WEST, Engineer and Manager.

Gas Works, Maidstone, April 21, 1880.

THE Gloucester Gas Company, ceasing
to manufacture gas at their old works, will have the
undermentioned **APPARATUS** for Sale about the beginning
of August, viz.:—

About 150 feet of D-shape Wrought-Iron Hydraulic
Main, size 19 in. by 19 in. Also about 38 ft. of D-shaped
Wrought-Iron Hydraulic Main, size 20 in. by 20 in. An-
nular Condenser, consisting of six Vertical Pipes, 24 in.
diameter, 19 ft. high, with three 12-in. Slide-Valves and
12-in. Connections.

Scrubber (round), 5 ft. by 20 ft., with three 12-in. Slide-
Valves, and 12-in. Connections.

Exhauster (Jones) to pass about 15,000 feet per hour.

Exhauster (Beales) to pass about 25,000 feet per hour.

Two Vertical Steam-Engines, each about 6-horse power,
with Pulleys, and Shafting used for driving the above.

Boiler 14 ft. 6 in. by 8 ft. 6 in., with Centre Tube, and
four Galloway Patent Tubes.

4-horse power Horizontal Steam-Engine.

Three 4-in. Pumps, with cranked Shafting and a pair of
Mitre Wheels.

Two Purifiers, 16 ft. by 8 ft., with six 12-in. Slide-Valves
and 12-in. Connections.

Gasholder, Double Lift, with Cast-Iron Tank, capacity
37,000 feet.

Gasholder, Double Lift, capacity 100,000 feet.

Gasholder, Double Lift, capacity 240,000 feet.

One 12-in. Governor, by Wright, London, with 12-in.
Valves, Bye-Pass, and Connections.

Two 12-in. four-way faced Valves, by Cockey.

For further information, &c., apply to the undersigned.

R. MORLAND, Engineer.

SECOND-HAND ENGINES, EXHAUSTERS,
BOILERS, &c.

THE Scarborough Gas Company invite
OFFERS for the Purchase of their present Duplicate
Exhausting Machinery, comprising Two 7-in. Cylinder
by 14-in. Stroke Horizontal Steam-Engines; Two 20,000
cubic feet per hour Gwynne and Beale's Patent Exhausters;
Two Hydraulic Governors in Connection with Throttle
Valves of Engines; and Two Cornish Boilers, 11 ft. by
3 ft. 9 in.

The whole are of superior make and have been carefully
used, and are well worth attention, being about to be
removed for replacement by larger and more powerful
apparatus.

The machinery may be seen in operation until the 30th
of April, and further particulars may be obtained on
application to the undersigned.

By order,

WILLIAM J. MOON, Manager.

Scarborough, March 5, 1880.

TO CHEMICAL MANUFACTURERS.

THE Gas-Works Committee of the Keigh-
ley Local Board of Health invite **TENDERS** for the
Purchase of the **TAR** and **AMMONIACAL LIQUOR**
produced at their Works from the 1st of July next to
June 30, 1881.

Particulars and forms of tender can be obtained on
application to the undersigned, to whom tenders must be
sent not later than Monday, the 24th inst.

By order,

J. LAYCOCK.

Low Bridge, Keighley, May 6, 1880.

TO LIME MERCHANTS.

THE Directors of the Loughborough Gas
Company will be glad to receive **TENDERS** for
Supplying good Hand-Picked **LIME**, for Purifying pur-
poses, for One, Two, or Three years, to be delivered at the
Loughborough Railway Station, carriage paid. The quan-
tity used per year is about 180 tons. The Lime must be
well burnt and free from stone. The delivery to be from
time to time as the Manager shall direct, commencing from
the 1st of July.

Tenders to be addressed to me, and delivered by the 20th
of the present month.

J. B. BALL, A.I.C.E., Manager.

TO MANUFACTURING CHEMISTS.

THE Directors of the Loughborough Gas
Company invite **TENDERS** for the Purchase of the
Surplus **TAR** and **AMMONIACAL LIQUOR** produced at
their Works for One, Two, or Three years, from the 1st of
July next. The quantity of Tar made per year is about
180 tons, and about 320 tons of Ammonia Water. Both
residuals will be delivered into Contractor's boats at the
expense of the Company.

Terms and conditions of the contract may be obtained of
the undersigned.

Tenders to be addressed to the Manager, and delivered
by the 20th of the present month.

J. B. BALL, A.I.C.E., Manager.

COAL TENDER.

THE Directors of the Loughborough Gas
Company are prepared to receive **TENDERS** for One,
Two, or Three years for 4000 tons per year, of good, well-
screened **GAS COALS**, to be delivered at the Lough-
borough Railway Station, or Canal Wharf, which is 300
yards from Works, carriage paid, and forwarded in the
following monthly quantities, viz.:—

1880, July	200 tons.
„ August	200 „
„ September	350 „
„ October	350 „
„ November	550 „
„ December	550 „
1881, January	550 „
„ February	450 „
„ March	350 „
„ April	150 „
„ May	150 „
„ June	150 „
Total	4000 tons.

The Coal to be entirely free from refuse of every kind.
Sealed tenders to be addressed to me, and delivered at
the Offices by the 20th of the present month.

The Directors do not bind themselves to accept the
lowest or any tender.

J. B. BALL, A.I.C.E., Manager.

BOROUGH OF BURY.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Gas Committee of the Corporation
of Bury are prepared to receive **TENDERS** for **GAS**
COAL for One, Two, or Three years, commencing on the
1st of June next, to be delivered free at the railway siding at
Buckley Wells, or at the Corporation siding Town's
Yard, Fernhill, as may be required. Estimated quantity
for the first year, 10,000 tons; for the second and third years,
12,000 tons each.

Further particulars may be obtained upon application to
Mr. Samuel Parsons, Manager, Gas-Works, Elton.

Tenders, endorsed "Tender for Gas Coal," stating the
colliery from whence the Coal is proposed to be supplied,
to be sent to me, the undersigned, on or before Wednesday,
the 26th inst.

The Committee do not bind themselves to accept the
lowest or any tender.

By order,

FREDERICK BULL, Town Clerk.

Corporation Offices, Bury, May 7, 1880.

BOROUGH OF ROTHERHAM GAS-WORKS.

TO GASHOLDER MAKERS.

THE Gas Committee invite Tenders for
the entire Resheeting of, and Additions to their
80-ft. **GASHOLDER**. The additions consist of a new set
of Wrought-Iron Brackets for Wheels.
Specifications can be seen, and forms of tender obtained,
by applying to Mr. Goodwin, Manager, Gas-Works,
Rotherham.

Tenders, endorsed "Tender for Gasholder Repairs," to be
sent in to me on or before the 20th day of May inst. The lowest
or any tender not necessarily accepted.

By order,

GEO. W. HODGKINSON, Town Clerk.

Council Hall, Rotherham, May 7, 1880.

BOROUGH OF ROTHERHAM GAS-WORKS.

TO BOILER MANUFACTURERS.

THE Gas Committee invite Tenders for
the Supply of Two **CORNISH BOILERS**, 20 ft. by
6 ft., each fitted up with two Flues; also four Cross Tubes
and Valves, Gauges and Fitting complete.

Specification and drawings can be seen, and forms of
tender obtained, by applying to Mr. Goodwin, Manager,
Gas-Works, Rotherham.

Tenders, endorsed "Tender for Boilers," to be sent in
to me on or before the 20th day of May inst. The lowest
or any tender not necessarily accepted.

By order,

GEO. W. HODGKINSON, Town Clerk.

Council Hall, Rotherham, May 7, 1880.

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TO CORRESPONDENTS.

FRITH.—Boil ammoniacal liquor with milk of lime and pass the vapour through five or six waters. The last will be clear and colourless.

J. G.—We are much obliged to you for the information in your letter. At present the litigation going on between some of the parties you name precludes our publishing any part of it; but when the legal proceedings come to an end, we shall make use of some, at all events, of the facts you bring to our knowledge.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 25, 1880.

Circular to Gas Companies.

THE communication which we publish elsewhere from the Gas Engineer to the Leeds Corporation, coupled with the announcement which we are able to make that the South Metropolitan Company have determined to reduce the price of gas in the district of the late Phoenix Company to 3s. per thousand cubic feet from the 30th of June next, form a remarkable commentary upon the observations in our last "Circular" as to the municipal acquisition and conduct of gas-works. As our readers are aware, the scheme for the amalgamation of the South Metropolitan and Phoenix Companies authorized the United Company to continue the price of 3s. 4d. in the Phoenix district for twelve months from the date of amalgamation—that is, until Jan. 1, 1881—without detriment to the dividends of the original South Metropolitan Shareholders. This would retain to the Company some £30,000 of revenue on the year—a sum probably specially welcome just now, as helping to cover the necessarily heavy charges incident to the amalgamation. By conceding the reduction from the earlier date, however, the Directors expedite to the same degree the payment to the holders of South Metropolitan and Phoenix shares an increased dividend of one-half per cent.

The initial price in the Act of the South Metropolitan Company being 3s. 6d. per thousand feet, the price now and for some time past charged in their district—viz., 3s. per thousand—warrants the payment of a dividend of eleven and

a half per cent. The proportion of profits paid by the stock of the late Surrey Consumers Company (B) to that of the original South Metropolitan (A), under the scheme for the amalgamation of those two Companies, enabled the latter to share last half year a dividend of eleven and three-quarters per cent., while the former was reduced to eleven per cent. Although the range of equal division of profits was raised in the Phoenix amalgamation scheme to eleven per cent. from ten and three-quarters, at which it stood in that of the Surrey, yet the great increase in the amount of B (contributing) capital, due to the absorption into that class of the whole of the Phoenix shares and stock, will enable the A Shareholders to receive from June next twelve per cent., while the B take eleven and a quarter per cent. Thus the sliding scale asserts itself at once and naturally in its birth-place and congenial home, by inducing the earliest possible reduction of price and increase of dividend, or increase of dividend with reduction of price, whichever way our readers may prefer to put it.

The action of the Directors of the South Metropolitan Company and their chief adviser, Mr. George Livesey, in this matter, is, as we have said, a perfectly natural and proper one. We think it is a particularly happy circumstance that the price is so promptly made uniform throughout the district, and we congratulate Directors, Shareholders, and Consumers alike. At the same time we feel that this prompt reduction points to one serious evil attaching to the present position of legislation on the subject of the sliding scale, and to it we draw the attention of our readers. How does it happen, we ask, that these considerable reductions in price in the districts of the Phoenix and Surrey Consumers Companies are possible immediately after amalgamation? The time which has elapsed is not sufficient to have brought about any considerable economies in management or otherwise, and we are forced to the conclusion that the condition of the Companies themselves before amalgamation was such as to warrant, if not to require that the price of gas should be reduced. The Phoenix Company, for instance, used not to think that the filling up of the reserve-fund to the very brim should necessarily precede a concession to the consumers, and there can be little doubt in the mind of any one conversant with the character and traditions of the Company that, under ordinary circumstances, the price charged would not have been kept at the price it was. The reason is not far to seek: The Company were under the necessity of applying to Parliament for more capital; with the increased powers they sought they must inevitably accept the sliding scale; the initial price from which the sliding scale operated would be determined by the rate at which gas was actually supplied; therefore it was desirable to keep as high a price as possible, consistently with some regard for appearances and fairness.

The unfortunate departure, in the case of the South Metropolitan Company, from the idea of an uniform initial price, which obtained when the principle of the sliding scale was accepted by the Commercial and Chartered Companies, opened the way to a fight in the case of each Company seeking powers; and the punishing of a well-conducted and successful Company, by giving them a low initial price because their selling price at the time was low, could not but influence largely the action of all those others to whom an application to Parliament was in any degree imminent. Thus the present position of affairs is objectionable on both sides. Companies may well complain if an honest fulfilment of their legitimate duty to their consumers—that of giving them the advantage arising from times of cheap production—is to be used as a scourge when they go to Parliament; and, on the other hand, the consumers have a clear and manifest ground of complaint if the price of gas is being kept up unnecessarily high, so that Companies may make out a better case for a high initial. How this condition of things is to be met is not easy to see. The application of the sliding scale to all statutory Companies alike would answer to *The Times* definition as "heroic" treatment. It would involve probably a laborious inquiry in half the towns in the kingdom, for the chances are that the acceptance of the present selling price as the normal one would be resisted in some cases by the consumers and in others by the Companies. Some way, however, will have to be found to reconcile the present antagonism. For ourselves, we have not professed in the past, and we do not now affect an admiration which we do not feel for the sliding scale. We are old-fashioned enough to retain our preference for the earlier legislation, and to believe and maintain that the true interests of Gas Companies in the long run would have been better served by a faithful and loyal observance of the Gas-

Works Clauses Act of 1847—the details of which might have been modified as occasion required without departing from its general principles—than by the more recent efforts in the way of improvement. We believe that a long life of steady prosperity such as Gas Companies were entitled to expect, would be better than a short period of specially palmy days, followed by the extinction of their business, even on *very good terms*; and this consummation will certainly be hastened by any considerable increase of dividends.

Nothing, in our opinion, is more likely to stimulate the cry in favour of municipal management of gas undertakings than for Companies working under the sliding scale either, on the one hand, to plead or admit that they need the inducement it offers to make them do their duty, or, on the other, without so pleading, to prove the fact by speedy additions to dividends. We admit that it is late now to repeat objections to a principle which has been accepted with general approval by both Municipal Authorities and Gas Companies. What we desire is to point out dangers in connection with it which may be avoided, and especially to urge the desirability of aiding, by every available means, the assimilation or harmonizing of the conditions under which the business is conducted, and the profits of it determined.

In the letter to which we have already referred, Mr. Henry Woodall, of Leeds, courteously draws our attention to what he considers an omission on our part. We have failed not only to give due credit to the Gas Committee of Leeds for their liberal and praiseworthy policy in relation to the consumers, but also to point our often-urged argument in favour of giving to gas consumers the advantages arising from the profits contributed by them, by a reference to the same illustration. We at once admit the fairness of Mr. Woodall's criticism from this point of view, our justification being that we have dealt with a general principle, and not with what he will probably admit to be an exceptional case. The Corporation of Leeds did, in or about the year 1876, see the error of their ways, and turned into what we regard as the path of rectitude. We rejoice over their amendment, and welcome them as penitent prodigals should be welcomed. Having tried a policy of high prices and niggardly expenditure for their first five years, and accumulated debt and dissatisfaction thereby, they have now tried other five years of fair and liberal dealing with their consumers, and the results are in every way encouraging. We offer no grudging congratulations to the Leeds Council and their Gas Engineer. They have done more than any other body to show practically what are the advantages possible to be obtained from municipal management. If one swallow made a summer, our views might be in some danger of being modified by such an example; but until the public virtue of the Leeds Council has secured some imitators, we must continue to deal with the case not from its exceptional but from its general aspect. We think it probable that a continuance of the custom of annually reducing the price of gas will shortly relieve Mr. Woodall from at least one of his embarrassments—viz., that of large and perplexing balances of profit.

Gas affairs at Leeds are conducted by the Council under almost identical conditions to those which would have governed the Companies they bought up, had the latter continued the supply and been compelled to raise their new capital by the means now prescribed—viz., public tender. The auction clauses without the sliding scale take from Companies much of the advantage that used to attach to the constant increase of business; they have to look to the consolidating of the value of their original property as a compensation for its want of growth. The raising of capital in this way, much as we may regret it for some reasons, does, however, take away the argument which Corporations were able to use before the adoption of those clauses—that of their ability to raise money for the carrying on of the business upon much less onerous terms. Without the unwelcome aid of the auction clauses, Companies were well able to hold their own—for reasons, among others, which we gave last week—in conjunction with Corporations. With them there can be no doubt that the comparison which at present is honourably in favour of the older system will not be reversed.

The abstract of accounts of the borough of Rochdale for the past year, which has just been issued, shows that the profits made by the Corporation gas undertaking for this period were £8886, or more than £800 in excess of those of the previous year. Besides this a sum of £1922 has been taken out of revenue in order to pay for new purifying apparatus, which is an arrangement that does not appear to meet with unqualified approval in the town, and may, indeed, be characterized as an inconvenient procedure. The consumption

of gas in Rochdale shows a considerable increase over that of the preceding year, the total amount realized being £41,137, as against £40,283 in the previous year; while the working expenses show a general decrease, although wages have risen in the carbonizing department. The expenditure on extensions and alterations, which has been rather large during the past few years, has come to an end for the present, only £681 being charged under this head in the accounts, besides the expenditure on the purifying plant before mentioned. The present value of the works is estimated at £161,780. In face of this satisfactory state of things, it is creditable to a strong body of the members of the Council, having the ex-Mayor at their head, that they sought to reduce the price of gas, and, in fact, succeeded in carrying their proposition by a majority of one; but, unfortunately, when the resolution thus passed was brought up for confirmation a week later, the battle had to be fought over again, and the reduction was negatived by a majority of six. This is rather discouraging; but when the proposal is again brought forward next year, it may be hoped that a greater reduction than the modest threepence per thousand feet now so nearly carried will be found desirable. Sundry members of the Council apparently failed to see the connection between lowness of price and increase of consumption, as they expressed fears lest the loss of revenue which the reduction showed on the basis of the past year's sale would not be recovered by any extension of business that might be expected to ensue. But this consideration was not the sole, or even the principal reason for the rejection of the proposal, the true cause of the hostile vote being a desire on the part of many members of the Council to make the gas profits a source of additional revenue, which was all the more tempting as the Corporation Water Supply has to be largely subsidized from the rates. Taunts levelled by the party of reduction against their opponents, disciples of Mr. John Bright, respecting their practical countenance of the heresies of indirect taxation, as manifested in their willingness to make gas consumers pay an extra portion of the rates, disguised as gas bills, failed to affect the issue, which stands as another instance of the uncertain action of representative bodies.

The Gas Committee of the Middlesbrough Town Council are giving practical effect to their conviction that the depression in trade which has afflicted their town has passed over, by bringing forward a proposal to complete certain extensions of their manufacturing plant which were commenced in 1877, and soon after suspended in consequence of the decrease of consumption which set in towards the close of that year. The supply of gas has been satisfactorily maintained with the old plant up to the present time, but the prospects of the undertaking being the same now, after the interval of diminished production, as they were when the extension was originally contemplated, little opposition to their completion could be made. Although the proposition itself is of local interest, and involves an outlay of about £600 only, the fact of its being brought forward shows the return of a state of things which must give general satisfaction.

The Corporation of Cork City are not altogether satisfied with the provisions of the Bill which is being promoted in the present session of Parliament by the Gas Company, their chief objection being to the initial price which the Company have asked for, although they are quite satisfied with the principle of the sliding scale, with which the Bill will make them acquainted. The dissatisfaction with the proposed price of 4s. 6d. per thousand feet is due to the fact that Mr. G. W. Stevenson, whom the Corporation have called in to advise them in this matter, has stated as his opinion that 3s. 6d. per thousand feet would be quite sufficient to provide for the necessities of the Company. Although not placing implicit faith in any single engineer, the experience which they have had of no less than sixteen engineers, employed by them within the past two years, having taught them caution in this respect, this statement of Mr. Stevenson's has induced the Corporation to join issue with the Gas Company on the question of price, and opposition to the passage of the Bill is consequently threatened, unless the Company give way. An amicable arrangement is hinted at as desirable; but although the Company have fairly stated their own idea as to price, the Corporation, strangely enough, decline to state their views with equal clearness, although the basis upon which those views must have been formed is well known. We should have thought that, under the circumstances, and bearing in mind the dread of costly additions to their already imposing list of professional advisers, which several members of the Corporation expressed when opposition in Parliament was talked of, an understanding between the parties might be as easily brought about before as after a parliamentary conflict.

Arbitration proceedings between the Corporation of Birmingham and the districts of Oldbury and Tipton were resumed last week at the Surveyors Institute, Great George Street, Westminster, before Sir H. A. Hunt, C.B., the Umpire, and Messrs. F. J. Bramwell, C.E., and T. Hawksley, C.E., Arbitrators for the Local Boards and the Corporation respectively, the purpose of the arbitration being to determine, in accordance with the provisions of the Birmingham Corporation Gas Act, 1875, the price to be paid by the districts in question for the distributing apparatus and goodwill of the gas undertaking within the area which they propose to take over, by virtue of a permissive clause in the Act cited. The principle upon which the valuation is to be made was settled by Sir H. A. Hunt in the West Bromwich reference, the award in which case was for £70,750, this sum being the value to the seller (at the date of the service of the notice to purchase) of the subject matter of the purchase to the Staffordshire Company, unenhanced by any advantages resulting from the acquisition of the property by the Birmingham Corporation in 1875. As far as has yet transpired, evidence was taken with the object of ascertaining the value of the mains and distributing plant already in existence, and of the cost of laying an additional main for the separate supply of a certain district, which will be necessarily incurred by the Birmingham Corporation if the two districts are taken away; and also of valuing the free-will, allowing for a prospective increase after the rate of three and a half per cent. While evidence on the last point was being given, Mr. Hawksley remarked that the presence of a reporter was highly objectionable, on the ground that the publication of the evidence before the award was given created local agitation. The reporter accordingly withdrew. Agitation, local or general, is doubtlessly pernicious, and the cause of peace and quietness would be greatly promoted if Mr. Hawksley's opinion were more generally shared by other persons engaged in prosecuting similar inquiries. It might certainly be urged on the other side that the evidence is sometimes more instructive than the judgment; but this, of course, is the bystanders view, and, as such, is not worth consideration.

The Birkenhead Town Council have taken a wise step in deciding to separate the management of their gas and water works, and to appoint a responsible Engineer to take the sole charge of the former. Some opposition was expressed at the meeting of the Council at which the resolution was passed; but, although persevered in to the verge of obstruction, it was eventually overcome. The facts of the case appear to be that the two departments have grown out of the methods of administration which have been in vogue until the present time, and consequently many complaints have arisen, particularly respecting the gas supply. In appointing an Engineer who will be able to put the gas-works on a proper footing, in accordance with modern practice, and keep them up to the increasing requirements of the town, the Council will find that the small increase in salary over that which would be necessary for an inferior official will be an absolute economy in the end, besides being the surest way of making the gas consumers satisfied.

The result of the last year's working of the Liverpool Gas-Fittings Company, Limited, has been highly satisfactory to the Shareholders, and also offers much food for reflection to outsiders. The undertaking is an offshoot of the Liverpool United Gas Company, who used to do a large business in gas-fittings before the disastrous affair of the landing-stage—destroyed by fire caused by the carelessness of a workman, and for which the Gas Company were held responsible—induced the Company to give up a branch of business in which their profits were more restricted than their risk. After this event the Gas Company handed over their fitting business to the newly-formed Limited Company, which was started with a capital of only £10,000 in £1 shares, the dividend upon which, in the fourth year's working, is declared to be ten per cent., with a bonus of one shilling per share, or actually fifteen per cent., free of income-tax. The extent of the Company's business may be inferred from the fact that they paid during the year more than their subscribed capital in salaries and wages alone, while they purchased over £8000 worth of chandeliers and fittings, and closed the year with a stock-in-trade valued at over £4000. We should like to see more of these undertakings fostered by Gas Companies, whose interests would be promoted thereby, without any risk being incurred by the larger body. Of course, in most cases, Gas-Fitting Companies would have to make their own business connection; but although a profit of 15 per cent. in four years is not to be earned everywhere, it should not be difficult in any large town to attract a paying trade to any similar ven-

ture, started with a thoroughly good stock, and working in accord with the local Gas Company.

An important exhibition of gas apparatus is to be opened at Glasgow in September next, which is intended by its promoters—the Council of the Philosophical Society of Glasgow—to excel anything of the kind that has yet been held in any town in the kingdom. Awards are to be given to successful exhibitors, and it is therefore to be hoped that the magnitude of the exhibition and the discrimination of the jurors will conjointly operate in making the honours distributed of so much real value as the nature of such things permits. At least, it is to be expected that the second city of the empire will, if matters are properly managed, get together a valuable representative collection of gas apparatus, which will naturally tend to popularize the use of gas among the public of North Britain. Dr. W. Wallace, Dr. Fergus, and Mr. W. Foulis, C.E., are among the originators of the movement in favour of holding the exhibition, and in their hands the conditions necessary to ensure success will not be neglected, and a strong Working Committee has been formed to make preliminary arrangements forthwith.

An interesting paper, of which we give a report in another column, was recently read before the Society of Arts, by Mr. T. Fletcher, of Warrington, "On the Use of Gaseous Fuel, with Special Reference to its Application to Laboratory Furnaces." Mr. Fletcher fully confirms the statements that have from time to time appeared in the JOURNAL respecting the value of gas as fuel, in a technical sense, and irrespective of its cost, although, as a matter of fact, a comparison between gas, at the usual price at which it is sold in our towns, and solid fuel, for any small or delicate purposes, shows a decided economy to be gained by using the former. Mr. Fletcher speaks with authority on the subject of which he treats, having devoted much labour and skill to the production of a heating burner which should possess certain characteristics of compactness, shortness, and solidity of flame, which he claims to be essential in order to obtain the highest possible duty from the gaseous fuel consumed. He speaks of solid gas-flames eighteen inches in diameter, and of others four feet long, giving heat sufficient for melting cast iron, and by which gold or silver can be refined or porcelain fired with ease, and he highly extols the convenience and rapidity with which the requisite heat can be produced and applied. Mr. Fletcher uses air gas, made by a very simple method of his own devising, as well as coal gas, and this is doubtless convenient enough when the latter cannot be obtained, although the lack of homogeneity—as it may be called for want of a better term—of a mixture of hydrocarbon vapour with air, as compared with a true gas, gives rise to some curious phenomena. Mr. Fletcher is very severe upon the generality of gas-stoves as at present made and sold, and indicates certain lines for improvements, which would, if properly worked out, tend to enhance the popular appreciation of these useful appliances. No doubt gas boilers and cookers are far from being perfect, and any improvement which Mr. Fletcher can introduce will be a decided benefit to the community. We confess, however, to feeling a little dubious about the possibility of getting such a high duty out of ordinary gas as Mr. Fletcher records as his own experience, when he says that he has boiled a gallon of water with one and a half cubic feet of gas. Now, if the water was at 50° Fahr. when he started, it would take 1620 units of heat to raise it to boiling point, and as the heating power of one and a half cubic feet of common gas, calculated from its constituents, is only about 1050 units, it is evident that Mr. Fletcher's arrangement is a very wonderful one indeed, or his gas must have been of an uncommon kind. We should like to hear more about this system of Mr. Fletcher's.

Some misapprehension having been created by the use of the word "competition" in last week's "Circular to Gas Companies," in reference to the recent lamp and burner trials at Birmingham, it is right to state that the makers of the various burners experimented with, were not invited to compete (in the ordinary acceptance of the term) by sending in burners suitable for the *special form of lantern* which had been adopted by the Gas Committee for certain parts of the town. The burners were, in fact, purchased in the usual way, for the Gas Committee, and the results arrived at were from private experiments carried out—as Mr. Hunt stated in his remarks at the last meeting of the Midland Association of Gas Managers—under his direction for the information of his Committee. We would lay special stress on the fact that none of the makers of the burners tried had any knowledge of the experiments being conducted, till the results were made known to the public; and this will qualify the meaning of the word used.

Water and Sanitary Notes.

THE Directors of the Lambeth Water-Works Company, in their report to be presented at the meeting of the Proprietors to-day, make the following statement:—"The Directors are precluded from considering any recommendation for an increase in the dividend, by reason of the agreement entered into with Mr. E. J. Smith, under the proposed 'Metropolis Water-Works Purchase Bill, 1880, in connection with which they have nothing further to report.' During the half year, more than twelve hundred houses and other supplies, estimated eventually to yield an annual water rental of nearly three thousand pounds, have been connected with the Company's works. The capital account shows an expenditure in the past six months of £31,404, making a total of nearly £1,400,000. The water-rents for the half year were £75,022. The dividend proposed is at the rate of $6\frac{1}{2}$ per cent. per annum, absorbing £37,907, and leaving a balance of nearly £4000 to be carried forward. The share capital is certified at £1,182,860.

A mythical story concerning the Government Auditor of the Metropolitan Water Companies has been going about for some time past, and it is to be regretted that Mr. Allen Stoneham did not see fit to contradict the figment when it first obtained currency. Possibly he thought it was so absurd that nobody would believe it. But nevertheless there are people who do believe it, and among the rest is one who writes in the *Echo*, and calls himself "Father Jean." Discussing the subject of the Metropolitan Water Supply, this authority recently made the following assertion:—"Existing defects in supply are so notorious that the Government Auditor states, 'as a remedy, that competing works, to afford a constant and ample supply of pure softened spring water, at high pressure, could be constructed at an outlay of £10,000,000.'" This preposterous story has its origin in a communication from Mr. Jabez Hogg, which appeared in *The Times* of April 5. By an error in the typographical arrangement, a statement made by Mr. Hogg appeared as a quotation from something put on record by the Government Auditor. Hence Mr. Stoneham has the credit of a statement with regard to the water supply which properly rests with Mr. Jabez Hogg. Where the latter obtained his information we do not know.

The report of the District Auditor in reference to the accounts of the Stockton and Middlesbrough Corporations Joint Water Board, created considerable excitement among the members of that body a short time back, Mr. J. Dodds, M.P., a prominent member of the Board, going so far as to propose a resolution declaring that the Auditor's observations were "alike impertinent, unjustifiable, and in excess of his duties." This was felt to be a little too strong, and the Board went no farther than to declare that the Auditor had exceeded his duties, on which point they desired to give him a reminder, so that he might not transgress again. But when the minutes of the Water Board went before the Town Council of Middlesbrough, the tables were unexpectedly turned, the Corporation being thankful, rather than otherwise, to Mr. Radford, the Auditor in question, for the special feature in his report, on account of the extent to which it enlightened them respecting the "fearful sacrifice" at which the water-works were obtained. Taking this view of the case, the Town Council passed a resolution expressing their dissent from the minutes of the Water Board relative to the Auditor's report, and went on to say that they considered themselves "indebted to that gentleman" for the revelations which he had made. Such candour is very creditable to the Corporation, and the whole affair reads like a warning history to those fiery opponents of the London Water Companies who have quarrelled so intensely with the Bill of Sir Richard Cross. In reference to the acquisition of the Stockton and Middlesbrough Water-Works by the Municipal Authorities, Mr. Radford said: "It is much to be regretted that the law and parliamentary proceedings should have been marked with so much hostility. Had more pacific counsels prevailed, a great deal of money would have been saved to the ratepayers." It is, perhaps, a happy thing for the Local Authorities, that their Act "does not give the Auditor the usual powers of disallowance and surcharge." The Auditor says, "I can only report;" but he has done so with good effect, and has the satisfaction of finding his outspokenness approved by the chief Local Authority. But it is too late to repair the loss. At the outset, no expenditure is thought too much in fighting a Water Company; but, when the fray is over, there comes an after-reckoning which may possibly prove unpleasant, as in the Stockton and Middlesbrough case.

A visit has been paid to the Aylesbury drainage works by Captain Hildyard, the Assessor to Mr. Harrison, the Inspector

who recently held the Local Government Board inquiry into the Lower Thames Valley main drainage scheme. The Assessor was accompanied by several Engineers and others interested in the treatment of sewage. The method now in vogue at Aylesbury, and which has been in operation for some time, is the A. B. C. process of the Native Guano Company. Ten tons per week of "native guano" are manufactured at the Aylesbury works, and sell at £3 10s. per ton. That the process can produce an extremely good effluent, was shown some time ago at Crossness, and proof to the same effect appears to be given at Aylesbury. With reference to the Metropolitan sewage, we observe that General Scott is about to make trial of his cement process at the southern outfall, and there is some prospect of a portion of the northern sewage being applied to irrigation purposes, in accordance with a project in which parliamentary powers are being sought, under the title of the Dagenham and District Farmers Sewage Utilization Bill.

A Committee of the Bolton Corporation having visited several large towns for the purpose of inspecting different methods for the treatment of sewage, have reported in favour of precipitation by lime, as being the cheapest and simplest of the precipitation processes. This is the method which has been in operation at Bolton for several years past, supplemented by charcoal and other ingredients, and the Committee see no reason to adopt any change of material; but new works are to be constructed for the purpose of carrying out the lime process more extensively.

The prize of £100 offered by the Royal Agricultural Society for the best-managed sewage farm utilizing the sewage of not more than twenty thousand people, has been adjudicated jointly to the sewage farm of the Corporation of Belfast, managed by Mr. J. H. Collett, and that of Wrexham, farmed by Lieut.-Colonel Alfred S. Jones, V.C. The £100 prize for farms utilizing the sewage of more than twenty thousand people has been adjudicated to the Earl of Warwick, for the Leamington sewage farm, managed, under the direction of Captain Fosbery, the agent of the Earl of Warwick, by Mr. Tough, the bailiff. A special prize of £25 has also been presented to Mr. R. J. Brundell, for his management of the sewage farm at Doncaster. The mortality among the persons living on sundry sewage farms is said not to exceed three per thousand per annum. At the present time there are about a hundred sewage farms in operation in different parts of the country.

The Society of Arts, silent for a time on the Metropolitan Water Question, enjoys an outlet for its eloquence in another direction. In little more than a fortnight's time the Society will hold its annual "Conference on the Progress of Public Health," and several matters in which the public are considerably interested appear in the programme. A resolution is to be discussed with reference to the sanitary inspection and classification of dwellings, including a scheme for the granting of "certificates of healthworthiness" in respect of them. It is stated that the conditions and modes of granting these certificates would be analogous to the practice of the department of Lloyd's Association in granting certificates of class and seaworthiness to the mercantile marine. Accordingly, if this system be adopted, we may read of houses being advertised for sale or for letting as "Classed A 1 for twenty years," and so forth. In all cases where people are entering on the occupation of new premises, even in so ordinary a case as hiring furnished apartments for a few weeks, a trustworthy certificate of healthfulness would save much trouble and anxiety, and the fact that such a certificate was not forthcoming might operate as a useful warning. A demand for something which shall answer this purpose seems maturing in the public mind.

DEATH OF PROFESSOR ANSTED.—Last week we announced the death of a gentleman long connected with the JOURNAL, and to-day we record the loss of another of our contributors—David Thomas Ansted, M.A., F.R.S., F.G.S., F.R.G.S., &c., whose death took place on Thursday, the 13th inst. Professor Ansted has, of late, been an almost constant writer for us on water topics; his long, varied, and practical experience entitling him to be looked upon as quite an authority on these matters. He was frequently called as a witness before Parliamentary Committees on Water Bills, where his thorough acquaintance with the subject on which he treated gave great weight to his evidence. He was also the author of several books and essays, prominent among which is his "Water and Water Supply, chiefly in reference to the British Islands," published the year before last. Professor Ansted, who at the time of his death was 66 years old, at one time held a professorship at Cambridge, and was an acceptable lecturer. He was well known at Woodbridge, where he resided; was a magistrate for the county of Essex, and from time to time took his place on the Woodbridge bench.

EFFLUVIUM NUISANCES.

FOURTH AND LAST ARTICLE.

The manufacture of salts of ammonia from gas liquor occupied much of Dr. Ballard's attention, especially the production of sulphate, which, being the most common use to which the raw material is put, has attracted much notice from inspectors of nuisances in many parts of the kingdom.

Commencing by a reference to the old process, now generally abandoned, of saturating gas liquor with oil of vitriol in a tank, and then evaporating the solution of sulphate in lead-lined shallow tanks until the crystallized sulphate was obtained—both stages of the process being attended with the evolution of sulphuretted hydrogen, which gave rise to very loud and grievous complaints—Dr. Ballard proceeds to give an account of the various modified methods of manufacture which he has seen in use at the present time. In place of adding sulphuric acid directly to the liquor, the practice now is to distil the liquor with or without the addition of lime, and to saturate sulphuric acid with the ammoniacal vapour thus obtained. In some works the distillation is effected by introducing the liquor into a closed vessel, and heating it either by a fire beneath or by steam, superheated or otherwise. After as much ammonia as can be obtained in this way is taken off, milk of lime is introduced into the boiler, or the liquor is transferred to another boiler for this purpose, and the heating is continued until all or nearly all the contained ammonia is distilled off. The remaining contents of the boiler are then run into a tank or pit where the lime is deposited, while the liquid part either drains away or sinks into the earth. In large works an arrangement on the principle of the Coffey still is in use for distilling the gas liquor by the aid of steam, with or without the use of lime; but Dr. Ballard notes as the best method for using lime, a plan according to which the liquor running from the tower still passes into a boiler supplied with milk of lime and heated by a fire or by steam. The steam from this boiler, containing free ammonia from the distillation of the carbonate, is that which is thrown into the tower, and so there pass off by the exit-pipe at the top of the tower, steam, sulphide of ammonium driven out of the descending liquor, and free ammonia, which pass together to the saturator. Dr. Ballard condemns as wasteful the system adopted at some works of not using any lime.

There are several different forms of saturator. In all of them, however, the two things principally provided for are the complete saturation of the acid, and the carrying off of the liberated gases, the chief of which is sulphuretted hydrogen, in such a manner that they shall not be dangerous to the workmen. One form of saturator consists of a close tank, containing sulphuric acid, in the bottom of which lies a perforated pipe which brings the vapours from the still. The gases are taken off by a pipe from the top of the tank, and are variously disposed of. The vapours are passed in continuously until the acid is saturated, when it is run off to be evaporated, generally in a shallow lead-lined pan, by means of a steam coil. As the liquor evaporates, the sulphate becomes deposited in a crystalline form. Offensive steam is given off during the evaporation. Another form of saturator consists of a tank similar to the preceding example, but not completely closed, to which, as the contained acid becomes saturated, frequent additions of strong sulphuric acid are made through a funnel. The evolved gas is drawn off by a fan, or chimney draught. In this case as the solution becomes supersaturated with sulphate the salt falls in crystals, which are drawn out, when thought proper, into another tank, where the crystallization is completed on cooling, the mother liquor which drains off being returned to the saturator for another operation. Another form of saturator is that commonly termed a "fishing-box." It consists of a lead-lined vessel divided into two compartments by a vertical curtain of lead, which does not touch the bottom, but seals itself in the contained liquor. One of these compartments has lower sides than the other, and is open at the top. The other compartment is close, except that it has a pipe in the top to carry off the liberated gases. The perforated vapour-pipe from the still passes to the bottom of the closed compartment. Strong acid is added from time to time as required. The sulphate falls as it is formed, and is ladled out from the open compartment. This is, in Dr. Ballard's opinion, the best form of saturator for preventing the escape of offensive gases into the atmosphere of the works. The pipe which carries the gases off is sometimes taken through a tank of liquor to warm it, or beneath the drying-floor on which the sulphate is laid to drain, and thus a portion of the waste heat is utilized.

Sulphate of ammonia works, when badly designed or carelessly managed, are a most intolerable nuisance, in consequence of the sulphuretted hydrogen mixed with some other offensive hydrocarbons which are evolved in the processes carried on therein. Medical men and the public generally have much dread of the effects of the nuisance on health, in which, however, Dr. Ballard does not bear them out, as he gives a list of the effects commonly observable therefrom, which differ in no essential particular from those due, in his opinion, to the operation of almost any offensive smell.

The sources of nuisance from such works as these may be one or more of the following, viz. :—(1) The reception, transference or storage of the ammoniacal liquor. (2) The escape of offensive gases and vapours in consequence of leakages about the apparatus. (3) Insufficient precautions in disposing of the waste liquor and lime discharged from the still. If these waste matters are discharged while hot, which is customary, the vapours that arise are offensive. If the hot waste is allowed to run into the sewers, nuisance is certain to arise, as was the case recently at Battersea. (4) The discharge of the offensive gases and vapours from the saturator into the air, which forms the most ordinary of the sources of nuisance from sulphate of ammonia works. (5) The evolution of offensive vapours when

the whole contents of a saturator are drawn out into an open tank to cool. (6) The evaporating down of the solution drawn from the saturator, when strong acid is not used.

As to the remedies for these several sources of nuisance, they may be enumerated as follows :—(1) The gas liquor should be kept from exposure to air, by using every available means of covering it while in transit from the gas-works to the place of manufacture, and by keeping the opening of the storage-tank guarded with a purifying-box supplied with hydrated peroxide of iron. (2) Care should be taken that all parts of the apparatus are in good condition and gas-tight. (3) For the prevention of nuisance during the running off of the waste matters from the still, the most important point is that they should be thoroughly exhausted of ammonia. By careful working, the percentage of ammonia remaining may be reduced to about 0.002. The hot waste from the still should always be taken off through a pipe into a close receptacle for deposition of the lime, if any be used, ventilation being provided for by a pipe of sufficient length to condense vaporous matters rising through it. The liquid portion should never, until quite cold, be discharged into a sewer with which house-drains communicate. The removal of the lime deposit should be effected expeditiously, with careful guarding against unnecessary exposure, and covered with earth if deposited in a heap. (4) The liberated gases should either be conducted into a tall chimney-shaft, or should be thoroughly burnt, after having been completely condensed and dried. The burning may, however, result in the production of a fresh nuisance by the formation of sulphurous acid, while the condensed matters are offensive, unless great care be taken to get them cool enough before allowing them to run away. Hence, instead of burning the gases, they may be arrested by oxide of iron purifiers, into which they may be driven by a steam-jet exhauster. The oxide of iron may, of course, be revived in the same way as for gas purification. (5) Nuisance from the fifth source mentioned may be prevented by keeping the cooling-tank covered so long as its contents remain hot enough to give off offensive vapours. (6) During the evaporation of the sulphate solution, steam should be driven through the saturator for 20 minutes or half an hour, after shutting off the ammoniacal liquor, the steam being carried off and condensed in the usual way. This will obviate the nuisance which might otherwise arise.

We may note, in concluding this part of our comments, that all these preventive measures are in operation at one or another of the establishments which Dr. Ballard has visited, and should therefore be readily adopted by other manufacturers who are liable to receive complaints of nuisance from any of the sources to which they refer.

When sal-ammoniac is manufactured from gas liquor by direct decomposition with hydrochloric acid, two methods are in use. By one method the gas liquor is introduced into a tank or vat, either open or partially covered, and hydrochloric acid is run in gradually until saturation is complete; or a system of saturation by ammoniacal vapour, evolved with or without the use of lime, is pursued after the plan previously described for the manufacture of sulphate. The cooling and crystallizing out of the chloride is also done in a similar way as for sulphate. The crude crystals are used in the process of galvanizing iron, but for the production of commercial sal-ammoniac a further process is necessary, which consists in baking the crystals, either in a layer on an open platform, or in a close oven, in which a process of sublimation is carried on. The manufacture of this product is apt to cause great nuisance, even more than in the manufacture of sulphate, unless great care is observed in all the operations involved; yet it is quite possible to conduct it in such a manner that no offence may be caused, by the adoption of similar precautions as before mentioned for sulphate-making. In any case, the method of distillation is to be preferred to that of direct saturation of the crude liquor.

The distillation of tar is another important department of industry which Dr. Ballard has passed under review. The processes carried on at tar-works consist in the distillation of crude coal tar, and in addition, at many large establishments, the subsequent treatment of the distillates for the preparation of benzole, crude carbolic acid, &c., and of crude anthracene. The coal tar, mixed with more or less ammoniacal liquor, is distilled in large iron stills, each of which may contain from 6 tons to 20 or 30 tons, heated from beneath by coal or "dead oil." The products of distillation, after having been condensed, are collected separately, the distillation being fractional. The light oils, which contain benzole and solvent naphtha, first come over, followed by the heavy or creosote oils, which are usually run off in two portions, the first being carbolic oil. Naphthaline also comes over at this stage of the distillation. Then anthracene oil is collected last of all, the remaining contents of the still being pitch. Up to the time of the collection of the anthracene oil no appreciable quantity of permanent gas comes off; but in this last stage, owing to the high temperature—200° to 300° C.—permanent gases are formed, consisting of about two-thirds carburetted hydrogen and one-third sulphuretted hydrogen. In England all the operations of distillation are performed in one still, but in Scotland two stills are used. In the best works the first distillation is effected by throwing in free steam, and the products are all condensed together. The resultant water containing ammonia and the light oils, which are separated by drawing off the former from the bottom and the latter from the top of the receiver. The material left in the still is known as "boiled tar," which is subsequently transferred to other stills for treatment by fire heat for the heavy oils. The tar made at the Scotch gas-works contains but little anthracene or carbolic oil, and the heavy oil is usually sent away at once for pickling timber, and the pitch is used for making asphalt, or for artificial fuel.

Dr. Ballard accords much praise to the arrangements of Messrs.

George Millar and Co.'s tar-works, at Dalmarnock, Glasgow, which he holds up as a model establishment for neatness and complete freedom from offence. At these works plain cylindrical boilers, fired from beneath, are used instead of the usual spherical still, and the charging and discharging of the tar and pitch are conducted in close pipes or conduits. The pitch, after being run out from the still, is allowed to cool in separate chambers before being put into tubs or run into a bay to solidify. The anthracene oil is left to stand, when a solid crystalline deposit of crude anthracene is formed. This crude deposit is separated from the oil by straining, and is then pressed. The other oils are subjected to various processes of redistillation and rectification, for obtaining from them such substances as benzole, solvent naphtha, carbolic acid, &c., which generally form separate trades.

The effluvia from tar-works are sometimes a very considerable nuisance, not only in their immediate neighbourhood, but even at a distance of half a mile or more. The vapours from hot pitch will travel, as a compact white cloud, near the surface of the ground, to great distances, and their pungent, irritating effects are well known, and to many persons they are intensely disagreeable. The only ill effect upon health that Dr. Ballard has heard of is, however, that they sometimes produce headache, giddiness, faintness, nausea, and perhaps some oppression of the breathing, but never anything very serious, or any permanent ill effects.

The ordinary sources from which nuisance may proceed are the following:—(1) Offensive odour of sulphide of ammonium proceeding from the tar when it is received in open barges, and is in course of transference to the store-tanks. (2) The escape into the atmosphere of offensive uncondensed and non-condensable products of distillation. (3) The escape of the vapours of hot pitch. (4) The combustion of creosote oil as fuel for the stills, when the arrangements are defective.

The remedies for these nuisances are briefly as follows:—(1) The tar should always be kept carefully covered, as prescribed for gas-works. (2) The nuisance arising from the discharge of offensive gases and vapours during distillation is to be obviated by the adoption of means to collect these gases, condense such as are condensable, and burn such as are combustible, or otherwise to deal with them chemically. The most perfect means of doing this which Dr. Ballard has observed are those in operation at Messrs. Burt, Boulton, and Haywood's works at Silvertown. From each condenser the condensed and uncondensed matters pass into a receiver having an opening at the top, which, during working, is firmly closed with a faced iron lid. Out of this receiver the condensed liquids are drawn off below to the store-tanks, while the uncondensed gases and vapours are drawn off above by an exhaustor. The gases and vapours from all these receivers are taken off by one exhaust main which leads into two washers, the first arranged on the principle of a Woulffe bottle. After this the gases pass through a third condenser or washer, shaped like a long cylindrical boiler, partly filled with water, through and over which they pass to the outlet-pipe, which terminates in a furnace where this uncondensed portion is consumed. Besides the prevention of nuisance, this exhausting apparatus is profitable in working, according to the manufacturers' statements. (3) The nuisance arising from the pitch vapours can be much controlled by the proper use of the cooling-oven for pitch after it leaves the still, and its consequent emission into the bays only when it is cooled below the point at which vapours can be disengaged. Due retention of the pitch in the cooling-oven is also advantageous to the manufacturers, by the ensuing retention of creosote oils and their incorporation into the body of the pitch, thereby softening it. At many large works the pitch bays are also enclosed. (4) When creosote oils are used as fuel, proper appliances can and should be obtained for their combustion without smoke.

The manufacture of carbolic acid is carried on at the Beckton Gas-Works and at many tar distilleries. The carbolic oil obtained by the distillation of tar, as before mentioned, is the source from which it is obtained. Carbolic oil contains carbolic and cresylic acids mixed with other light and heavy oils in varying proportions, and the first process is designed to separate them from these oils. The carbolic oil is first treated in an iron tank with caustic soda, which dissolves out the carbolic and cresylic acids. The solution is syphoned out into an open lead-lined tank, when sulphuric acid is added. This combines with the soda, and causes the separation of the crude carbolic acid, which is then ladled or syphoned off. The remaining mixture of light and heavy oils is of value, and is subsequently distilled fractionally for the preparation of benzole, &c. The solution of sulphate of soda from the acid tank is thrown away. Carbolic and cresylic acids are prepared from the crude acid by a series of fractional distillations and crystallizations. The residue of the first distillation, which ought to be conducted to dryness, is a light spongy coke, used as fuel. In subsequent distillations an acid comes over which solidifies at a higher temperature than that which results from the first distillation. The products of condensation are collected in numerous small fractions, and are usually received in a series of galvanized iron vessels. When the receivers are cooled, the carbolic acid crystallizes, while the cresylic acid holding some carbolic acid in solution remains liquid. Various subsequent operations are carried on with the object of further refining the acids.

The nuisance caused by the above-described processes chiefly consists of the escape of offensive gases towards the end of those distillations when a coke is produced. This may be avoided by condensing and washing the gases, consuming the non-condensable remainder in a furnace as in former examples.

It is scarcely necessary to enter here into the details of the manufacture of the other products of coal tar, such as benzole, aniline,

&c., which are more or less exclusively chemical businesses, and only very distantly connected with gas-works. Suffice it to say that they are to be found fully discussed in Dr. Ballard's report. With one more notice of a particular trade process intimately connected with the manufacture of gas, this series of articles will terminate. The preparation of "ammonia material" for gas-works consists in the saturation of wood sawdust with sulphuric acid, for the production of a material used at some few gas-works for the separation of ammonia from the crude gas. After the material has been used at the works, it is taken back and subjected to other processes, either for the separation from it of the sulphate of ammonia it then contains, or in order to prepare it in some other way for use by the manufacturers of artificial manures. The sawdust is, in the first place, caused to pass through a covered channel in which a screw works and moves the sawdust into the place where it is stored. As the sawdust passes through the channel, it receives upon it a little stream of sulphuric acid, which blackens it, causing the evolution of acid fumes, consisting of sulphurous and acetic acid. These fumes, being offensive, must be washed and passed into a chimney to finally dispose of them. The material, as it is returned from the gas-works, may contain as much as 50 per cent. of sulphate of ammonia, and from 5 to 10 per cent. of sulphocyanide of ammonium. The material is then baked to drive off the offensive hydrocarbons which it contains, and is afterwards disposed of to the manure manufacturers, who treat it in the ordinary way. When the hydrocarbon gases are drawn off and consumed in a furnace, no appreciable nuisance is caused by the process.

Communicated Article.

EFFECT OF TEMPERATURE IN THE GAS AND AIR SUPPLY UPON THE ILLUMINATING POWER OF GAS-FLAMES.

By Mr. R. H. PATTERSON, F.S.S.

THIRD AND LAST PART.

The experiments made at Munich relative to the effect of the temperature of gas at the point of ignition upon the illuminating power of its flame, were carried both upwards and downwards from the ordinary temperature. As previously described, in my experiments in 1871 I found no difference in the illuminating power of the gas when supplied to the burner at the highest temperature employed at Munich, namely—212° and 288° Fahr. We come now to

THE EFFECTS OF COOLING THE GAS.

The results of cooling the gas below the ordinary temperature at Munich were as follows:—When the U-tube was immersed in snow, so as to bring the temperature of the gas down to 32° Fahr., the illuminating power was found to have fallen from 100 down to a point varying from 75 to 86; in other words, the light was reduced, on the average, to the extent of 20 per cent; and when the temperature of the gas was still further lowered by immersing the U-tube in a mixture of salt and ice (temperature 4° below zero), the illuminating power of the gas-flame was reduced by nearly two-thirds, ranging from 33 to 40, as against its ordinary illuminating power of 100.

The latter temperature (−4° Fahr.) is one to which, in this country, the gas, as supplied to the public, is hardly ever subjected; and although I contemplated doing so, I did not carry the application of cold to this extent. But as regards gas at the freezing point (32° Fahr.), my experiments were made in a very stringent manner; for the gas at this low temperature was tried against gas at the highest temperature employed at Munich. By means of a bye-pass, gas at the freezing point and the same gas at a temperature of 296° Fahr. were supplied alternately to the burner, but without making the slightest difference in the readings of the photometer. The photometer was observed most carefully both myself and by Mr. W. Thompson, and we could not see the slightest difference.

Now, in this case I had expected a different result; not, however, of a kind affecting the real question at issue—viz., the effect of temperature in the gas upon the illuminating power of its flame—but owing to a change in the constitution of the gas itself, which is quite a different matter. Just as a very high heat alters the composition of gas, greatly diminishing its illuminating power, so will extreme cold, from a kindred cause, produce a similar result. In the former case, there is a disintegrating chemical effect produced by excessive heat, occasioning, *inter alia*, a deposit of carbon; in the latter, there is the effect of freezing, by which the water contained in gas in the form of aqueous vapour is separated from the gas in the form of ice, and a portion of the illuminating hydrocarbons are condensed along with it. Neither of these circumstances properly enters into the question as to the effect of temperature at the point of ignition upon the illuminating power of the flame. Nevertheless I had expected that the freezing temperature would have produced a loss of illuminating substance in the gas; and the fact that this did not occur was doubtless owing to the very brief time (possibly not above a moment) that the gas was subjected to the cold. The temperature of 32°, or even a little lower, was fully imparted to the gas, but only for an instant before the gas sprang into flame at the point of ignition.

When results are obtained so discordant as those at Munich and in my own experiments, in which I had the valuable co-operation of Mr. W. Thompson, the position of the case is by no means satisfactory. As regards the heating of the gas, the discordance is not very great; for at Munich, with gas at 212° Fahr., the increase in illuminating power was only 4 per cent., and at 288° Fahr. the increase was 18 per cent. But the discordance when the gas was cooled below the ordinary temperature is very striking; for when the gas

was reduced to 32° Fahr. at Munich, the loss of illuminating power, compared with gas at the ordinary temperature, was from 75 to 86—average 20 per cent.; whereas in my own experiments, when gas at 32° Fahr. was tried against the same gas at 296° Fahr., the disc of the photometer showed no change.

As already stated, I think there can be no question (supposing, of course, that the composition of the gas itself undergoes no change by deposit of illuminating substance) the hotter the gas at the point of ignition the more favourable will its temperature be to effective combustion; and that the lower its temperature the less favourable will it be to intensity of combustion. But the practical point is, is this *tendency* in either case of any appreciable effect? My own experiments showed that it had none. And in the first part of this paper I stated considerations which appear to me to be sufficient to explain the fact as I found it—viz., the ready or instantaneous combustibility of coal gas, whereby the slightest spark of fire at once raises gas to a temperature above 3000° Fahr. In the face of such a temperature in a gas-flame, what effect can be expected from a mere raising of the temperature of the unignited gas from 65° to short of 300° Fahr., or from reducing the temperature from 65° to 32° Fahr.? With such reasonable considerations to support them, I believe in the trustworthiness of the results obtained in my experiments; whereas, without such corroborative considerations, I should not have relied upon them with any confidence in the face of the experiments made at Munich.

The explanation of the great decrease of illuminating power found at Munich when the gas temperature was reduced to 32° Fahr., probably is not the effect of that temperature in the gas upon the combustion and brilliancy of the flame—which is the point at issue—but the loss of illuminating substance in the gas owing to the freezing and deposit of its moisture, which is never condensed by itself, but always along with some portion of the illuminating hydrocarbons.

There is one other point that deserves to be mentioned, although I cannot venture to rate its degree of importance. It is this: We do not know the precise shape and structure of the burner employed in the Munich experiments, but we do know now-a-days, and very clearly, how greatly the illuminating power of gas is affected by the burner. A really good burner—and more or less every burner—does most justice to the gas when the gas is consumed at a particular quantity, in volume, as well as quality. And the *volume* of the gas issuing from the burner would of necessity vary according to its temperature—contracting or expanding in proportion as the temperature is lowered or raised. The same effects, of course, occurred in my own experiments; but whether the different burner employed at Munich had anything to do with the different results then obtained, I cannot say. I hardly think it did; but it is well to state the point.

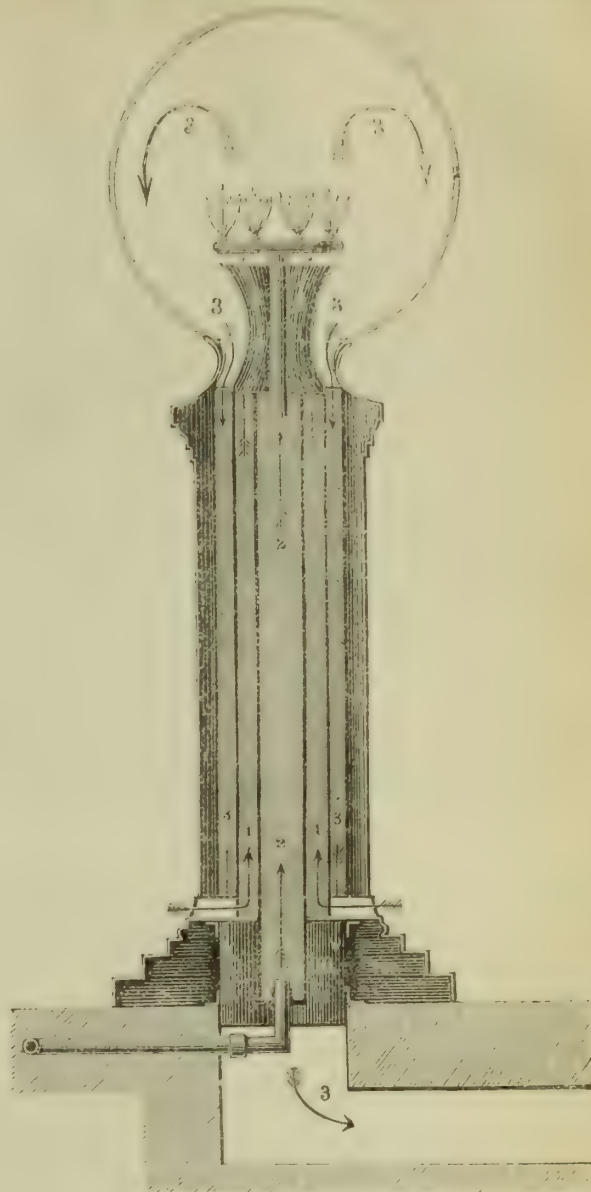
HEATING BOTH THE GAS AND THE AIR.

We now come to Herr Siemens's experiments, described in the JOURNAL for Jan. 13 [see *ante*, p. 60], in which both the gas and the air were heated.

The competition of the electric light, which has given such an impetus to improvements in gas illumination, furnished the motive for these recent experiments by Herr Siemens; but he mentions that he first turned his attention to the subject some 20 years ago, when the advantage of heat-regenerating furnaces became demonstrated; the "hot-blast," which has the same principle, being, of course, of much earlier date. Herr Siemens's first experiments were confined to heating the air supply, and they were so unsuccessful that he deemed his object impossible of attainment. These early experiments were made in the same manner as the Rev. Mr. Bowditch's—namely, by using a double chimney for the Argand, and thereby heating the air before it reached the gas-flame in the inner chimney. Herr Siemens's explanation of his failure is that the heat to which the chimney of the Argand was exposed was so great as to destroy it. But if, as stated by Dr. Letheby, the heat which can thus be imparted to the chimney without necessarily destroying it be as high as 600° Fahr., we should have expected Herr Siemens not to have so readily abandoned his experiments; at least, if he succeeded in obtaining an increase of fully 60 per cent. in the illuminating power of the gas, as was stated by Dr. Letheby.

Subsequently, as his experience of regenerative gas-furnaces was increased, Herr Siemens came to see that a double chimney, or such-like apparatus, was unnecessary, and (he says) actually disadvantageous; and that he could attain his object simply by making use of the *natural currents* of gas and heated air—"by taking advantage of the automatic motion of gas, air, and the products of combustion at different temperatures." Herr Siemens gives diagrams of several different kinds of apparatus for applying this principle; but it will be sufficient here to deal with the principal and apparently the best form of it, appending his description of it.

Variety A is a pillar lamp, which, as may be seen by the drawing, consists of three concentric tubes, surmounted by a glass globe. At the lower part of the globe is an ordinary burner, with six radial flames. All the space in the tubes is filled with wire netting, which I call regenerators, and which serve either to abstract heat from passing gases, or to communicate heat to them. The middle pipe being the gas supply, the air is admitted from below into the second annular pipe, and, passing upwards into the globe, is there burnt with the gas. The products of this combustion pass away down through the annular space of the outermost pipe, into a chimney or aspirator flue. (The arrangement and course of the currents are shown in the drawing.) The wire net regenerators, in the annular space of the outer pipe, are thus heated by the products of combustion as they pass away from the globe, and this effect is specially marked in the upper part of the wirework. The heat thus extracted is communicated by conduction and radiation to the regenerators in the air-pipe, and also through the side to the inside gas-pipe. Air and gas are thus pre-heated, and this pre-heating increases in proportion as the temperature of the flame, increased by the pre-heating of air and gas, increases the temperature of the regenerators in the outer pipe. The increase of



SIEMENS'S LAMP, VARIETY A.

temperature, and consequently of the illuminating power of the flame in the globe, continues until the cooling effect of radiation balances the production of heat.

In short, Herr Siemens places a burner (or several burners) on the top of a pillar consisting of three concentric tubes, all of which are filled with wire gauze, in order to convey heat from the surface of the tubes through the gas and air, intimate contact being indispensable for heating the gas. The central tube conveys the gas to the burners; the next, or middle tube, contains the air supply; and the outermost tube conveys away the products of combustion, which, being at a very high temperature in their downward passage, heat the air and the gas in the two inner tubes. The gas-tube, of course, is carried quite up to the burner, and the air-tube has its outlet close to and immediately beneath the burner; but the top of the outermost tube is a good way below the burner, in order that the products of combustion may descend to it without coming in contact with the air supply and the burning gas.

This is a most ingenious and economical means of heating the air, and in a less degree the gas. But the remarkable thing is, that the products of combustion can in this manner be carried off without damaging the combustion of the flame. It seems almost inconceivable that the products of combustion—the exceedingly hot vapour into which the gas-flame is resolved—should, upon reaching the top of the lantern, immediately turn downward, and, descending around the sides of the lantern, pass freely away down the tube into the open air. No doubt the products of combustion (CO₂) are twice as heavy as common air, and would take such a course if they were cool; but in this case they are in their very hottest and lightest state; and I think the general expectation would have been that, in this lantern of Herr Siemens, the products of combustion would refuse to descend at once, and would linger in the upper part, or indeed all through the lantern, thereby impeding combustion. Of course, if an "exhaust" were employed upon the outermost tube, by which the hot products of combustion are withdrawn from the lantern, the successful working of Herr Siemens's lantern would be readily intelligible; but Herr Siemens makes no mention of an exhaust, and also he states that he relies solely upon the "natural currents." If this be so—and it cannot be doubted after Herr Siemens's statement to that effect—what Herr Siemens has thus accomplished appears to me most valuable, as an example, with reference to the construction of gas-lanterns generally. The obvious inference from Herr Siemens's apparatus is, that it is not necessary to have any outlet at the top for the issue of

the products of combustion; and, accordingly, these hot vapours in their downward course become entirely available for heating the air and gas.

Mr. Sugg, in his lantern patented last year, may be said to have demonstrated a kindred fact (old enough, it is true, as regards oil-lamps)—namely, that it is not necessary to have an inlet at the bottom for the supply of fresh air. It will be seen that both Mr. Sugg's and Herr Siemens's arrangements depend upon the natural or automatic currents of fresh air and the products of combustion, at the different temperatures which they necessarily possess. Mr. Sugg makes his air supply descend around (and without impinging upon) the upward current of the products of combustion, which escape as usual from the top of the lantern; Herr Siemens makes the products of combustion descend around (and without impinging upon) the fresh air and burning gas. Mr. Sugg, in fact, closes the bottom of the lantern, and Herr Siemens closes the top. The former of these arrangements is perfectly intelligible; but, *a priori*, I should have been incredulous as to the practical possibility of the latter. As regards Mr. Sugg's lantern, it has always seemed to me that the greatest difficulty in constructing large gas-burners—or at least the defect which has most to be guarded against—is the strong upward rush of air from below; and now that Mr. Sugg has proved that the bottom of the gas-lantern can be entirely closed, and the air admitted downwards from the top, a most valuable onward step has been accomplished in the use of gas for high degrees of illumination.

The economy of Herr Siemens's heat-regenerative gas-lamps consists in heating both the air and the gas by means of the products of combustion; and, further, except by the means which he has employed, it appears impossible that the heat can be applied so close to the point of ignition as to be of any use; for the air, and still more the gas, very quickly lose the heat imparted to them, especially when they are in the small quantity requisite for gas-lamps.

The most novel and interesting feature of Herr Siemens's lamp lies in its fundamental principle—viz., the utilization of the natural currents within the lamp. Therefore I shall quote the explanation which the inventor gives of the matter:—

It is necessary to explain the fact that the highly-heated products of combustion, rising upwards in the globe, turn therein and pass away downwards, without affecting the flame or the air supply. This is explained by the rising flame taking the hottest passage in the middle of the globe, while the combustion products, in passing off, naturally take the coolest way, along the inner surface of the globe. . . . In variety A, the flame and its products rise straight upwards, the gases produced being hot, and of small specific gravity. At the top of the globe they encounter a natural obstacle and turn downwards, unless this movement has been previously induced by the action of the draught. As, however, the hot gases or combustion products have little inclination to move downwards, they will, when compelled to do so, take the coolest way—viz., past the inner surface of the globe. The upward and downward currents in the ball keep as widely separated from each other as possible. The peculiar effects of the automatic currents are also shown quite as favourably in the regenerators of variety A. The downward currents of the hot combustion products always take the coolest way, their specific gravity being greatest there. The upward currents of hot air, on the contrary, take the hottest course. The consequence is that regenerators are always uniformly heated in horizontal layers. The stream moving downwards, as well as the one moving upwards, always tends to keep as near as possible to the surface of the pipe by which they are separated, because directly on the surface of this pipe is to be found the heating influence for the rising current, and the cooling influence for the downward current. With this arrangement the exchange of heat is, therefore, as complete as possible.

Herr Siemens has not ascertained what is the temperature which the flame thus attains. Of course, the sole cause of the increase of light is the increased intensity of the flame, or the gas combustion; and the heat must be a sore trial to the glass globes. Herr Siemens says: "Although only the flame, not the products of combustion, radiates heat [that is, imparts heat without actual contact], yet the glass is made very hot, and is easily cracked. To avoid this, I harden the glass so as almost to entirely overcome its tendency to fracture." This statement suggests a remark relative to his early and abortive experiments in heating the air supply by means of an Argand with a double chimney. He states (as I understand him) that he found success impossible in those early experiments, owing to the inability of the glass to withstand the high heat. Now, while fully admitting that his present apparatus is far more ingenious, and also much more efficient for its purpose, than the double Argand, although much less simple and readily available, the question arises, Could not the glass of the Argand, by his annealing process, be made to resist fracture equally with his new globes? If not, this must be owing, partly at least, to the temperature *within* being greater in the case of the double Argand than in his present globe. But if the internal temperature in the former case be higher than that in the latter, the intensity of the flame in the Argand should likewise be greater, and the amount of light also greater. No doubt it is probable that, owing to the larger size of Herr Siemens's globe, the glass is less directly affected by the radiating heat from the flame. On the other hand, since the highly heated gases of combustion are retained in his globe, while they escape from the Argand, all the heat except that radiated by the flame should be less in the latter than in the former.

Herr Siemens states the temperature of an ordinary gas-flame to be 1600° C., and he conjecturally estimates the temperature of the electric light at 1800° C.—these figures being equivalent respectively to 2953° and 3272° Fahr., and he says that another 100° C. added to the temperature of the gas-flame "would make a very great difference in the illuminating power." This is a very reasonable inference; but Herr Siemens has not yet ascertained whether the fact is actually so.

I may remark that 1600° C. (although probably correct) is a lower temperature for a gas-flame than might be inferred from the state-

ments of some other authorities. Some authorities state the temperature of the Bunsen burner at 1800° C. (3272° Fahr.); and in experiments which I have made, by melting metal wire in the flames, I found that a gas-flame possessed a higher temperature than that of the Bunsen burner—I sometimes succeeded in melting a piece of platinum wire in a flat-flame burner (and the heat of an Argand is probably higher), although I failed to do this in a Bunsen flame. This result appears to me to be partially supported by the fact that in the Bunsen burner the gas is largely intermingled with air; and although this circumstance will certainly give an intimate supply of oxygen to the gas-stream, it will also throw into the body of the flame a large quantity of incombustible nitrogen, which, by becoming equally heated with the flame, will tend to cool it by absorbing heat from the burning gas. But the general opinion is quite the other way; and, so far as I see, the facts of the case have to be ascertained as well as explained.

The Increase of Light.

The last and most important point is the increase of light which is obtained from the heating of the air and gas in Herr Siemens's lamp. The claim which he urges upon this point may well make the reader stand aghast. He says: "As regards the intensity of the light, I can safely state that it is at least *six times greater* than in ordinary gas-burners; but the exact determination of this I leave to more skilled observers. I may, however, point out that the power of the light at present produced is no criterion of the future development of my system, since the apparatus is still incomplete, and the intensity will be found to vary in different arrangements." An increase of 600 per cent. from heating the gas and air! and a further increase expected by-and-by! Herr Siemens feels confident that the increase of light from the gas is sixfold, but he does not say that he submitted his lamp to testings for illuminating power. And until this is done, I for one positively decline to believe in the result here claimed. As previously pointed out, even the 67 per cent. of increase shown by Dr. Letheby's experiments rested upon only one complete testing. But what is 67 per cent. to "at least" 600 per cent.? It is also a warning fact that Dr. Letheby obtained no increase of illuminating power when operating upon common gas. Herr Siemens does not state the quality of gas which he employed in his lamp; but, whether it were cannel or common, I wholly decline (in the present state of the question) to believe that a sixfold increase of illuminating power, or anything like it, was obtained or is obtainable by heating the gas and the air in the process of gas-combustion.

Is it the Hot Air or the Hot Gas?

Mr. Bowditch, followed by Drs. Frankland and Letheby, heated the air supply to the flame, but not the gas itself. Herr Siemens heats both; and he claims a tenfold increase compared with that obtained (somewhat doubtfully) by Dr. Letheby. Now, in Herr Siemens's experiments, what is due to the hot air, and what to the hot gas? This is a point which he could readily determine; and its determination would serve most usefully as a guide both to others and to himself in the further development of his system which he contemplates. That heating the air supply promotes intensity of combustion, I have no doubt; but I have great doubts as to whether, as a practical matter, heating the gas makes any appreciable difference. I doubt very much whether Herr Siemens's lamp heats the gas up to 300° Fahr., and, until the opposite is proved, I must believe that such a temperature in the gas before ignition will make no difference, considering that on ignition the gas at once attains a temperature of upwards of 3000° Fahr., if not still higher.

There is one characteristic of the Siemens lamp which must be favourable to intensity of combustion—namely, the fact that the burner itself is highly heated, and from another source than the gas-flame; a point which I have treated at length in my Second Part. Nevertheless, throwing this into the bargain, I shall await correct experiments with the Siemens lamp with great interest, but with no small incredulity as to the results at present claimed for it.

The Wigham Triform Burner.

It is only fair to state that the first application, in a practical form, of heating the air and gas was made by Mr. Wigham, of Dublin, in his large triform and quadriform burners for lighthouses. Mr. Wigham deserves the credit of having been the first to successfully construct a really large gas-burner; and further, as regards a combination of jets or flat-flame burners, the Wigham Burner of 1870 utterly eclipses the small combinations of such burners which have recently been acquiring notoriety. What are three or four flat-flame burners placed together in a lantern compared with 100 of such jets, with their flames combined, as in the Wigham burner of ten years ago?

When reporting upon Mr. Wigham's triform burner—which consists of three of his burners placed in a tier—Professor Tyndall and others state that there is a distinct superiority of illuminating power in the upper burners—those that are supplied with heated air, which passes through the undermost burner; but they do not venture to estimate the precise degree of this superiority. Had it been 500 per cent., or even 100 per cent., I am sure they would have said more about it.

WARRINGTON AND THE LIVERPOOL CORPORATION (VYRWY) WATER SCHEME.—A statutory meeting of owners and ratepayers of Warrington was held last Wednesday, at which a resolution was passed approving of the Town Council's proceedings on the 4th inst., when it was agreed to oppose the Bill of the Liverpool Corporation to carry out the Vyrwy water scheme. The main object they have is to prevent the laying of water-mains in the bed of the Mersey, as they are of opinion that it may impede the navigation of the river, and they consider it desirable that the mains should be laid some distance below the bed. Another object they have in view is to obtain clauses in the Bill so that Warrington may, if they wish, be supplied with water from the same source.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

CORPORATION MANAGEMENT OF GAS UNDERTAKINGS.

SIR,—Approving as I do most thoroughly of the principle you have so constantly enunciated, that gas profits should be for gas consumers, it has often appeared strange to me that you have never enforced your arguments by reference to what is perhaps the most uncompromising example of that policy. I am prompted by your observations in the "Circular to Gas Companies" in your last publication, to ask you to allow me to supply the omission.

Five years ago, when I entered upon my duties in Leeds, I found that profits accruing from the business had been uniformly handed over to the borough fund, whilst at that particular time a very large deficit on the year 1874 was owing to the same. The profits of 1876, however, sufficed to clear off this indebtedness, and the account once squared, I was delighted to find that my Committee, almost to a man, were favourable to what I think I may fairly designate as the *free trade* principle.

The result has been eminently satisfactory, as the following statement of the prices charged for gas will show:—

Year ending June 30, 1876	3s. 9d. per 1000 feet.
" " 1877	3 3 "
" " 1878	2 9 "
" " 1879	2 6 "
" " 1880	2 2 "

And I see no reason why further reductions should not, year by year, be made for some time to come.

At the commencement of each financial year my Committee instructed me to prepare an estimate of probable income and expenditure. In preparing that estimate, it is my duty to avoid a balance if possible (large balances being considered by my Committee as bad financing), and so I anticipate all such matters as increased business, altered values of material bought or sold, reduction of leakage, improved carbonization, &c., with the object of reducing the price to the lowest figure. And although, notwithstanding every effort to avoid them, large balances of profit have resulted, my zest in pursuance of the policy is such, that I am hopeful of limiting them in process of time to something inconsiderable. I contend that this principle is just and equitable as well as expedient.

Gas consumers, whose interests are in the hands of companies, have a vested interest in all the improvements which have been effected at their (the consumers) charge. Antiquated directors, managers, or apparatus—or, perhaps, all three combined—may have inflicted a very heavy tax upon them in the past, and it is, therefore, only fair that those who have borne the brunt of disastrous combinations, should be entitled to receive the prospective gains of better knowledge, skill, and appliances.

It is often contended that the ratepayers having incurred the liability in relation to capital, are entitled to appropriate the profits. The argument, in my opinion, is most illusory. Let me put a case in point. The capital of a corporation gas undertaking is £100,000; the profit, after paying interest, £10,000. The ratepayers of to-day pay, say, 1 per cent. on the capital to a sinking-fund—£1000—in aid of posterity, and appropriate the £9000. Meanwhile the business is increasing, and the capital is being augmented at a rate probably exceeding threefold the amount of the sinking-fund. As a consequence of this policy, the price is high, and gas is the more assailable by competition, while the liability of the ratepayer of the future is ever increasing. Now there is no reason whatever in the arguments of the ratepayers advocates, unless it is conceded that gas may be superseded. Yet there are many places where gas—which might be made almost as necessary, and, therefore, as invulnerable as coal—is being subjected to competition by being kept at a high price, and the interests of future ratepayers jeopardized by the very process designed to protect them.

Leeds, May 21, 1880.

HENRY WOODALL.

ON THE EFFECTS OF HEAT IN RAREFYING GAS IN BURNERS.

SIR,—“Willing to Learn” overlooks what appears to me the chief fact and element in the question. The lighter the specific gravity of a gas, the more readily does it ascend, or pass through an orifice in any direction. In other words, a larger volume of a light gas will pass through an orifice, within a given time, than of a heavy one; the explanation being, that there is less matter within any given volume of the lighter gas.

Now, the gas within the burner being heated, expands, acquiring a lighter specific gravity; so that, the pressure behind remaining the same (*i.e.*, the pressure from the main), a larger volume of this lighter and thinner gas will issue from the burner than would occur if the gas remained cool, denser, and heavier.

That no more gas can issue from a burner than enters it needs hardly be said; but if the gas be expanded *within the burner*, while the supply or pressure from behind remains as before, the gas must issue in larger volume, and also, or therefore, with increased velocity. At least, so the case appears to me.

For illustration:—Take a tube through which water is flowing, and apply heat to the tube near the outlet, so as to vaporize, or convert into steam, the water or a part of it. Undoubtedly the steam (the expanded and vaporized water) will issue in larger volume, and therefore with greater velocity than water would do. Of course it issues also possessed of greater pressure. A cork which would stop the flow of water would be blown out when the water is expanded and converted into steam.

Further, as is well known, the poorer the quality of a gas—*i.e.*, the thinner and lighter it is—the more damaging is the effect of pressure or velocity of issue upon its illuminating power.

I may take the liberty to add that, were it usual to do so, “Willing to Learn” is precisely the motto which I should desire to prefix to the papers I am now writing. I am endeavouring to arrive at correct conclusions upon some matters of combined practical and theoretical

interest to the gas profession. It may be easy to form an opinion upon a single set of facts, or on one separate view of the case; but it is no easy matter to see that all the facts are set forth and collectively taken into consideration. This will be found especially true as regards the article which will appear next week; and I shall be thankful for the opinions and knowledge of others upon the (to me puzzling) phenomena, with which I shall deal as I best can.

R. H. PATTERSON.

May 22, 1880.

SIR,—We have noticed the inquiry of “Willing to Learn,” in your issue of May 18, and we think he has not sufficiently studied the question in relation to different descriptions of gas-burners. His letter seems to imply that he is thinking only of burners having a larger orifice at the base (through which the gas is admitted) than at the outlet, or point of ignition; and if so, he would be probably correct in his conclusion. But it has been now for many years recognized that the law for burning gas economically is to have a larger *outlet* at the burning point than *inlet* at the base of the burner, so that the pressure is greatly reduced before it arrives at the point of ignition; and this law holds good both with Argand and flat-flame burners, which is evidenced by the fact that the area of the orifice at the burning point in Brönner’s burner is many times larger than the area of the orifice at the inlet of the burner. So with the “London” Argand, the combined area of the orifices at the top or burning point is also many times larger than the combined area of the three small tubes supplying gas to the body of the burner. It therefore follows that the gas has plenty of room to expand in the chamber of the burner, and the pressure is consequently reduced to a very low one at the burning point; and “the pressure in the burner” is not (as “Willing to Learn” puts it) “greater than the pressure of the gas entering the burner,” but, on the contrary, many times less.

There is another point in Mr. Patterson’s article with which we entirely concur. It will be found in your last issue, p. 751, under the heading, “Effect of Non-Conducting Burners on Illuminating Power,” where he says “the steatite abstracts less heat from the flame than the metal does.” This is so to such an extent that it is possible with Brönner’s burners to take hold of them firmly between the fingers while burning, quite close up to the steatite top. The temperature of the body of the burner, which is of brass, is scarcely warm; and, indeed, the lower part of the burner is actually cool. The steatite top, however, is intensely hot, which does not bear out Mr. Patterson, that it, the *steatite*, keeps itself cool; but, as it appears to us, being a bad conductor and a good absorbent of heat, it retains the heat within itself, and does not allow it to extend to the body of the burner.

155, Cannon Street, E.C., May 22, 1880. HENRY GREENE AND SON.

PUMPING GAS AT BECKTON.

SIR,—We learn from Mr. Trewby’s letter, published in the JOURNAL of the 18th inst., p. 752, “that I do not pretend, nor am I fool enough to claim, the slightest novelty for the arrangement specified, as it is just what any engineer would stipulate for, considering the circumstances of the case.” Now, Sir, if you will refer to your JOURNAL of the 20th of April, p. 590, you will find that the system was described as a “novelty,” and “the whole arrangement was designed by Mr. G. C. Trewby.” Our letters were written to correct this statement.

The patent of Mr. John Beale, to which Mr. Trewby refers, was for a *steam-engine*, and has nothing to do with the arrangement now referred to.

Mr. Trewby does not notice our statement that a *fac simile* of the plan described as a “novelty,” and his “design,” was engraved and explained in our “Gas Catalogue” of 1877, a copy of which was sent to him at the time (long prior to the specification of 1879, written by himself, to which he refers). He ignores also the fact that we had *erected prior to that date* our new patented steady machines at Liverpool, Bromley, &c.

We do claim to be the first to see the necessity for the use of absolutely steady gas exhausting and pumping machinery, capable of conveying gas from one station to another (or to distances), and to have *invented a perfect system of accomplishing these objects, which has never hitherto been done.*

Essex Street Works, Strand, W.C., May 24, 1880. Gwynne and Co.

MR. SUGG AND THE HOLLOW-TOP BURNER, Etc.

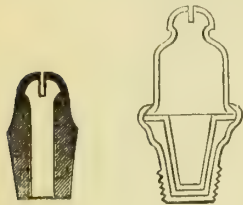
SIR,—Though Mr. Sugg’s beginning of this controversy with a two-column letter gives me the right, by your favour, to have the last word, I should not have availed myself of the privilege had not he introduced into his last letter a sworn “declaration,” which he gives as evidence in support of his oft-repeated statement that he was the inventor of the hollow-top burner, so called by him. As I have had something to say on this subject before, and have often been asked by gas engineers and others what are the recorded facts relating to the invention of this burner, and as it is a matter of historical interest, I will supply proof of who were the inventors.

In passing I may say, what I have often said before, that whoever is entitled to the honour of originating it, I claim none of it; I am simply an improver of it. I patented a new and improved mode of manufacturing it in my own plastic material, “enamel,” in 1877. In January, 1879, I greatly enlarged its capacity and lighting power, as is well known; and for a purpose that has now become notorious, Mr. Sugg paid me the compliment—such as it is—of copying these enlarged and improved burners for use at Birmingham. As I have previously shown that Mr. Sugg did not patent these improvements, as he said he did, nor mention the burner in any patent in 1874, the above may be taken as my established position in reference to this burner; and whether Brown, Jones, or Robinson invented it, it makes no matter to me, except as one connected with gas matters, and interested in seeing honour given where it is due.

If there could be no invention shown prior to the earliest date Mr. Sugg has fixed upon when he made his historic model, the making of the model would not alone entitle him to the credit he claims. It is he who by his own efforts first made a success who is entitled to the credit, and not the man with the invention in a chrysalis state. Mr. Sugg does not claim to have done more than make a model, and that it now ap-

pears was not in "1873," "about 1873," nor "1872," but, according to the sworn testimony, the date was 1868. I will now show that the burner was patented in 1860, and that will dispose of Mr. Sugg's statement that Mr. John Goodson made, by his instruction, the "model for the first hollow-top burner."

This will be seen from the engravings which I send herewith. The small one is a copy of fig. 1, and the larger one a copy of fig. 2, of the filed drawings of patent No. 2574 of 1860.



Those who know my slit-unions, and the excellent burners of the same kind made in steatite by the Germans, from whom Mr. Sugg procures his, and terms them the hollow-top, will at once see that these are the same as those shown in the engraving. The small engraving shows a burner made out of solid material, and the head is chambered or hollowed out by a specially-made tool. The larger engraving shows the same burner (with

additions) made out of sheet metal. Referring to burners made out of solid material, the specification says: "Our improvements consist in causing the internal cavity or canal of the stem, pipe, or tube of the burner to terminate towards the apex of the burner in a small bulb or enlargement of the cavity." The improvements in "sheet metal burners consist in narrowing the pipe, stem, or tube of the burner a little below the apex, so as to form a neck or contracted passage, above which, and between the orifices or orifice through which the gas passes for combustion, the upper part of the burner is formed into a small bulb or hollow chamber or cavity." The patentees were the Brothers Wadsworth, and the manufacturers, who have been supplying the burners ever since, are Messrs. Ralph Heaton and Sons, the Mint, Birmingham. In 1868, the last change of time at which Mr. Sugg says his man made "the model for the first hollow-top burner," millions of the burners were in existence, and were to be found in not less than half the gas-fitters shops in the kingdom. This patent puts a difficulty in the way of Mr. Sugg's claim, which I leave him to remove.

And now, Sir, pardon me for trespassing for a line or two more on the lamp question, and then my disagreeable task is finished. Mr. Sugg says in his last letter, alluding to myself, "If you read his letters you will see that he does not dispute my position—that in all points in which our lanterns are similar, either I or some other person has anticipated him." This is a characteristically vague statement, and without pretending to know what it means, I will say that whenever he has ventured to make a specific statement I have not only disputed his "position," but have in every case made him change it; and, if I had changed mine as often as he has changed his, I should have considered that I had no position left worth keeping, and that the less said about those I had occupied the better. I will now state that my two patents are the result of six months of wearying experiment—first in the laboratory and then outside; 50 feet from the ground I experimented to secure efficiency in atmospheric commotions; and step by step the apparatus was built up, each part being experimented with until it was made to answer the purpose required. There is not a feature that is essential to the apparatus, or that is patented, for which I am indebted to any person, or that is not new for the purpose to which it has been applied. That my apparatus was properly conceived and carried out is proved by the fact that, though last in the field, it has distanced all competitors in fair fight.

I thank you for the patience and courtesy you have shown to me during this controversy.

Blackman Lane, Leeds, May 22, 1880.

G. BRAY.

THE FORMATION OF NAPHTHALINE.

SIR,—As the proceedings of the Southern District Association of Gas Engineers and Managers, at their meeting on the 13th inst., have been reported in the JOURNAL, I should like to correct a remark I made in the discussion, the erroneous nature of which will be apparent to any chemist reading the report—viz., the statement in reference to the hydrocarbons contained in gas, that "they are all homologues of the radical CH_2 ." This is, of course, only true of the gaseous hydrocarbons of the olefant series, and not of the hydrocarbon vapours in suspension, these belonging to the benzol class, C_6H_6 .

Dr. Max Zäugerle, in his "Lehrbuch der Chemie," regards naphthaline (C_{10}H_8) as a derivative of benzol, in which two atoms of hydrogen are displaced by the bi-valent group C_4H_4 (diacetylen), in accordance with the following diagram:—



According to this, naphthaline consists of two benzol groups having two of their atoms of carbon in common one with the other, and may be expressed by the formula $\text{C}_2 \left\{ \begin{array}{l} \text{C}_4\text{H}_4 \\ \text{C}_6\text{H}_6 \end{array} \right.$

It would be interesting to know the opinion of some of our own chemists in regard to this point, for if this view be correct, it would appear probable that naphthaline is formed during the process of cooling by the breaking up of some of the hydrocarbons—possibly acetylen (C_2H_2)—and the association of their atoms of carbon with benzol groups as shown above.

Gas-Works, Peterborough, May 21, 1880.

G. E. STEVENSON.

BOLTON CORPORATION GAS SUPPLY.—In the course of a discussion, at the last meeting of the Bolton Town Council, as to the price paid for certain land purchased for an extension of the gas-works, the Chairman of the Gas Committee (Alderman Moscrop) stated that five years ago the maximum quantity of gas made in the day of 24 hours was 2,655,000 cubic feet. Since that period not an additional yard of land had been taken to extend the works, yet on the 17th of January this year the maximum consumption of gas was not less than 3,267,000 cubic feet, or an increase on that of five years ago of 23 per cent.

Miscellaneous News.

PRESENTATION TO MR. CORBET WOODALL.

On Thursday evening last a gathering of a very interesting character took place at the Vauxhall works of the late Phoenix Company. In response to the invitation of Mr. Corbet Woodall, all the men employed at the Bankside and Vauxhall stations who could be spared from their duties, some 500 in number, together with the officers of the engineering and distributing staffs, assembled in a marquee which had been erected on the works for the purpose, and partook of an excellently served "knife and fork" tea. A concert was afterwards given in a large room adjoining, which had been tastefully decorated for the occasion. In the course of the evening, Mr. Woodall took occasion to say that he did not like to leave the men, with whom he had worked pleasantly for a good many years, without an opportunity of saying good-bye to them collectively. He paid a cordial tribute to the general good conduct and loyalty of the men, and also to the considerate treatment which had always been accorded to them by the late Phoenix Board. He expressed confidence in the happy future of the Company and its employees, and urged the latter to increased personal interest in the success of the undertaking.

Mr. J. F. Braidwood, the Superintendent of the Vauxhall station, then expressed the regret which was generally felt at Mr. Woodall's withdrawal from the Company, and the respect and esteem in which he was held. In the name of those assembled, he presented him with a set of beautiful silver epergnes, and a bracelet for Mrs. Woodall, and, amid hearty cheers, wished him and his family much happiness and prosperity in the future.

Among other changes consequent upon the amalgamation, Mr. Braidwood, who has been Mr. Woodall's assistant for eight years, and during the greater part of that time resident at Vauxhall, is appointed Engineer to the Greenwich station of the Company. To him also, on his removal from them, the men and officers of the works presented a token of their goodwill in the form of a silver tea-service.

The proceedings were marked throughout by great heartiness and cordiality, and indicated a spirit between masters and men which we should be glad to see generally prevalent.

THE USE OF GASEOUS FUEL.

At the Meeting of the Society of Arts on Wednesday, the 28th ult.—Lord A. S. CHURCHILL in the chair—a paper was read by Mr. T. Fletcher, of Warrington, "On the Use of Gaseous Fuel, with Special Reference to its Application to Laboratory Furnaces." It was as follows:—

The first point to be considered is the special nature of the fuel. It must be understood that my remarks apply, in many points, equally to the ordinary gas, as made from coal, for lighting purposes, and also to air charged with the vapour of the lighter petroleum and other hydrocarbons. When gas is made from coal, a part only of the coal is volatilized and converted into gas. To get an idea of the actual fuel value of ordinary gas, I will take the results as obtained at the Manchester Gas-Works, where a mixture of 75 per cent. of cannel and 25 per cent. of coal is used. From one ton of this mixture the residue is about 13 cwt. of coke, 13 gallons of tar, and 25 gallons of ammonia liquor. The gas produced measures 10,000 cubic feet, which, if reduced to the solid form again, would weigh about 350 lbs. If we calculate this at, say, 1s. 2d. per cwt., which is a liberal allowance for its fuel value, we get the working value of gas as a fuel at about 4d. per 1000 cubic feet. The actual cost of the gas as delivered into the mains, including the labour, fuel, and materials used, is about 1s. 1d. or 1s. 2d. per 1000 feet. When these figures are compared with the cost of gas to the consumer, the difference is startling, and the fact is brought pretty forcibly to our minds that we have an excessively costly fuel to deal with.

In actual use, and when burnt with proper attention to details, it is not even so costly a fuel as coal for work which requires heat on a comparatively small scale and at intervals; in fact, for most of the work to be done in small laboratories, and also for cooking purposes, it has proved itself to be a cheaper fuel than coal or coke, owing not only to the fact that every cubic foot of gas burnt may be made to render its full duty, but also when the necessary work is done the expense is instantly stopped.

Gasoline, benzoline, and petroleum, which are hydrocarbons, are all practically the same as coal gas in composition, varying only from each other in the temperature at which they begin to give off inflammable vapour. If we take them weight for weight with gas, a simple calculation shows them to be worth, as fuel, about 10½d. per gallon, coal gas being 3s. 6d. per 1000 cubic feet, one gallon being about equal in fuel value to 250 feet of gas.

It must be clearly understood, in referring to the comparative cost of the liquid hydrocarbons, that the value, as compared with coal gas, is only true when they are burnt as gas or vapour. When used as spray with steam, or a cold-air blast, the cost is very greatly increased, owing to the large quantity which is mechanically carried into what is practically a bath of carbonic acid gas, in or at the back of the fire, and which partially or entirely prevents its combustion. The duty obtained in spray furnaces is exceedingly low, and they are—so far as my experience enables me to judge—most costly and wasteful of fuel, unless a hot-blast is used, so as to entirely vaporize the liquid before it begins to burn.

The figures I give are necessarily vague. Gas varies in quality, not only in every town, but also to a limited extent in the same town from day to day, and any exact figures for one place would not be correct for another. I simply give a rough idea of the fuel we have to do with, as regards its practical value. When we consider the cost of gaseous fuel, it becomes of serious importance that the method of burning, so as to obtain a high duty, requires careful study.

So much has already been done, that gas, even at its present high price, may be fairly considered a cheap fuel, both for workshops and domestic use.

Before saying anything as to the flame to be used in furnace burners, I will explain the material used to retain the heat, and without which I believe it would be impossible to obtain many of the results which I will at the conclusion show you. It certainly would be impossible to obtain them without a very greatly increased consumption of gas. The material of which all the furnace casings I have here to-night are made, is produced by a process patented by myself some years ago. It is a mixture of one part of refractory fire-clay or ganister, and from three to six parts of sawdust, the proportions being taken dry, by bulk. These are mixed, preferably with rice-flour paste, but water may be used for the heavier varieties, until slightly cohesive, rammed into moulds, and fired in an open kiln, with free access of air, so as to burn the sawdust out. The result is a cellular clay, similar in texture to bread, and which retains the heat so perfectly that I can, in this casing, which is only one inch thick, melt a crucible full of cast iron, and then take the whole in my bare hands and carry it about.

It will probably be better at once to explain the mode of making air gas from benzoline or petroleum spirit, as my future remarks, except, perhaps, for blowpipe use, will include both air gas made from spirit

petroleum, and also coal gas. I find, with my more recent pattern of burners for both draught and blast furnaces, that coal gas and air gas may be used interchangeably, and for many of the more delicate purposes I prefer the air gas, as being free from sulphur. The generator which I now show you contains a layer of spirit petroleum at the bottom. In this the ends of cotton screens stretched on wire are immersed, the spirit is absorbed and carried by capillary attraction up the cotton, exposing a large surface of spirit to the air which is blown through. To perfectly saturate the air with the vapour, the box is divided lengthways in such a manner that the air passes backwards and forwards four times the length of the box, and in traversing this distance has to pass through 32 cotton screens, each about 5 inches square. A similar arrangement is used by the Sun and Alpha air gas apparatuses, these having also a mechanical blowing arrangement. They are, however, excessively costly for furnace work, having complicated and bulky parts, totally unnecessary except for lighting purposes.

Before going further, I must set right one great misconception with regard to the heat obtained from a gas-flame. Many people imagine that a Bunsen, or blue smokeless flame, gives a larger quantity of heat than an illuminating flame. This is not the case. If the gas is equally well burnt, the total amount of heat from each is precisely the same, but the heat differs in one most important point in character.

The radiated heat—i.e., that which travels in straight lines in all directions from the flame, and which makes the pleasant feeling of a bright fire—is far greater in quantity from an illuminating flame than from a blue one. If we want to cook a joint of meat by gas, and get the same satisfactory result as when roasted before an open fire, we use the direct radiated heat from illuminating flames placed over the meat and inside the oven. If, without altering anything else, we convert the illuminating flame into a blue one, by mixing air with the gas before burning, our cooking is practically at an end; the radiated heat disappears almost entirely, and, to get any result, we must now put the meat over the flame, and bake instead of roast it. As you see, the hand may be held almost in contact with a non-illuminating flame, obtained by burning a mixture of gas and air. When I stop the air supply, the radiated heat becomes so intense as to be unbearable.

The actual temperature of an illuminating flame is very high, much higher than that of a blue flame; in fact, in a good illuminating flame, at the point where the white part commences, near the centre, it is sometimes possible to fuse an exceedingly fine platinum wire. It is this very high temperature which, to a great extent, causes the radiated heat observed; and, for the same reason, it is useless to expect a satisfactory gas fire made by heating blocks of asbestos with a gas-flame, until a very much higher temperature flame is used than is the case at present. When we have a crucible or solid body to heat, radiated heat is not wanted, and the most economical plan, so far as is known at present, is to use a blue smokeless flame, and to place the body to be heated in actual contact with it. By this means the heat is rapidly taken from the flame without the deposition of soot, and without loss of heat by radiation into the surrounding air.

We must now consider the fact that all flames under ordinary conditions are hollow and cold inside. I have here a pile of gunpowder, which I will place in the centre of a large and powerful flame. You see that not only will the gunpowder remain unchanged, but the centre of the flame is actually cold. To show this more clearly, I will use a burner with a flame which can be made either solid or hollow. I will first place the gunpowder in the hollow flame, and then convert it into a solid one, and thereby ignite the gunpowder. With care, it is possible to put the hand in the centre of this flame, provided the wrist is protected by wet cloths from the outer film of flame; but it is difficult to prevent scalding by the steam which is formed by the outer film of flame and the wet cloth. The actual temperature in the centre of the flame I have tested by introducing a delicate thermometer, and find it is usually about 110° Fahr. I will also prove that it is hollow, by conducting the unconsumed gas and air from the centre of the flame by a tube, and igniting it, making, as you see, a second and separate flame, this second flame disappearing when the flame is made solid.

I believe that the honour of being the first to obtain a solid flame is due to Mr. Wallace, of Manchester, whose plan I shall explain presently. He was, in fact, the pioneer of a new revelation with regard to gaseous fuel, and I am sorry to say his discovery has not yet obtained the attention it merits from all makers of gas apparatus for heating purposes.

There is one condition, with regard to gaseous fuel, which requires close attention. The vessels to be heated are, as a rule, short and small; the gas must, therefore, be perfectly burnt not later than the instant the flame touches its work, and thus, for most purposes, a hollow and long flame is comparatively worthless. To render the combustion more rapid, and to thereby shorten the flame, Mr. Gore, of Birmingham, first hit on the expedient of subdividing it into layers, producing a number of narrow flames with air spaces between. By this means he produced a short compound flame, which, with a little assistance from a chimney draught, would fuse cast iron in a crucible. Following in his steps, Mr. Griffin, of London, produced a multitubular burner, virtually the same in effect as Gore's—in fact, a form of burner almost identical with Griffin's is shown in the specification of Gore's patent.

These earlier burners had all one serious fault. If the chimney draught happened to be too great for the quantity of gas available, or if the gas supply was irregular, an excess of air was pulled in and mixed with the gas, rendering the mixture explosive, and causing the burner to what is commonly called "light back." To prevent this, Mr. Stanistreet, of Liverpool, placed, as an experiment, a sheet of wire gauze on the top of the tubes, and communicated the result to me. With this arrangement the gauze was destroyed every time the furnace was used, and to obviate this I placed the gauze under the tubes, thus making the first high temperature draught furnace burner which would bear sudden changes of the gas supply without an explosion. This burner has now been superseded by another form, which I have recently invented, and which, in principle and arrangement, is totally different. To explain the principle of the new burner, I must go back a little.

Mr. Wallace's burner is an upright tube, open at the bottom, with a small gas-jet underneath, pointing directly upwards. The top of the tube is covered with a perforated copper cap. The rush of the gas from the jet carries upwards with it a large quantity of air which, with a gas-jet of one exact size, produces an explosive mixture. The perforated cap prevents the flame rushing down the tube, and we have what we never had before—a solid flame, requiring no external air supply, produced by the quiet burning of an explosive mixture of gas and air. This being the case, we obtain a short flame of very high temperature, which requires no excess of air to ensure perfect combustion, and we therefore work so as to get the highest possible duty from our fuel.

Following in the steps of Wallace, I found great inconvenience from the height and size necessary to produce large and powerful flames; but after a long series of experiments I hit on the plan of placing Wallace's injecting-jet at one end of an open horizontal tube, leaving the other end open, and enclosed in a tight box, the upper side of which is covered with gauze. With this burner I obtain a flame solid to the centre, in a con-

venient and simple form. I find from experience that there is no practical limit to the size of burners made on this principle. I have made them 18 inches in diameter on the surface of the gauze, capable of burning in one solid flame a gas supply of 200 cubic feet per hour; I have also made them 4 feet in length for coffee roasters. As this burner requires only an outlet for burnt air, it will work perfectly in very confined spaces, where an ordinary hollow-flame burner cannot be kept lighted. A very beautiful application of this burner has been patented by Messrs. Bonser and Son, of Tower Hill, for the purpose of roasting coffee, the burner being placed inside the roasting cylinder.

I have here one of Bonser and Son's sample roasters, which will roast 1 lb. of coffee in about five minutes, and which is well worthy of examination, and also a solid-flame burner, 8 inches in diameter, which, with a well-constructed boiler, will generate steam sufficient for a 1-horse power engine. When I use this burner for draught furnaces, I make it with a cast-iron grid, to prevent any liability of the gauze to get red hot, and to prevent also the peculiar roaring noise caused by a solid flame produced with the assistance of a chimney, and which I shall again refer to; and you here see a few examples of its application for crucible, muffle, and porcelain painters furnaces. One great difficulty with gas crucible furnaces has been a means of safely supporting a crucible, so as to hold it securely without interfering with the full impact of the flame.

Gore, in the first gas furnace made, supported his crucible by projecting ribs inside a taper cylinder. This caused liability to stick fast, and also necessitated the use of crucibles of one exact shape and size. Griffin made an advance on this, by carrying the crucible on a tripod grate of fire-clay. This, although used at present, is liable to damage, and is not altogether satisfactory. Another plan introduced is to fix an upright plug of fire-clay in the centre of the burner, which is, in my experience, worse than Gore's original plan, as the stand is unsteady, and is also liable to stick to, and come away with the crucible.

For draught furnaces I have at last solved this difficulty completely, by placing the crucible on the solid bottom of the furnace, by the side of the burner, and drawing the flame sideways across the crucible, the chimney being placed at the opposite side of the burner. This not only completely solves the difficulty, but places the chimney in the best possible position, and exposes the crucible more perfectly to the impact of the flame. I have received to-day a model of a further improvement on this, in which the flame is made to traverse completely round the crucible, thus still further utilizing the heat of the flame.

In blast furnaces, the difficulty of the supports is also overcome by placing the crucible on the bottom of the furnace, and inserting the burner at the side. The casings by which the heat is retained are of porous or cellular clay, the process of making which I have already described. All the casings which you see here to-night are made of this material, which I consider one of the most important points, where economy of fuel, speed of working, and great heat are required. Without this cellular clay, the results I obtain could not be approached, except by an enormous increase in the heating power of the burners used.

I do not think it probable, or possible, that really high temperatures will ever be attained in small draught gas furnaces, for several reasons. First, the very large burner surface necessary to make a perfect mixture of gas and air, with sufficient rapidity to burn a large quantity of gas instantly and perfectly, makes the burner liable to damage. It will be found that, with a draught gas furnace, burning in an economical manner, the flame is in absolute contact with the burner surface—a state of things which, curiously enough, does not exist with a blast furnace, where the flame is always at a greater or less distance from the face of the burner. For this reason I should never recommend the use of draught furnaces with long chimneys for high temperatures, although for such work as the fusion of brass, silver, and gold, the usual routine work of laboratories, and the firing of glass, china, &c., they are perfectly adapted, and, if well constructed, will give a very high duty for the gas consumed. Another objection to draught furnaces is the difficulty of having all the lids and parts fitting so perfectly air-tight as to keep all cold air out of the chimneys, and thereby interfering with their satisfactory working. Where the pull of the chimney is great from its height, there is a great liability to this leakage of cold air into it, and there is also a great waste of heat in keeping the chimney at a sufficiently high temperature to enable it to work efficiently. Draught furnaces have their place and fill it, but for many purposes there is nothing to approach a blast furnace, used with either coal gas or gasoline vapour.

The furnace I now show you is perhaps the most perfect example of the great results to be obtained with gaseous fuel. The casing which holds the crucible is a simple thick pot of my porous clay, with a hole in the side, and a lid with a hole in the centre for the escape of the products of combustion. The burner, I consider, is as perfect for its work as the casing. It is a true solid flame, formed by injecting, with a little foot blower, a fine stream of air at a high pressure into a tube, into which gas or gasoline vapour enters at the side. By using the air at a high pressure, the larger quantity of air required for combustion is pulled in mechanically at the openings in the tube, thus dispensing with the large and costly blowing apparatus which would otherwise be necessary. The end of the tube against the hole in the casing may be open, but is then liable to make a rattling unpleasant noise. To prevent this, I cover it with a cap of gauze, which, when the furnace is at a blinding white heat, is perfectly cold, partly owing to the fact, as I previously explained, that a gas-flame produced by a blast is never in absolute contact with the burner which produces it, and partly to the constant blast of cold air and gas passing through. The burner fits tight against the casing. A perfectly explosive mixture is made rapidly in very small quantities, and burnt in a close non-conducting chamber so perfectly and so instantaneously, that not a trace of flame is visible in the furnace. In this furnace I can, as you will see, starting all cold, get a crucible well over a cast-iron melting heat in five minutes, and to a blinding white, approaching a blue heat in ten minutes.

The gas consumed in this furnace, as I shall work it at the conclusion of the paper, is about 40 cubic feet per hour. It therefore requires less than 4 cubic feet of gas to raise a crucible, sufficiently large to hold 2 lbs. of cast iron, to over the fusing point of cast iron, and it takes about 7 cubic feet of gas to melt this weight of iron so that it can be poured. Let it be remembered that this quantity of gas costs a little over one farthing, and is equivalent to about 4 oz. of coal. Let it also be remembered that this minute quantity of fuel not only melts the iron, but heats up a cold furnace and crucible. It is very easy to work the furnace with only a small gas supply, but in this case the heat is obtained much more slowly, and the total quantity of gas used to obtain the same result is greater.

Greater power and greater rapidity of working than is shown by this furnace is not desirable, though it could be easily obtained by increasing the air and gas supply. No crucibles known will with ease stand a greater power than this furnace gives; whilst for simplicity of construction and ability to bear hard work, anything better could hardly be desired. With this furnace I think the art of heating crucibles by gas may be looked upon to be complete.

Consider, for one moment, the actual results obtained in this furnace with 4 oz. of fuel, and compare the number of pounds of coal or coke

necessary to produce the same result, then the economy of gas fuel, under proper conditions, becomes self-evident. Bear in mind also that it is applicable to either coal gas or air gas from benzoline, the latter fuel enabling the furnace to be used for the fusion of pure nickel and delicate coloured enamels and glass, which the sulphur always present in coal gas would otherwise prevent the furnace being applied to. When we consider the important part which nickel is likely to play in the future for many purposes, more especially in its pure and malleable form, this power of melting so refractory a metal in a simple furnace is a matter of no little importance.

I have only time to say a few words about blowpipes. The flame of a blowpipe is, to a certain extent, hollow; but not so much so as is the case with the ordinary flame, made without an air blast. The reason of the very high temperature obtained with a blowpipe flame is that the heat is driven to one point and accumulated there. I have here an example of an arrangement, devised by myself some years ago, for heating both the blast of air and the gas, producing a flame having a temperature far above that required to melt platinum. A blowpipe flame, however large, has little power compared with the burner of the blast furnace which I have just described, when we have large bodies of material to heat. The combustion is neither so rapid nor so perfect; in fact, the blowpipe flame is hollow and long, with only one hot point. The furnace burner flame is solid, short, and of equal temperature throughout.

I will now explain some of the differences between coal gas and gasoline or benzoline vapour, in practical use. Coal gas is never free from sulphur, and it is therefore difficult to use for the heating of metals and other substances which are liable to damage by sulphur compounds. It is also not satisfactory for the fusion of enamels, except in perfectly tight chambers, from which the products of combustion can be completely excluded. The vapours of the lighter petroleum, on the contrary, are free from sulphur, and I have repeatedly fused the most delicate enamel colours in the open flame without the slightest injury. Another curious difference in the two fuels is, that when gasoline or benzoline vapour is used with a blowpipe, the flame is exceedingly liable to blow out. I can use no other satisfactory simile, except that the gasoline flame appears to be "brittle," and not to hang tenaciously to the blowpipe as a gas-flame does. When anything is in the gasoline flame which is at a sufficiently high temperature to keep up the combustion, this is no disadvantage. In the furnace, air gas from benzoline burns with perfect steadiness, precisely like coal gas; but when we attempt to use it for blowpipe work, the flame is continually leaving the point of the jet and blowing out. In this respect the field for experiment is yet open.

I believe I obtained from my friend Mr. Bower, only last night, an idea which may serve to solve this difficulty, but which I have not been able yet to test. I found that with benzoline gas his blowpipe was much more satisfactory than my own, the only difference between the two blowpipes being that his had an exceedingly thick air jet; mine had a very thin one. The jet of thick glass or metal does not appear to lift the flame away to the same extent, and some experiments will be made in this direction.

It must be remembered that coal gas is lighter than air. Gasoline gas is, however, much heavier; and therefore atmospheric, or Bunsen burners made for coal gas, which are open at the bottom, will not work satisfactorily with gasoline gas, as the latter falls, and escapes from the lower openings. For gasoline gas, the only heating burners which can be used are those arranged in a similar manner to the solid flame burners, with a horizontal jet and air tube. On account of the weight of gasoline gas, if the generator is placed at the top of a building, the weight of the gas is sufficient to supply an Argand burner in the lower part of the building, although the pressure obtained is not sufficient to work any of the common lighting burners which do not require a chimney.

I have two exceedingly curious flames to show you. One is a solid flame, produced on a surface of gauze by a chimney draught, the chimney being free to vibrate. The explosions, by the management of the chimney, can be varied in their rapidity, producing different tones. I do not recommend this in its present form as a musical instrument; I simply show it as a curiosity. The other is a flame which requires close examination to see its beauty. It is produced under peculiar conditions. When the vapour of gasoline is burnt on a gauze surface, with just sufficient air to make a blue flame, the surface of the gauze is covered with innumerable round blue beads of flame, rushing about in all directions. I cannot offer an explanation of this, and I cannot produce the same effect with a coal gas flame under any conditions.

In conclusion, there are many purposes to which gas fuel can be applied far more perfectly than it is at present. In fact, we may say that its use, except in blast furnaces and blowpipes, is yet in its infancy; and the work done by Gore, Wallace, and others, may be considered only as a small sign of what is yet to come. I believe the time is, perhaps, not far distant when gas will be used exclusively for cooking purposes, and that its rapid adoption all over the world depends only on the makers of the apparatus. If the makers of gas-heating arrangements had to pay for all the gas wasted in their apparatus, I think many improvements would very quickly be made. My own experience is that the whole of the cooking for a family of eleven can be done perfectly, entirely without the assistance of a fire, at a cost of about 2d. per day for gas. When we compare this with the cost entailed by some apparatus now sold, the necessity for improvement is self-evident. Where liquids have to be boiled or vessels heated, the work must be done by one solid flame, not by a number or one hollow flame. The ovens and pans must be as shallow and broad as possible, and must also be no thicker than is absolutely necessary. I have seen gas-cooking apparatus in which some 2 cwt. or 3 cwt. of iron has to be heated before any satisfactory work can be done. My own ovens and pans are as thin as they can possibly be made, and I find, by experience, that our largest oven is fully hot in two minutes. In a properly-arranged water-heater, it requires about 1½ cubic feet of gas to boil one gallon of water. This is the result I get in actual work, under the best conditions. I may safely take it as an average, with the burners generally used for cooking, that from 5 to 12 cubic feet of gas are burnt to do the same work, owing partly to the improper construction of the burners, and partly to the faults, shape, and unnecessary weight of the vessels used.

Amongst the still more recent improvements in gas-heating apparatus which have not yet been made public, I may mention two. The first is a simple and cheap arrangement for melting and pouring into ingots of different shapes a few ounces of gold or silver, without the use of a furnace. My first arrangement of this kind was essentially different. In this, as you see, both blowpipe, crucible, and ingot mould are mounted on one rocking stand. The two sides of the ingot mould slide over each other, to enable ingots of different shapes and weights to be cast; and the rocking stand, clamp, and blowpipe are all obtained in a single casting, reducing the cost of the whole to a few shillings. It is well known that the toughness and working properties of gold are greatly improved by this method of melting with a flat crucible and a blowpipe, and the results compare very favourably with those obtained in the best furnaces. As regards time, a 3 oz. ingot can, with ease, be melted and poured in not more than two minutes.

Another and more generally important apparatus is what may fairly be considered a new discovery, so far as gas is concerned. It is only too well

known that good steel is ruined if heated with a gas blowpipe flame, and that steel band-saws brazed with a gas blowpipe are brittle and worthless. It is also impossible to weld with the heat obtained from a blowpipe. I find, by using a small hearth which I have here, filled with coke, broken small, and by directing a blowpipe through the open tuyere, I can get a welding heat in about two or three minutes, and I obtain heat which is for all practical purposes as good as a charcoal forge. For the repair of small tools, and for such delicate forgings as are necessary for sewing-machines, &c., this new adaptation of gas appears likely to become exceedingly valuable. It is, in fact, a small self-lighting forge, perfectly clean and simple in use, and adapted for the most delicate work. Its value those only who have delicate steel forgings to make can appreciate.

A short discussion followed, and a vote of thanks was then passed to Mr. Fletcher for his paper.

MR. SUGG ON THE SCIENTIFIC USE OF GAS.

As already briefly noticed in our columns, Mr. Sugg, on Tuesday, the 20th ult., delivered a lecture, on "The Scientific Use of Coal Gas," before the Hull Literary and Philosophical Society. The lecture, which was abundantly illustrated by diagrams and experiments, was very well received; but with the greater portion of it our readers would be little interested, as it was a recital of facts with which they are, of course, thoroughly acquainted. There were, however, parts which deserve notice in our columns, and we take the opportunity of reproducing them.

After giving, in a popular kind of way, a description of how gas is produced and what are its constituent parts, the lecturer dwelt on the necessity of properly proportioned internal fittings for houses, as affecting the question of pressure. At this point he exhibited Joslin's patent apparatus for rapidly measuring the flow of gas by simple inspection. This apparatus, a description of which is appended, was fixed to one of the burners shown, and about it Mr. Sugg said: I have placed the burner on a very ingenious little apparatus, the invention of Mr. George Joslin, of Colchester. It is simply a taper glass tube which serves as a conduit for the gas that supplies the burner. It may be placed anywhere in the pipe conveying the gas. I have it here just under the burner. Within the taper tube is a small disc of mica, of such a diameter that when it falls to the bottom of the tube it fits closely to the sides. When I turn on the gas the mica disc rises in the tube till it has reached a point at which the quantity of gas required by the burner can escape from under it by the space between its edge and the sides of the tube. As the tube is taper, it is clear that the higher it goes the greater the space will be between the circumference of the disc and the sides of the tube, and *vice versa*. Therefore, in order to know at a glance how much gas is passing, I have only to read the figures or degrees marked on the outside of the tube. These have been verified by trials with an experimental meter.

The lecturer then passed on to the question of the use of burners with and without governors to them; also as to the effect of artificial light on the eyesight. On this latter point he dwelt somewhat at length, his remarks being as follows:—

I have now to bring before you a subject of the greatest possible interest in relation to the use of artificial light. It is an indisputable fact that there is in the present day a large increase in the number of young men and women, and even children, who are obliged to use spectacles. In France and Germany, as well as in England, this subject has attracted the attention of scientific men, and it is one which must not be allowed to be passed over without serious consideration. The present high standard of education compels young boys and girls, and also young men and women, to work a great deal by artificial light. Some do their work by the aid of candles, others by lamps; but a great number employ gas. The light is, however, mostly insufficient and very flickering indeed. Now one of the most important things in relation to artificial lighting is the quality of the light, regarded from a chemical point of view. Solar light, as you are aware, is composed of heat rays, light rays, and chemical rays, and when a ray of light is made to divide itself, or split up, by being passed through a prism, we see that it is composed of the colours—red, orange, yellow, green, blue, and violet. This is called its spectrum. The red is the heat ray, and this tones off into the yellow or light ray; this changes into the green, then becomes blue, and finally ends in violet. The greatest heat is found to be beyond the red ray of the visible spectrum, while the greatest chemical effect of light is, in like manner, beyond the visible spectrum on the other side. The chemical or "actinic" ray, as it is called, is that which produces the greatest effect upon a photographer's sensitive plate, and without this ray we could not obtain a satisfactory photographic portrait.* But there is a remarkable variation in the state of daylight with regard to its chemical property during the hours of the day. At early dawn there is light almost without actinism, or chemical rays; but as noon approaches the light of day increases in actinic power, and in the afternoon rapidly declines, till at evening we have a light almost devoid of actinic property. In like manner as the actinic ray, or chemical ray as it is usually called, to distinguish it from the other component parts of light, acts upon the prepared photographic plate, so it acts upon that most perfect of all photographic apparatus, the human eye.

Light which contains a great quantity of actinism injures the optic nerve, and renders it insensitive, exactly as a photographic plate is rendered useless and insensitive by the same agency if it is over-exposed to it. Therefore, the most natural thing that occurs to all human beings is to get out of the blinding glare of daylight at noon into rooms or shaded places where there is light with but little actinism. The rapid diminution of this chemical property of light towards the close of day points out to us clearly that the eye must not be exposed for too great a length of time to the action of the actinic rays. Consequently, it seems to me that what we want as an artificial light is that kind of light, so agreeable to the eyes, which we have on summer evenings—white and diffusive, but almost devoid of actinic rays.

Now, if we read by the light of a candle placed too far from us, the pupil of the eye is abnormally dilated, and the diaphragm of the eye is opened to its widest extent to take in all the rays of light possible. This arrangement, which is quite suitable to the construction of a cat's eye, is altogether unsuitable to the human eye. The delicate nerves are over-strained, and, in time, become permanently injured. If we use the candle near to the eye, the greatest amount of the sharp speck of light falls on the eye, and prevents us from seeing so distinctly the object we are looking at. The greater and more brilliant this light may be, the more the evil is intensified. The extreme is reached when we place a strong unshaded gaslight directly in front of the eye, and in close proximity to it. All the disagreeable and hurtful effect of strong daylight is produced upon the eye, without its immense diffusion and perfect steadiness. Sharp bright rays are darted into the eye when we look up, and a strong glare is kept on the eyelids of the downcast eyes. The flicker of the light keeps the diaphragm of the eye constantly trying to adjust itself to

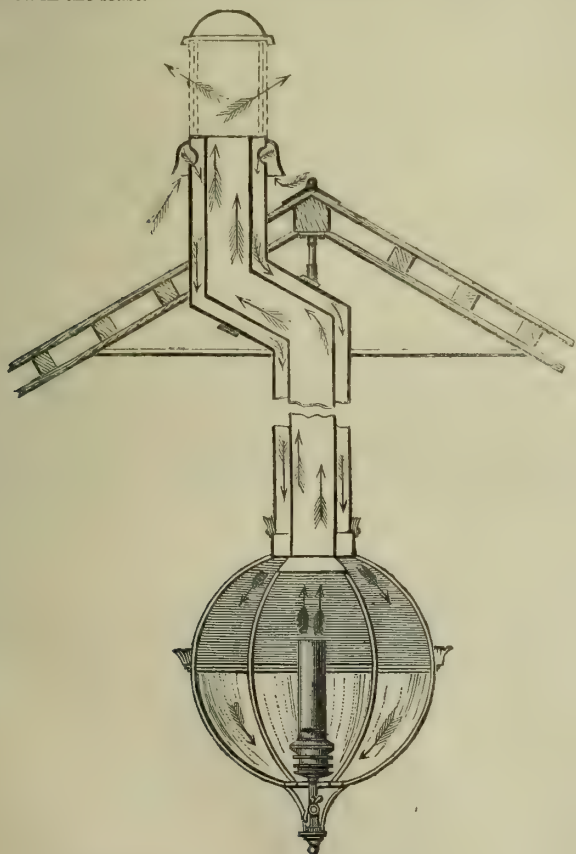
* Captain Abney, of South Kensington, has demonstrated that the red ray as well as the other rays can be photographed.

variable light, causing great fatigue. In addition to this, the heat of the lamp is thrown full on the front part of the head. Nothing is more contrary to the wise provision of nature, and therefore nothing is so sure to be deleterious to us. But this is the condition of things in relation to the artificial light which is used by our young girls and boys in their evening studies. Is it, then, to be wondered at that the eyes become prematurely old and insensitive—lose their brightness and all the fine perception of colour and form with which nature originally endowed them? It is useless to argue that there are instances of persons who have studied for years by the aid of artificial light, and still have good eyesight. Instances can as easily be found of persons who have done everything they possibly could to destroy their constitutions, and yet have not succeeded; but for one person who has not impaired his sight by the injudicious use of artificial light in pursuing his studies, thousands upon thousands have done so. I ask you to earnestly consider this fact—that if you give a high-class education to your children, and they impair their eyesight in gaining it, they waste all the great advantages of that high education, and are heavily handicapped in the race of life by the fact of their being obliged to wear spectacles. It is hardly possible to estimate the loss suffered by persons with defective eyesight during the course of their lives.

But you will naturally ask, What is the remedy for this state of things? I reply, a very simple and easy one. If you work by the aid of a candle, let it be a good one, and provide yourself with one of those little candle-shades, not opaque, but slightly translucent, of rose tint outside and white inside, so that a rose colour light falls on the eyes. If it is a lamp—either moderator or petroleum, but especially the latter—do the same thing, and, in addition, put a little curtain of pale rose paper or silk round the lower edge of the shade. Further than this, a screen of glass, paper, or other natural non-conductor of heat should be interposed between the head and the light, so that a current of air passes up between the light and the screen. The reason for it is this: Red stops the actinic ray. Clear glass is an impediment to heat, and also to a great extent to the actinic rays. The best light for drawing, writing, or reading is, therefore, in my opinion an Argand burner shaded, in the manner I have indicated, with a screen of ruby glass to protect the eyes from the actinic rays and heat of the gas. This is one of the non-actinic reading lights. [Lamp shown and explained.] Although, as you see, an exceptionally powerful light (equal to 30 candles), I find by repeated trials that persons who, as a rule, are unable from weakness of sight to read by any artificial light with comfort have been able to do so without fatigue with this strong light. For ordinary use such a light equal to 16 candles or so will be found best.

It is an important fact that Argand gas-burners with glass chimneys, though more powerful in light-giving properties with like consumption of gas than fishtail or flat-flame burners which are used without chimneys, are more useful in developing a soft and non-actinic light than the latter. Thus, for example, a flat-flame burner giving a light equal to 200 candles, will, with proper reflectors, enable a photographer to take a portrait in one minute; an Argand burner, equal to 400 candles, requires nearly the same time to take the portrait. The inference, therefore, is that the Argand burner with its chimney possesses only half the actinic power of the open flat-flame burner; and this is fairly borne out by the fact that in well-lighted rooms the photographic power of the outdoor daylight is diminished to more than one-half by the opposition of the glass in the windows to the entrance of the actinic rays.

Mr. Sugg then called attention to the complaints made about the heat and the alleged deleterious effects of the products of the combustion of gas on pictures, libraries, and museums, billiard-rooms, &c., and showed a drawing of a light suitable for a museum, picture gallery, or library. The light given by such an arrangement might be equal to from 100 to 1000 candles, and the products of combustion carried off, and the supply of fresh air to the lights brought in, without any communication with the room in which the lights were placed, and without altering the temperature of the room 1°. A small, closely-confined billiard-room at the Raleigh Club in London was, he said, now lighted by two of these lights, each light equal to 200 candles, and the temperature of the room was not increased in the least.



PATENT SELF-VENTILATING LIGHT, SIMILAR TO SOME IN USE AT ETON COLLEGE.

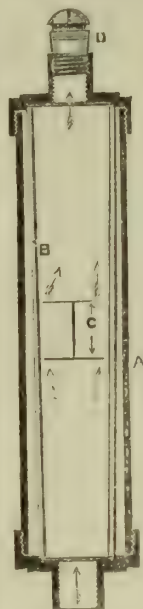
[The above engraving shows one of Sugg's Globe Form Self-Ventilating

Lights for 100 or 200 candle burner. The lantern is of clear glass below, and white glass on the upper part; the two being divided by an ornamental fret, similar to that immediately above the globe, and surrounding the inlet and outlet flues. The outer or inlet flue—the outlet being contained within it—may, of course, be ornamented with any required design. The cold air inlet is shown immediately above the roof, and the currents of air in both directions are indicated by arrows.]

The lecture concluded by a reference to the use of gas in engines for obtaining motive power; in stoves for heating purposes; and, in its compressed state, for providing the means of effectually lighting railway carriages.

JOESLIN'S APPARATUS FOR ASCERTAINING THE HOURLY RATE OF GAS CONSUMED BY BURNERS.

This ingenious little apparatus, referred to in the above lecture, is the subject of a patent dated June 19, 1879 (No. 2428), the inventor being Mr. George Joslin, of Colchester.



The position of the discs, C, indicates the hourly consumption of gas.

SAN PAULO GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held at the London Offices, Pinner's Hall, E.C., on Friday, the 14th inst.—Mr. FREDERICK DELMAR, F.S.A., in the chair.

The SECRETARY (Mr. W. Southall) having read the notice convening the meeting, the following report was taken as read:—

The Directors have the pleasure to submit to the Shareholders the annexed statements of accounts for the six months ending Dec. 31, 1879, duly audited, which show that the total receipts for public and private lighting and rental of meters amount to £10,269 15s. 5d., as against £9464 2s. 11d. in the corresponding six months of 1878.

The net amount of revenue carried to profit and loss account for the half year is £3587 14s. 10d., which, added to the amount brought forward, £1847 0s. 6d. (after payment of the last dividend in October, £3817 10s., and deduction of £197 13s. written off Maud & Co.'s debt), makes a total of £5434 15s. 4d., out of which the Directors recommend a dividend to be paid for the six months at the rate of 10 per cent. per annum, free of income-tax, amounting to £3881 0s. 8d., and a further 20 per cent. (£158 2s. 6d.) to be taken off the balance of Maud & Co.'s debt, carrying forward at the credit of profit and loss £1395 12s. 2d. to the present half year.

Of the original issue of 7 per cent. debentures, there now only remain £1170 to be exchanged (at the option of the holders) for paid-up shares held in reserve. Of the second series debentures, £1230 have been paid off, and the balance (£1770) renewed for four years at 5½ per cent. per annum.

The Manager, under date of March 13 last, reported: "The public lighting has only been increased at present by 10 lamps, although 50 were sanctioned by the Legislative Assembly, the order for the erection of the remainder having been delayed by the Public Works Department. The city is increasing in a most extraordinary manner. Tramcars are running to nearly all the suburbs, and as the roads on this account have been improved, the people are clamouring for gas. It is only a question of time, and both public and private lighting must increase considerably."

The Gas Engineer's report on the works is highly satisfactory. After thoroughly repairing the houses, &c., he states the works, buildings, and machinery to be in a thoroughly efficient condition.

Two of the Directors, E. Batt, Esq., M.D., and S. F. Porter, Esq., retire by rotation, and, being eligible, offer themselves for re-election. The Auditor, Mr. Wm. Cash, also retires, and, being eligible, offers himself for re-election.

The CHAIRMAN, in moving the adoption of the report, said the Shareholders must regard the Company as being in a progressive state, this being their tenth annual meeting. He then referred to the difficulties against which they had had to contend in the first instance, the works not having been completed in the period stipulated, and afterwards alluded to his own services on behalf of the Company, to his correspondence with Ministers and other gentlemen, and to his efforts in bringing the Company to its present position. He did not look for remuneration, but worked from the pride he felt in advancing the welfare of the Company, in which many of his friends were interested, and in which he himself held £5000 of the shares. Just at the time when money was required and their financial difficulties were so great, the then Engineer, Mr. T. Rumball, brought forward a claim for £4000; but it was paid, as they thought it better at once to make an end of what they regarded as a bad job.

Mr. RUMBALL said it was an agreement when the Company was formed that he should receive that amount.

The CHAIRMAN said with regard to the manner in which the work had been done, their present Engineer wrote on Oct. 1 last that the Engineer's house had been for a long time sadly out of order, but that he had commenced to put it in thorough repair. He further stated that it was very badly put up in the first instance. On the 1st of February he wrote respecting the foreman's house, that he had commenced the work which was rendered necessary there. "It was in a very bad condition—in fact, it's a wonder how it held up so long." He urged them to keep out of the hands of engineers and contractors, who had been the ruin of a great many companies. They could, he said, manage the Company very well without. He referred the Shareholders to the good dividend the Directors were able to declare, and observed that it was remarkable that it was

not more. From what their Manager said, there was every prospect that it would be considerably increased. He made this statement to show that the Company had a right to congratulate themselves on the position they were in. With regard to the report, there was not a great deal to say, everything appearing to speak for itself. The item of general repairs in the revenue account was owing to the repairs to the buildings he had referred to. Printing and stationery figured for £88 17s., against £19 in the corresponding period of the year 1878, and the cause of the increase was that a very large number of account-books, circulars, gas bills, &c., had been sent out. The difference in exchange was considerable—£1057 as compared with £317 last year; but these were all things for which the Directors could not be held responsible. In about three years, however, it was found that the exchange equalized itself, and the good time was to come in this matter. As to the original debentures, there was only £1170 to be exchanged for paid-up shares which were held in reserve. There was also very little of the other debenture stock out, so the Company stood in a considerably more favourable position than they did. With regard to their funds, they had taken off 10 per cent. for depreciation, which he thought was a fair allowance. They had sent out a great many mains, but this was a gratifying expense, because it meant an extension of lighting, of which he believed there was every prospect. As to the stock of materials on hand and in transit, it stood at £12,690 in the balance-sheet, the total of which was £20,731; so there was on the other side certainly £7000 in the Company's favour. The item of £790 against Maua and Co., the bankers, was still owing. The Shareholders might fairly conclude that this money would eventually be paid, and, if so, it would come as an agreeable surprise to them; if not, it would make them no worse off than they were at present. As to the imposition of duties, about £360 had been illegally charged the Company up to the present. The Manager wrote that he had represented to the Engineer Fiscal and to the President of San Paulo that if they continued to exact duties the Company could not extend the public lighting; but the President had received a letter from the Minister of Finance at Rio, refusing to allow materials to pass free of duty. The question of duties was with the General Government in Rio, and beyond the control of the President of San Paulo, who, however, had promised to see all back accounts owing by the Provincial Government satisfactorily settled. He feared there would be no recovery of the duties illegally charged without diplomatic interference. This he (the Chairman) intended to try to obtain. With regard to the public lighting, as the amount paid for this came from the general revenue of the province and not from municipal sources, the people outside the city were obliged to contribute; but as they derived no benefit they naturally objected to any increase in public lighting expenditure, and any increase was obtained by the President from the Legislative Assembly with great difficulty. From 300 to 500 extra lamps were required to light the city and suburbs well. The Company's Manager wrote on March 13: "The public lamps have been increased by ten. Fifty were sanctioned twelve months ago, but the Public Works Department have delayed giving orders to erect them. I have reasons to believe that on account of public pressure further extensions will be made in the next few months." On March 22 he wrote as follows:—"In about ten days the public lamps will be increased by eleven. Pending further orders from the authorities, we purpose extending the mains to several outlying districts, in order to supply private houses that are already fitted up in anticipation of the extension of public lighting." The Company paid as they went on, and, this being so, there was, he said, no occasion for reserves. They thought, as they were paying as they went on out of revenue, the money that remained belonged to the Shareholders. With regard to private lighting, in the present year there had been a marked difference, and they were very busy putting in services and fixing meters. The city was increasing in an extraordinary manner. This supported the statement he had already made, that the Directors had every reason to believe they would have a rapid increase in the revenue. The public appeared to be well satisfied with the quality of the gas which the Company supplied to them. There were some complaints about the price charged, as it now fluctuated with the exchange. This was, however, unavoidable. The loss of gas from leakage, condensation, &c., was now small. In order to show how the Company were progressing, he would remind the Shareholders how the concern had been going on since 1876. In that year the gross income was £16,971, and the net profit was £3801; in 1877 the gross revenue was £17,727, the net profit being £5214; in 1878 the gross revenue was £19,455, and the net profit amounted to £7089; and in 1879 the gross revenue was £23,461, while the net profit was £7816. Thus, as they would see, there had been a gradual progress. The increase in the net profit last year was not in the same ratio as before, but there were the expenses that year for repairs, and the greater difference in exchange. This accounted for the proportionate decrease in the net profits, but the increase in the gross revenue was on the same scale as before. Their Engineer reported that every thing in the general way was going on as well as could be wished and all the staff under his superintendence were giving every satisfaction. Speaking as a Shareholder as well as a Director, he (the Chairman) was perfectly satisfied with the position of affairs, as to which the Shareholders now knew all that he knew. If not, there were the books of the Company, and he would be happy to reply to any question. In reply to an inquiry, he added that their Gas Engineer, who was a very able man, sent the Directors reports every month by the mail.

A SHAREHOLDER said that the difference in the loss by exchange between the half year under review and the corresponding period of 1878 appeared from the accounts to be about £700, but the Chairman had said that the price of gas fluctuated according to the rate of exchange. If that were so, why should the difference in the exchange appear?

The CHAIRMAN said it was not a real loss. It was mentioned in order to call attention to the matter, and it had some influence on the sum total.

Mr. RUMBALL requested that the minute-book might be produced, to show that the arrangement by which he was to receive £4000 was stated therein, Mr. Delmar being present at the time. An erroneous impression had been produced on the meeting, and he desired that it might be removed.

The SOLICITOR (Mr. Batten) urged that the meeting might be conducted in order, and suggested that the first thing to be done should be the adoption of the report and balance-sheet, which the Chairman would move.

The CHAIRMAN then moved, and Mr. S. F. PORTER seconded, the motion for the adoption of the report, and it was carried, and the dividend therein recommended declared.

Some discussion having taken place as to the retention of Mr. R. Clay as an "Honorary Director,"

Mr. SANVILLE moved, and Mr. HEARNE seconded, the re-election of the retiring Directors, and the motion was carried, as was also one re-appointing Mr. W. Cash, the Auditor.

Some further discussion then ensued as to the appointment of Mr. Rumball to a seat at the Board in place of Mr. Clay; but, on a show of hands being taken, the meeting was found to be in favour of the Board as then constituted. A poll was, however, demanded, and the result was that a considerable majority was opposed to Mr. Rumball's election.

The meeting closed with the usual compliment to the Chairman.

BOMBAY GAS COMPANY, LIMITED.

The Ordinary Half-Yearly General Meeting of this Company was held at the London Offices, Drapers Gardens, E.C., on Thursday last—D. T. EVANS, Esq., in the chair.

The SECRETARY (Mr. W. Marshall) read the notice convening the meeting, and the following report of the Directors was taken as read:—

Your Directors have pleasure in submitting to the Shareholders a statement of accounts, duly audited, for the half year ending the 31st of December last.

There has been an increase in the gas and meter rental, as compared with the corresponding half of last year; but in the cost of production there has been a slight increase. The returns from coke and tar show a small decrease.

Considering the continued stagnation of trade in Bombay, your Directors think it a matter for congratulation that the consumption of gas and the profit thereon have been so fairly maintained.

The loss on exchange during the half year was £2714 14s. 2d. This sum, with that previously standing at the debit of exchange equalization account—viz., £2609 11s. 7d.—makes a total of £5324 5s. 9d., to be provided for. Of this the Directors have charged £2200 to profit and loss account, and £3124 5s. 9d. to the reserve-fund (equalization dividend account), thus writing off the whole loss. The Directors had less hesitation in adopting this course, forasmuch as there have been during the current half year no remittances from Bombay, and consequently no loss on exchange. This, it is expected, will enable them to provide a considerable amount in the current half year, either for appropriation to the reserve-fund (exchange equalization account), or to meet any loss on exchange in the latter half of the year.

The amount at the credit of profit and loss account for the half year is £8547 19s. 9d.; which, with the balance brought forward, £157 12s. 11d., makes a total of £9705 12s. 8d. Out of this your Directors recommend a dividend of 4 per cent. (making $\frac{1}{2}$ per cent. for the year), free of income-tax. This will absorb £3960, leaving £105 12s. 8d. to be carried forward to the next half year.

The Local Audit Committee commenced their duties in October last, and are performing them with zeal and efficiency.

Your Directors have removed the offices of the Company to 6, Drapers Gardens, Throgmorton Avenue, E.C., whereby, whilst sufficient accommodation is provided, a saving has been effected in rent and outgoings.

The Directors who retire by rotation are William Swainson Stuart and Warine Bayley Marshall Lysley, who, being eligible, offer themselves for re-election.

The Auditors, Edward George Bradley and Robert King, retire from office, and, being eligible, offer themselves for re-election.

Dr.	General Balance, Dec. 31, 1879.	Cr.
Capital authorized— (50,000 shares, at £5 each— £250,000.)		Construction account . . . £203,396 12 10
Retort account		1,532 9 9
Services account		76 12 6
Goods in transit		2,136 14 10
Stocks, viz.—		
Chandeliers, brackets, &c.		4,483 1 1
Brass and iron goods . . .		5,154 18 5
Mains, services, and tools .		1,895 2 4
Meters		2,945 5 2
Coal		7,725 6 6
Residual products		149 5 7
Amount owing to Company		5,863 13 8
Invested funds—Victoria		
Government 4½ per cent.		
Debenture Railway Loan, 1878		1,842 15 0
Cash at Bankers, on deposit, and in hand, viz.—		
In Bombay . £3,968 11 0		
In London . 6,441 16 9		
Bank bills in hand		10,226 10 5
		20,636 18 2
		£257,838 15 10

Profit and Loss Account, for the Half Year ending Dec. 31, 1879.							
Coal carbonized	£7,407	14	8	Gas and meter rental	£20,098	1	5
Wages	1,202	17	5	Coke, tar, fittings, &c.	3,611	16	8
Purifying	14	19	10	Interest	68	17	11
Trade and general charges	704	5	10				
Salaries and Collectors com- mission	1,621	12	1				
Rents, rates, and taxes	420	9	3				
Directors & Local Audit Com- mittee's remuneration	638	15	0				
Bad debts	12	14	4				
Law charges		7	7	10			
Exchange account	2,200	0	0				
Balance	9,547	19	9				
	£23,778	16	0		£23,778	16	0

General Revenue Account, Dec. 31, 1879.			
Balance carried down.	£9,705 12 8	Balance, June 30, 1879 . . .	£8,557 12 11
		Less dividend paid Dec. 1, 1879	8,400 0 0
			£157 12 11
		Balance for half year ending Dec. 31, 1879 . . .	9,547 19 9
	£9,705 12 8		£9,705 12 8
		Balance for appropriation .	£9,705 12 8

The CHAIRMAN: I am ill, and must, therefore, ask your indulgence. I have been Chairman of the Company from its commencement—it is now in its nineteenth year—and during this period I have presided at each annual meeting, and I may say at each half-yearly meeting. The accounts are before you, and they speak for themselves. I will not attempt at this moment to go through them; but if any gentleman has any question to ask, and will kindly put it, it will be answered. At the close of the last annual meeting I made this remark: "We shall not do very brilliantly this year, but I think we shall be able to maintain the dividend." Events have justified that prediction. We have been able to maintain the dividend, but not without difficulty. The gas and meter rental shows an increase of £231. This is not much, but it is reassuring in this sense, that if you look at the great depression of trade which has existed in Bombay, and the necessity there has been for economy, and observe the suspension of the public works, I think it is not unsatisfactory that we have maintained the gas and meter rental, and have made a small increase, such as it is. In the item of coke, tar, and fittings, which for obvious reasons we group together, a decrease is shown of £150. With respect to coke, we have not done so well this year as we could have wished, and there are various reasons for it. Very strong allies and supporters of ours are the lime-burners in and around Bombay, but during the past six months these have been no consumers at all. The public works, and notably the drainage system, were at an end, and we have had no support or assistance from them. We have, therefore, only had to look to the general public for the consumption of our coke. We have done all we possibly could in the matter. We have been encouraging the consumption of coke in small coke-stoves, and these are coming more or less into use. The leakage upon the year is small, being below 8 per cent. The item of coal, of course, is most important, indeed it is almost the basis of our property. The coal carbonized during the year has been slightly dearer, but the increase is not a very serious matter—£1 14s. 7d. in 1878, as against £1 16s. 7d. in 1879. We have now in stock a twelvemonth's supply. We chartered

two steamers in January last, the freight being low, and the tonnage wanted on the other side—to go through the Canal—with English coal. The English coal has a disposition to fire, but in the Australian coal there is not that disposition. We had suffered by this, and, profiting by our experience, we directed English coal to be used as soon as it arrived. By this means we avoid the risk of firing. That has been an experiment which has been followed with excellent results. We got from it a considerably larger tonnage of coke. Last month's returns showed an increase of 50 tons. I now come to the matter of the exchanges. I hope the Shareholders will be satisfied with the mode in which we have dealt with the matter of the exchanges. We were most anxious not to reduce the dividend, and I hope the course we have adopted will meet with approval. With respect to the current half year, inasmuch as we bring no money home, we shall incur no loss, and we have a very large sum in hand on the other side—about £12,000, bearing 5 per cent. interest, and we are waiting and watching a favourable moment in the exchange to bring it home. We hope during the current year to build up the reserve-fund to what it was before. I do not know that I have any more remarks to make, except this, that the prospects of the exchange are slightly improved. There is a loan of three millions being raised in Calcutta, and it seems probable the greater part of it will be subscribed on this side. There is also a hope that the weekly Council drawings will be either suspended or diminished; and, indeed, they are now being diminished. Business is reviving again in Bombay. The new docks are opened, and we shall have, as I hope, a considerable increase in the consumption of our gas there. The docks, Major Stuart informs me, have been lighted, and there is a resumption of all public works. I may give this assurance to you, that the consumption of gas is increasing, in that there are more private lights now than we have ever had, numbering, in fact, over 17,000. With these remarks, and in the hope and belief that we shall do very much better this half year than we have done during the past half year or year, I will close my remarks by moving the adoption of the report and the statement of accounts, including the declaration of a dividend of 4 per cent. for the half year.

Major Stuart seconded the motion.

Mr. NORTHOVER thought it was satisfactory that the Company lost £260 less than before by the rate of exchange. The rupee might be regarded as worth 20d., and he did not suppose it would go much higher. He did not think the Shareholders had much to complain of. He considered the Board had acted wisely in declaring the full dividend. The reserve-fund was not entirely wiped off, though it was reduced. On the other hand, he thought it was always best to meet any difficulty in the face. He noticed that, so far as coal was concerned, the stock was now £7725 against £18,749 this time twelve months ago. This had been in a measure already explained, and therefore the Shareholders were alive to the interests of the concern. As to the old "bogey," the electric light, which used to trouble them, he saw the other day that its brilliancy caused the loss of a vessel. *The Times*, too, was taking a different position. Formerly it was not "a clear stage and no favour;" it was in favour of the electric light; but now it seemed to have come round to a clearer view that, after all, there was not so much in electricity as was at first thought. The Shareholders, therefore, had nothing to fear on this score.

The CHAIRMAN: The Marquis of Ripon is on his way to India, and on his arrival there will, no doubt, be some festivities at Bombay, which will cause much gas to be used. During Sir Richard Temple's governorship we lost nearly all the lighting of the Government House, through his not residing at it. We hope the gentleman who is now going out will be more resident. In reply to an inquiry, he added that the Company were fully insured on this side—the fittings and buildings, but not against explosions.

Mr. WYLDE remarked that only three or four bad explosions had taken place since gas companies had been established.

Mr. H. P. STEPHENSON said as regarded fire insurance it would be a very heavy cost to insure all the Company's works. They did not know which was going to explode, and they could not "spot" the exact one. In his experience, he had known only a dozen explosions in gas-works, and he should almost call them all bad ones; but Mr. Wylde meant as regarded the amounts. The great difficulty was to "spot" the place where the explosion was going to occur. If it was intended to spread the insurance over the whole of the buildings, the cost would be enormous—it was about 10s. per cent. As to the electric light, Mr. Northover had raised the question, and he (Mr. Stephenson) merely wished to mention one matter to the Shareholders, which he thought they would consider a little interesting. He was Deputy-Chairman of the Crystal Palace District Gas Company, and some short time ago the Crystal Palace was lighted up with the electric light, and about a month after, to their astonishment, it had caused an increase in the gas bill of 30 per cent. That arose in this way: The light was so intense in the nave that all the other parts of the Palace were thrown into a great amount of shade, and the eye, accustomed to the intense light in the nave, could not see in the dark unless the gas were turned up as high as possible; and thus it added to the Company's gas bill. He believed that the electric light had now been taken away from the Palace. The Chairman had not mentioned that the Directors had received advices that the price of coal in Australia had been reduced from 13s. and 13s. 6d. down to 10s. a ton. At present there was a probability that it would go even lower. A fall of 5s. a ton on their coal—and most of it came from Australia—would be something important as regarded their profits, seeing that they used about 8000 tons. He quite agreed with Mr. Northover that it was not desirable to reduce the dividend until the Directors saw that they were really driven to it, and for this reason they had been using the reserve-fund to make up the increased loss on the exchange.

Major Stuart observed that a loss on exchange must still be looked for.

The motion was put, and carried unanimously.

The retiring Directors and Auditors were then severally re-elected.

Mr. WYLDE said it was most important that the audit should be well done in Bombay.

The CHAIRMAN replied that the Company had a very excellent Audit Committee in Bombay, and they were giving the Board the greatest satisfaction.

Mr. NORTHOVER moved a vote of thanks to the Chairman and Directors, and in doing so expressed a hope that they would continue to do in the future as they had done in the past—their best to promote the interests of the Shareholders. The Company had passed through certain difficulties, and he believed that, at any rate, they were not going to have worse times in the future, but, on the contrary, were likely to improve.

The motion was carried unanimously.

The CHAIRMAN, in returning thanks, expressed his acknowledgments to Mr. Northover for his kind remarks. He was quite sure that the Directors would do their duty in the future, and the Shareholders might rely on this from their conduct in the past. His brother Directors and himself had all of them acted zealously, conscientiously, and honestly in the service of the Shareholders.

Mr. NORTHOVER then moved a vote of thanks to the Secretary. He would not eulogize that gentleman in his presence, but he was entitled to say that whenever he (Mr. Northover) called at the office, he was most courteously received, and that every explanation was given him. He

should also like to mention the names of the Engineer and Manager in Bombay.

The motion was put, and carried unanimously.

The SECRETARY acknowledged the compliment, and the proceedings then terminated.

NICHEROY (BRAZIL) GAS COMPANY, LIMITED.

The Twelfth Annual Meeting of this Company was held at the London Offices, Great Winchester Street, on Thursday last—Mr. H. L. MICHOLLS in the chair.

The SECRETARY (Mr. W. W. Wright) having read the notice convening the meeting, the following report of the Directors was taken as read:—

The Directors submit herewith the accounts for the year 1879, duly audited. They think they may fairly congratulate the Shareholders upon the working of the past year. The Manager, Mr. Martin, has shown himself most attentive and capable, and the increased production of gas per ton of coal, the reduction in the amount of fines, and the better state of the works, prove that the change necessitated by the death of the late Manager has been of service to the Company.

The revenue shows a balance of £4324 17s. 1d., after deducting all bad debts, providing for doubtful ones, and putting £1000 to reserve, and £500 to a sinking-fund to pay off outstanding debentures. A dividend of 3 per cent. was paid in September last, and the Directors recommend the payment of a further dividend of 3 per cent., making 6 per cent. for the year, and leaving £437 17s. 3d. to be carried forward.

Mr. Edward Gotto is the retiring Director, and, being eligible, offers himself for re-election.

The Auditors, Messrs. Price, Waterhouse, and Co., retire, and offer themselves for re-election.

Dr.	Revenue Account, for the Year ending Dec. 31, 1879.		Cr.
Manufacture of gas—		Gas supplied—	
Coals carbonized	£3,722	Public lamps	£10,628
Purifying materials	50	Less fines	23
Salaries and wages	1,724		10,605
Repair and maintenance of		Public buildings	391
works	434	Private consumers	3,631
Distribution of gas—		Residual products	1,389
Salaries and wages	713	Fittings	133
Repair, &c., of mains and ser-		Transfer fees, &c.	3
vices-pipes	57	Gain on exchange	341
Lighting and repairing public			
lamps	1,079		
Management—			
Directors remuneration	500		
Agency in Brazil	441		
Honorarium to Concessionaire	250		
Bonus to Manager	100		
Collection	170		
Office expenses (England and			
Brazil)	370		
General expenses England and			
Brazil)	111		
Auditors	21		
Taxes (England and Brazil)	167		
Fire insurance-fund	100		
Bad debts	71		
Reserve for doubtful debts	300		
Sinking-fund to pay off debentures	500		
Interest on debentures	274		
Interest	12		
Carried to reserve for depreciation and cost of concession	1,000		
Balance, being profit for the year	4,324		
	£16,497		£16,497
	16		16
	5		5
Interim dividend, 1879.	£2,547	Balance brought down	£4,324
Balance of revenue, Dec. 31, 1879	2,985	Surplus of revenue, 1878	1,208
	13		11
	5		0
	£5,533		£5,533
	8		8
	1		1

The CHAIRMAN, in moving the adoption of the report, said he regretted that there was not a larger attendance, in order that he might speak more hopefully of the undertaking to a greater number of Shareholders. The accounts of the Company for the past year he thought he might say were decidedly more satisfactory than those of the previous year, and it was with great pleasure that for the present year he could speak even more hopefully than he had ever done since he had been Chairman of the Company. He did not consider that the Company was one of the most successful concerns going, but since the appointment of the new Manager, although the business had not increased, yet by his careful management, and by the great attention the Directors had given to the accounts and to general economy, they had been able to reduce the expenses considerably, and also to make a very much larger quantity of gas, per ton of coal carbonized, than had ever been produced before. In consequence of this, although really and truly very much more money had not been received from the absolute sale of gas, there was a larger profit realized than had ever been made since the Company had been in existence. The accounts spoke for themselves, and showed that this year there was a clear balance of profit. After placing £1000 to the reserve-fund, setting aside £500 to pay off the debenture debt, charging all the bad, and providing for the doubtful debts, there was still £4324 as the profit of the year, which really, considering what had been previously done, was, he thought, quite a satisfactory way to look at the Company's affairs. The Manager, as would be seen, had gained his agreed bonus of £100, which proved at once that he had given the proper attention to his work. He (the Chairman) was certain all the Shareholders would feel this to be a satisfactory arrangement—that the Manager should participate in the well-being of the Company. They really had to be thankful for him, as he had been found to be an earnest, intelligent, and able man, and he (the Chairman) could congratulate the Shareholders on having secured Mr. Martin's services. The Company was in a much more satisfactory condition than it had ever been before, and he could only trust that with the same attention that had hitherto been given to it, and with the same condition of affairs that had existed during the past year in the present year, things will go on quite as well; and that when he next had the pleasure of meeting the Shareholders there might be a better report to offer them than that which he then had to propose for their acceptance.

Mr. GOTTO (a Director), in seconding the motion, said he had only to add to the remarks made by the Chairman that it appeared to him to be a very wise course to devote so large a proportion of the profits to the reserve, and he believed that those who survived to see the end of the Company's concession would find that their reserves had amounted to 33 per cent. of the capital. He thought, if the Company continued in the course they had been pursuing, it would be likely to place them eventually in a very satisfactory position.

The motion was put, and carried unanimously.

The CHAIRMAN then moved the declaration of a 3 per cent. dividend for the half year ending Dec. 31. He had no doubt this would be acceptable to the Shareholders, and the Company could fairly pay it. A slightly larger dividend might have been paid, but not with the same amount of safety that the Directors could propose the present one. He felt satisfied that the Shareholders would be pleased with this distribution, and would

think the Directors had acted with judgment in doing as they had done with the accounts.

Mr. MARTINEAU seconded the motion, and it was carried.

The retiring Director and the Auditors were then re-elected, and the proceedings terminated.

STAFFORD CORPORATION GAS SUPPLY.

We have received from Mr. John Storer, the Manager of the Stafford Corporation Gas-Works, a copy of the accounts of the gas department for the twelve months ended the 25th of March last. The capital account is made up as follows:—£4983 6s. 8d. of the late Gas Company's debenture bonds at 4½ per cent.; £53,585 3s. and £3450 of Corporation mortgage and debenture loans, bearing interest at 4½ and 4 per cent. respectively; and £14,150 of perpetual annuities at 4 per cent. The fixed plant was valued at £78,215, an addition of £882 having been made during the past year. The following is the

Dr. Revenue Account for the Year ended March 25, 1880.		Cr.	
Manufacture of gas—		Sale of gas	£10,520 15 0
Coals, including duties, &c.,	£3,510 16 11	Public lighting and under	
Purifying materials, &c.,	106 6 2	contracts	1,103 1 0
Salaries of Engineer, Su-		Rental of meters	524 10 5
perintendents, & Officers		Residual products—	
at works	450 0 0	Coke, less labour and	
Wages and gratuities at		cartage	506 10 4
works	677 11 2	Tar, do. do.	775 3 8
Repair and maintenance		Ammoniacal liquor . . .	253 7 7
of works and plant . . .	1,180 5 7	Refuse lime	18 6 2
Distribution of gas—		Rents	27 0 0
Salaries of Inspectors, &c.	96 0 0	Fitting and service-laying	
Repair, maintenance, and		account	20 8 0
renewal of mains and			
service-pipes	328 2 11		
Repairing, renewing, and			
refixing meters	211 16 5		
Lighting and repairing			
public lamps	340 8 5		
Rents, rates, and taxes . .	411 12 10		
Management	226 14 9		
Depreciation-fund	728 3 0		
Bad debts	67 16 3		
Total expenditure	£8,335 14 5		
Balance carried to profit and			
loss account	5,413 7 9		
	£13,749 2 2		£13,749 2 2

Dr.—Profit and Loss Account (Net Revenue).

To Income-tax	£105 5 8		
Interest on temporary loans, accrued to March 25, 1880	78 13 0		
Interest on loan, accrued to March 4, 1880	2,259 15 5		
Interest on debenture bonds, accrued to Dec. 31, 1879	219 11 5		
Interest on perpetual annuities, accrued to March 25, 1880	566 0 0		
Interest on loans on debentures, accrued to Dec. 31, 1879	127 8 11		
	£3,356 14 5		
Balance	{ £842 5 9	2,898 19 1	
	{ 2,056 13 4		
		£6,255 13 6	

Cr.—Profit and Loss Account (Net Revenue).

By Balance of net profit, brought from last account, March 25, 1879	£2,342 5 9		
Less general district fund—amount transferred in reduction of rates	1,500 0 0		
	£842 5 9		
Revenue account balance, being profit for the year ending March 25, 1880	5,413 7 9		
	£6,255 13 6		

PROPOSED EXTENSION OF THE OVER DARWEN GAS AND WATER WORKS.

LOCAL GOVERNMENT BOARD INQUIRY.

The Town Council of Over Darwen having applied to the Local Government Board for sanction to borrow £16,000 for works of sewerage and street improvements, £6600 for gas-works extensions, and £2270 for works in connection with the water supply, Mr. S. J. SMITH, C.E., one of the Board's Inspectors, held an inquiry at the Town Hall, Over Darwen, on Tuesday, the 18th inst., when the Mayor (Alderman Snape, J.P.), the Town Clerk (Mr. C. Costeker), the Borough Surveyor (Mr. Stubbs), the Gas Manager (Mr. T. Duxbury), and several members of the Town Council, were in attendance.

The TOWN CLERK said the application to borrow £16,000 for sewerage and street improvement purposes was really made with the object of obtaining funds to put in thorough repair the main street of the town. The Corporation, however, only required £15,000 for this purpose, as they could now borrow £777 2s. 3d. under the special powers obtained last year in the Over Darwen Improvement Act; so that they proposed to ask the Local Government Board's sanction to borrow £15,000. He might add that the Corporation had recently taken in a considerable area, part of the township of Lower Darwen, which had no sewerage at all. With regard to the application for a loan of £6600 for gas-works purposes, he explained that £1450 was required to complete a new gasholder. The Corporation already had the sanction of the Local Government Board to borrow £15,000 for the new holders, but since that sanction was obtained they had extended the district so as to include part of Lower Darwen, which was formerly supplied by the Blackburn Corporation. They purchased the plant, but did not take into consideration that they would have to lay out a considerable sum of money in providing larger pipes, and in extending the mains. This item alone came to £3240. The mains were of various sizes, from 4-inch upwards. The additional plant they had had to put up had cost £135; making tight the old well for holding tar and ammoniacal liquor, £88; and 100 new lamp-pillars for lighting the district, £300. These items made up the £6600. As to the loan of £2270 for works in connection with the water supply, he explained that one part of the district was not supplied with water at all. The residents in that locality, being part of the borough, had made application to the Corporation to be supplied with water, and the Corporation now proposed to construct a small reservoir and supply them, at a cost of £600. Hoddlesden, the place in question, was within the Corporation's water district, and they proposed to take the water there by means of a 24-inch iron main from their present reservoirs, at a cost of £1400. The small reservoir was intended to supply the higher end of the town. The Corporation had some land of their own, and a valuable spring of water, which they intended to utilize by means of a small tank, just for the purpose of supplying a few houses at the upper end of the town. The water came from a spring, and supplied one or two private houses, but the overflow went into the brook and flowed down into Lower Darwen.

Mr. STUBBS said that the capacity of the proposed reservoir was 44,856 gallons.

Mr. DUXBURY remarked that it was proposed to spend £150 upon it.

The INSPECTOR said he did not think they would be able to construct it for this amount. He thought they had better add another £100 or £150 to the cost.

The TOWN CLERK said there was an item of £636 6s. for the extension of pipes in the district. It was proposed to have 739 yards of 6-inch, and 920 yards of 4-inch mains; and there was another item of £35 for new fire-plugs.

The MAYOR stated that the Corporation proposed to construct a line of rails from the Lancashire and Yorkshire Railway to the gas-works in the town, and he did not know whether the Inspector would entertain the question or not, as the Corporation had not made any formal application about the matter. It was for the purpose of bringing down coals to the works, and taking away some of the residuals, and they proposed to expend about £3000 upon it. If constructed, it would be the means of relieving the streets of a good deal of traffic.

The INSPECTOR said there would have to be another inquiry, but he would have some further talk over the matter with the Mayor. He proposed to look round the district, and he would report to the Local Government Board in due course.

The proceedings then terminated.

STOCKTON AND MIDDLESBROUGH CORPORATIONS WATER SUPPLY.

At the Quarterly Meeting of the Middlesbrough Town Council, on Tuesday, the 11th inst.—the MAYOR (Alderman Imeson) in the chair—the half-yearly report of the Water Board was presented.

Alderman BELL moved the adoption of the report, which contained the reports of Messrs. M'Kay and Co., the Board's Auditors, and Mr. Radford, the District Auditor, which latter we gave in the JOURNAL of the 20th ult., p. 603, together with a resolution of the Board relative to the latter gentleman. The statement of accounts showed the fluctuations in the items of revenue during the half year ending Feb. 14, as compared with the preceding half year. In Stockton there was a total decrease of £806 4s. 11d., made up as follows:—Domestic water-rents, £169 18s. 1d.; water supplied by meter, £100 9s. 7d.; and sundries, £35 17s. 8d. In Middlesbrough the domestic water-rents indicated a decrease of £777 15s. 10d.; but the water supplied by meter showed an increase of £916 14s. 2d., and sundries £45 11s. 6d.

Mr. MILDRED asked if £4000 written off in one year for allowances, discounts, and bad debts was not excessive.

Mr. J. STEVENSON said the Council were very glad to receive the report, and were especially indebted to Mr. Radford, who had presented in a very simple form the cost of acquiring the property of the old Company. He had noticed a minute passed by the Water Board, which he supposed was intended to be complimentary to Mr. Radford; but it did not go so far as the Council would like, seeing that they were getting information they had not hitherto possessed. Mr. Radford had traced the cost for the first seven months, and it was £842,296; but the capital expenditure up to the 10th of February was £853,234 13s. 10d., being £8796 for extension of the works under the Act, and £2142 which had been spent and must be added to the cost of acquiring the property. Reverting to a report by the Chairman of the Board, which was included in the Board's report, the Chairman said the net revenue for the half year was £14,465, as compared with £15,187 in the previous half year. The gross receipts showed a falling off, while the expenditure had increased £571. It seemed to require some explanation as to why the expenses were £1000 a year more than the average expenditure of the Company. Increasing the charge for water 25 per cent. did not add to the cost of collecting. As to the financial position of the Board in February last, £12,980 due to the bankers was paid off by the precept for £5000, £1203 received from the Corporation in advance for work in hand, and £8777 out of current water-rates collected in advance. Each Corporation contributed £5000 out of the rates. He did not notice that anything was written off for depreciation of plant. If they took the annual net revenue at £29,652, it would give them £3 9s. 6d. per cent. interest on the capital—£853,234—which, if they could borrow the whole of it at 4½ per cent., would leave a deficiency of £1 0s. 6d. per cent., or £8745 per annum, the amount to be taken out of the rates of the two towns.

Mr. ARCHIBALD said Mr. Radford had given them some valuable information, and they were obliged to him for it. He (Mr. Archibald) never before heard that so ridiculous a sum as £5 was offered for the water-works.

Mr. BARRITT asked how much was still owing to Mr. Mansergh, the Water Board's Engineer. They had paid £37,000 for surveying and boring, £4500 for engineering, and £13,000 to lawyers.

Alderman BELL said he only asked the Council to accept the report. As to Mr. Mildred's question regarding the somewhat irregular mode of dealing with the allowances, the matter had been left too much to collectors. But the Board's attention had been called to it, and he thought it would be found the allowances were decreasing. During the past two or three half years there had been considerable difficulty in collecting any rates. The chief cause of the allowances being large was the difficulty of getting in rates, and then there was the irregular mode of collecting. He was glad the report had received so much attention. Mr. Stevenson had gone through the accounts with some trouble, and he was a good deal astonished to hear him say the first information giving particulars of the cost of acquiring the water-works undertaking was contained in Mr. Radford's report. The Board's last half-yearly report contained exactly the same information as Mr. Stevenson professed he had obtained from Mr. Radford. It was the endeavour of the Board to place before the Corporations, in as complete a form as possible, all the information at their disposal. The capital had been well ascertained for some time, and the whole of it had been paid except £23,000. As to depreciation, there was a sinking-fund provided for by the 1876 Act, and would be made even more stringent by the Provisional Order which the Corporations were applying for. Mr. Stevenson hoped they would borrow at 4½ per cent. He (Alderman Bell) hoped they would do better, but this was a matter for the Corporations, and no doubt they did the best they could. In reply to Mr. Barritt, he might say there was a distinct agreement with Mr. Mansergh, by which a certain sum of money was due to him. He had received £2700 on account, and now he was being paid £1000. £1700 was still due to him. In due course the account would be all liquidated, and then he hoped there would be no further account until trade justified the Board in going on with the works in the upper reaches of the Tees. He should like to say a few words in regard to Mr. Radford. The Water Board thought fit to pass a resolution, and he, as Chairman, was obliged to give effect to it. Mr. Radford's report laboured under disadvantages. He put down the sum of £37,000 for surveying and boring, which was obviously incorrect, but he (Alderman Bell) had no means of checking it. The Council had better let the matter rest for the present, and not condemn the Board without having all the facts they possessed.

Alderman DUNNING said that the £37,000 was made up of the Company's as well as the Corporations charges for surveying and boring.

Mr. STEVENSON said he should like to disclaim all idea of complaining of

the accounts. His object was to draw certain deductions, and, as he understood, the Chairman of the Board had not questioned any of his figures. As to what the Council received some time ago, he did not know. He only quoted from the report before them, and had never seen the figures given before; but he might add that they seemed new to the majority of the Council.

The report was accepted.

Mr. RAYLTON DIXON then moved—"That this Council expresses its dissent from the minutes of the Water Board relative to the report of the District Auditor, and considers that it is indebted to that gentleman for having called the attention of the Board, and through it the Corporation and inhabitants of the borough, to the very important facts in connection with the acquisition of the water-works and the expenses incurred in carrying out the scheme."

Mr. WALTON seconded the resolution.

Mr. ARCHBOLD said that if the figures were inaccurate no such resolution ought to be passed.

Mr. DIXON said that as the Water Board had not raised any question about inaccuracy, the Council had a right to assume the figures were correct. It was a wrong policy to endeavour to "squash"—to "sit upon" a report because it was not palatable. It was better to have all the facts. The water-works had been obtained at a fearful sacrifice, and all the facts were wanted by the public.

Alderman BELL did not know what meaning was attached to the words "squash" and "sit upon," but if they meant that the Board wished to hide, to suppress information, they were as inapposite as they were inelegant.

Mr. MILDRED observed that the Council had had the benefit of Mr. Radford's report, and that he saw no advantage in censuring the Board.

Mr. HANSON said he intended to support the resolution, as he gathered from the Board's report that their desire was to snub Mr. Radford for having done something in excess of his duty. But he had given to the public in regard to the water-works—that unfortunate undertaking—certain figures in a clear tabulated form, such as the public had not seen them in before.

Mr. J. A. JONES thought Mr. Radford had exceeded his duty in expressing an opinion on the policy of the Board, but his figures were so valuable that he ought to be thanked for them.

The motion was then put, and carried by 14 votes to 7.

The meeting then terminated.

SOME NOTES FROM AMERICA.

(FROM OUR OWN CORRESPONDENT.)

The gas affairs of the Metropolis always receive a very liberal share of attention in your JOURNAL, which is natural enough when the immensity of the interest is taken into account; nor is it to be wondered at if, when writing of gas matters from this side of the Atlantic, I deal principally with the condition of the gas business in the Metropolis of America, which is not only of interest, but also not without its moral.

Before looking at the state of affairs to-day, it may be well to go back a little and take a slight glance at the early history of the various Companies; and I shall confine myself to the city proper. The first "grant" by the City of New York to a Gas Company was that to the New York Gaslight Company, dated May 12, 1823, being for the portion of the city south of Grand Street; and at the time this limit included most of the thickly-settled portion of the city. About ten years later—May 8, 1833—a "grant" was given to the Manhattan Gas Company to lay pipes from Grand Street up to Sixth Street; but this portion of the city becoming rapidly built up, the limit of the Company was, in 1847, extended to Forty-second Street, and later the boundary was carried up till it reached Seventy-ninth Street.

In 1858 the city made what I feel was a mistake, in giving a grant to the Metropolitan Company to lay pipes in any portion of the city, and thus enter into competition with both Companies. They, however, confined themselves to the portion of the city between Thirty-fourth and Seventy-ninth Streets, being pitted against the Manhattan Company; but an arrangement was before long arrived at, whereby the Manhattan Company supplied gas only below Thirty-fourth Street. So things ran smoothly till 1872, when the Mutual Company, with power to go over the whole city, began to make gas. This unsettled things, because not only were private customers changing from Company to Company, but the old Companies could not tell how soon the contract to light the public lamps might pass from them. The Mutual Company claimed to be able to make gas much cheaper than the old Companies, but as they used naphtha in a great measure to make their gas from, the older Companies rather had the best of it, and undoubtedly an arrangement could have been arrived at, if another competitor—the Municipal Company—had not stepped in to render things more complicated. Making their gas by a modification of the Tessie du Motay process, they supply a brilliant white light; but whether the large proportion of CO this gas is said to contain is a serious objection to its use, is another question. It is, however, undoubtedly true that they have taken away a good deal of business from the other Companies, trying apparently to get the tender loin, laying the pipes chiefly where the large consumers exist.

From last summer up to within a few weeks, a competition of the most disastrous character was indulged in by these various Companies. It was led off by the Manhattan Company reducing the price, and the other Companies quickly fell in like, till the price was reduced from 2 dols. 25 cents to from 1 dol. 50 cents to 75 cents; and with a little "shopping around" the larger consumers could get extra inducements thrown in, even at the lower figure. Then, indeed, was there rejoicing in the ranks of the gas consumers, truly did they think that the days of cheap gas had come, and their joy was only equalled by their indignation now that the price has gone back to the old point. As if the Companies would continue for ever to supply gas at less than it cost to make it! It is not found that the opposition Companies entered the field out of love for mankind, but to make money; and if for a time the price of gas reached an unnaturally low figure, it will now quickly regain its old point, for one of two things must have happened—either the weaker would have to sell out to the stronger, or else a "mutual arrangement" would be arrived at. In the present instance the fight was ended by a mutual arrangement (the terms of which are kept dark); and a general shaking of hands and raising of the prices ensued. At the latter move the consumers are very indignant, and the customers of one Company are trying to force them back to the low price. They have formed a permanent association, called the Municipal Gas Consumers Protection Association, and seem determined to do all in their power to obtain cheaper gas. It remains to be seen what success they will meet with. A Committee have been appointed to wait on the Company to present what they call their grievance. This protest is worthy of notice, because if they cannot secure their end in any other way they may invite the consumers of the other Companies to join them and petition the Legislature, and any action taken by that body in the present state of public opinion would probably be unjust towards the Companies. In the meantime, the course the Companies should pursue is evident—amalgamate, reduce the capital account, and endeavour

to effect an agreement with the Authorities, whereby a price which would be fair to all parties would be charged, in consideration of the exclusion of all competition. There has been nothing to induce the Companies to do anything but charge as high a price as they dared, when they knew how likely it was that competition would ensue.

On the afternoon of April 14 a serious explosion of gas occurred at the works of the New York Company, fatally injuring three of the workmen. The explosion occurred in the scrubber-house, and it appears that the manhole plates had just been removed from one of the scrubbers, preparatory to the execution of some repairs, when the explosion occurred. At the time the daily papers gave it as the opinion of the officers of the Company that the rays of the sun might have been brought to a focus, in passing through the window, on a piece of waste, setting it on fire, and thus causing the explosion. To say the least, this seems very improbable. Now the opinion is advanced that a spark from one of the engines of the elevated railroad caused the disaster, which also hardly seems probable, as sparks of any size dropped by these engines come direct from the furnace, and land in the road; and a spark to have to reach these gas-works must have been ejected from the smoke stack, where there is a fine screen to prevent such an occurrence. Any spark that could escape from the smoke stack would be of so small a size that it would not have heat enough to cause the explosion by the time it reached the scrubber-house. I have known a piece of waste, when left on a pipe or other metal surface heated by steam, to smoulder to such an extent that it would have to be removed with caution to prevent its breaking into a flame; and perhaps herein may lie the cause of this accident.

I had intended to touch upon some other matters, but the length this communication has already reached forces me to defer doing so to another time.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is practically little or nothing to report this week, so far as business is concerned, in either the coal or iron trades of this district. Since Wednesday most of the collieries and iron works have been closed for the holidays, and business has been altogether suspended. Nominally prices are the same as the previous week, and for gas making coals I hear of low figures being quoted. The average prices at the pit mouth may be given about as under:—Best coal, such as good screened Wigan Arley, 7s. 6d. to 8s.; seconds, such as inferior Arley and Pemberton four-feet, 6s. to 6s. 9d.; common round coal, 5s. to 5s. 6d.; burgy about 4s. to 4s. 3d.; and good slack, 3s. 6d. to 3s. 9d. per ton. In iron, local smelters are still asking about 52s. 6d. per ton, less 2½, for foundry and forge, delivered into the Manchester district. Bars could be bought at £6 12s. 6d. to £7, and puddled bars at under £4 per ton, but there is nothing doing.

An important development of the coal resources of the Manchester district is being effected at Ashton Moss, where, after operations extending over the last five years, valuable seams of coal varying in thickness from 2 ft. 6 in. to 4 ft. 6 in. have been proved, the existence of which, at least at a workable depth, had previously been regarded with very considerable doubt.

THE SOUTH STAFFORDSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

As usual at holiday time, but little has been done at the collieries in this district during the past week; nor is there much hope that business will be very brisk for the next few weeks to come. Matters at the present time are not so satisfactory as the promise of a month ago had led masters to look forward to, and a downward movement in the iron market will lead, it is feared, to a reduction in the price of fuel. At most of the South Staffordshire mines the output is not so great as it was during the early part of the year. Underselling is going on, and complaints of this practice are daily being made. Its continuance, aided by a weak and sluggish market, will doubtless hasten a downward tendency to a general alteration of tariff. Notice of a reduction of wages to the amount of 3d. per day was given by several of the large colliery owners hereabouts, and this came into effect on Saturday. The miners are crying out against the reduction, and on Thursday last a meeting of the men employed at Pelsall Hall Colliery, the Pelsall Coal and Iron Company's pits, and some half dozen others in the district, was held, to protest against any further reduction of wages. There is plenty of ironmaking coal for immediate use in stock, and but little has been imported into the district of late. In gas coals there is a fair business being done, and prices are more even in this branch. At the Cannock Chase and Brownhills Collieries things have shown no material alteration, and the demand for house coals is fairly good. In the Cannock Chase district, however, there is a feeling of dissatisfaction existing at the present arrangement of the sliding scale, and the union men are making efforts to get an early alteration of the same effected.

Coke is not in good request, but prices are quoted at the rates given last week.

The iron trade remains unaltered, though a few additional furnaces have been blown out. The production, when compared with that of a month ago, shows but little diminution, and it is now stated that many more furnaces were relit than were really needed to supply the wants of the market. Nevertheless, stocks have again accumulated, and a general reduction must follow. The Earl of Dudley and Messrs. Barrows, of the Bloomfield furnaces, have issued circulars to their customers, notifying a reduction of £1 per ton on marked bars. Other makers, it is stated, will shortly follow these examples. The Earl of Dudley's Manager, who is also the inventor of the Casson-Dormoy furnace, started a few days ago on a tour of inspection to the principal iron-works in the United States. The business being done with the American market is not of that cheerful character which makers looked forward to at the commencement of the quarter, and this fact is owing, to a great extent, to the altered tone of affairs. India continues to be the good market for all kinds of foundry iron-work, which is perhaps the most hopeful feature of the trade. The markets at both Wolverhampton, on Wednesday, and Birmingham, on Thursday, were unusually dull and quiet. Sales were slow, and there was underselling in branded bars and sheets. Pig iron was not in good request, but foundry iron was more actively inquired after. Nail rods, hoops, and common sheets were offered at prices much the same as quoted a week ago. For galvanizing sheets, also for iron and tube making, and for boiler plates, there was an average inquiry.

THE YORKSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The collieries, with few exceptions, were closed for several days last week on account of the Whitsuntide holidays, and operations in many were not resumed until Thursday, owing to the quiet, and almost unprecedented state of trade. As was stated in my last report, several important contracts for gas coal were pending, and were exciting a good deal of interest amongst colliery proprietors. The Nottingham gas coal contract for 100,000 tons per annum has been decided, and it is believed has been placed on as advantageous terms as before. It is stated that part of the contract has been given to the Thorncliffe Collieries, where a capital

gas coal is raised; but, with this exception, no part of the contract seems to have been placed in Yorkshire. There is but little improvement to be noted with respect to the demand for either the Silkstone or Barnsley thick-seam coal for London and the South, on which many collieries have to rely for trade. There is also but a limited business doing in household qualities for the Eastern Counties and Lincolnshire, whilst home sales are very moderate.

The production of locomotive and steam coal is pretty large, considering the resources of the district collieries. There is more doing in connection with the export trade to the Baltic and other ports. The South Yorkshire pits have the advantage of the coalowners in the West Riding with respect to the Grimsby trade, but the latter body enjoy greater facilities and an easier rate from Normanton and the West Riding district to Hull. Efforts are, however, being made to extend the Hull trade in South Yorkshire, and at the Oaks and some other pits where steam coal is largely raised a goodly number of the waggons are being fitted with "hopper" bottoms, in order to more easily facilitate the shipment of the coal into the vessels and steamers. Coalowners are earnestly waiting the decisions come to with regard to the supplies of locomotive and other kinds of fuel required by the Midland and Great Eastern Railway Companies, whose contracts are now being placed.

No change can be noted with respect to the coke trade, which of late has formed an important branch of mining operations. The output throughout Yorkshire, but particularly in the southern part of the coal-field, is very large, and is being almost constantly increased by the erection of some new ovens, tenders for completing 28 new ones at the North Gawber Hall Colliery being asked for at once. The demand for North Lincolnshire holds up well, notwithstanding the competition of Durham and North of England makers.

The chief feature of the week has been the visit of the Royal Commission on Accidents in Mines, who came to the South Yorkshire district on Thursday. The main object was a personal inspection of several of the collieries where sudden and destructive outbursts of gas have from time to time taken place, extinguishing the miners lamps, and in some instances firing them. The whole of the Committee, except Lord Lindsay and Sir G. Elliott, were present, and visited the Stafford Collieries and the Oaks Collieries—the former working the Silkstone, and the latter the Barnsley seam of coal—at both of which places several alarming outbursts have occurred.

The iron trade has undergone but little change during the past week. The output of pig iron has been maintained, but there has been little work done at the foundries and some of the forges, on account of the holidays.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The shipment of coals from the Tyne improved last week. They were equal to 6000 chaldrons a day from the Tyne Dock alone. The demand for gas coals is a moderate average. Best qualities ruled about 7s. a ton f.o.b. on the Tyne; 6s. 6d. medium qualities; 6s. per ton and less money for inferior sorts. Coke is not so dull as it was, sales having become better over the past week or ten days. Steam coals are in good demand. The better sorts of small coals sell well for local consumption. Stronger prices are paid. There have been improved arrivals of coasting vessels, which have come to load gas coals in the Tyne. They were engaged before they left their port and arrived here, as a rule. Very few seeking vessels have therefore been taken up. A few foreign sailing ships have been offered to load coals to carry coastwise at comparative low rates. Channel freights for sailing vessels are about 6s. per ton, and to the North of France 6s. 6d. to 6s. 9d. per ton. There is a pretty good supply of steamers for the home trade; but handy boats are rather scarce for long voyages. Higher freights have, therefore, had to be paid for steamers to load coals overseas.

Fire-bricks and fire-clay goods continue to be supplied to the northern parts of Europe, and the trade is well maintained; but chemicals seem to have entirely collapsed for the time. Prices of some articles have been as low as in the worst times. There are few speculative transactions, and but a limited number of orders. The outlook in the trade can only be described as unsatisfactory.

Foundry work is getting slack in the Tyne. Few gas or water pipes are shipped abroad at present. The iron trade is generally dull and irregular. Lead is cheaper. English makers, however, refuse to sell at present prices. Copper is slightly better. The importation of timber into the northern ports is not excessive. The consumptive demand has improved. The prices are stiffer; but there is no great advance.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The annual general meeting of the Stonehaven Gas Company was held last week—Mr. Alexander Weir, Bath Lodge, Chairman of the Company, presiding. The balance-sheet and statement of the affairs of the Company, for the year ending April 30, were submitted to the meeting, and were considered very satisfactory, the profit for the past year amounting to £569 6s. 9d. On the recommendation of the Directors, a dividend of 8½ per cent. was declared, being 6d. per share more than the dividend declared a year ago. The following gentlemen were appointed to the directorate for the ensuing year—namely, Provost Wood, Messrs. Thomas Mitchell, Alexander Weir, George Strathelee, David Carr, A. W. Kinnear, D. B. Hutcheon, J. W. Thomson, and J. G. Soutar. At a meeting of the Directors, held after the general meeting, Mr. Alexander Weir was re-elected Chairman of the Company, with Mr. James Wood as Secretary and Treasurer, and Mr. James Ross as Collector; and it was resolved to reduce the price of gas 5d. per 1000 cubic feet—from 5s. 5d. to 5s.—and to reduce the meter-rents from 2s. to 1s. 6d. per annum. The street-lamps of Stonehaven are wholly kept up by the Gas Company free of charge, so that if that circumstance were taken into account, and the Company were paid for the lamps, the price to ordinary consumers would now stand at 4s. 9d. per 1000 feet.

A man named William Smith, a bricklayer, residing in Allison Street, Ayr, was cited to appear before Bailie Sloan, at the Ayr Burgh Court, on Monday, the 17th inst., charged with tampering with the gas-meter in his house. He failed to appear, and forfeited his bail of £3.

The monthly meeting of the Forfar Corporation Gas Commissioners was held on Monday last week—Provost Lowson presiding. The question of borrowing powers was again up for consideration. Following the advice of the Parliamentary Agent, the Gas Committee recommended that additional powers should be applied for, by means of a Provisional Order under the Police Act. In supporting the recommendation, Bailie Laird, the Convener, made a long statement regarding the affairs of the Gas Commission, and the Provost and other speakers followed. In the course of the discussion it was generally agreed that the financial affairs of the Commission had been mismanaged, because the money standing at the credit of the contingent and sinking funds had been applied to the extension of the gas-works, and that after all the bank account was overdrawn, and the borrowing powers exceeded by £3000. The gas had also been sold at too low a price. It was agreed to adopt the recommendations of the

Committee, and it was remitted to a Committee to report on the amount required.

Some few weeks ago it was announced that a difficulty had arisen between the Gas Company and the Police Commissioners of Musselburgh in regard to the amount of the claim made for the price of gas by the first-named body. It has now transpired that the amount offered by the Commissioners—£82 19s.—has been accepted by the Gas Company. In referring to the matter at the last meeting of the Police Commissioners, Bailie Riddock stated that there would probably be no further disputes regarding the quality of the gas.

While in London lately, in connection with a parliamentary Bill, several of the Clyde Lighthouses Trustees visited the works of Pintsch's Gas Company, where the gas is manufactured for the buoy lighted on the Shoals Patch, Roseneath Point. It is stated that the Trustees are so satisfied with the result of the experiments at the Shoals Buoy that they intend shortly to extend the system, and that in a few weeks the buoy at Skelmorlie will be replaced by one similar to that at Roseneath, while before the winter arrives the buoys between Greenock and Glasgow will also be provided with the same illuminating power. At present the gas has to be brought in tanks from Pintsch's works in London, but when the new arrangements are entered into a small works will be erected on the banks of the Clyde for the manufacture of the gas.

Business was done in the stock of the Edinburgh Gas Company last Tuesday at £45 15s., being an advance of 5s. upon that of the previous Saturday.

Messrs. J. and A. Leslie, Civil Engineers, Edinburgh, have lately reported that with favourable weather the Dunfermline Water-Works will be completed by the end of August, the embanking of the reservoir having now been raised to within 42 feet of the top in the lowest part of the valley.

At the last monthly meeting of the Edinburgh and District Water Trustees, the following motion was agreed to by a large majority, namely—"That the sum in the new Bill be increased to £150,000, with the view of paying the cost of new mains and extension of pipes for a period of years out of capital; and that the Trustees remit to the Bill Committee to endeavour to have that sum inserted in the Bill." It was also agreed that consumers of water beyond the compulsory area embraced by the Water Acts should be charged 6 per cent. on the cost of laying down pipes, and 2d. per £1 on their rental, in excess of the cost of the domestic water-rate for Edinburgh; and it was further resolved that persons using water in bulk should pay 2d. per 1000 gals., and 6 per cent. on the cost of laying down the necessary pipes.

Mr. J. F. Bateman, C.E., lately visited Perth in connection with the new water-works, and attended a special meeting of the Water Commissioners, by whom he was subjected to a course of questioning on the effect on the health of the inhabitants, of the alleged poisoning of the water supply. He said it was almost impossible to get all the joints of the new pipes absolutely perfect at first, but he believed the admixture of sewage with the water supply was so slight as to be positively harmless to the public health, and he had given instructions to have the weakest part of the pipes embedded in concrete. On being further interrogated, Mr. Bateman said he believed the water collected in the filters which were supposed to have been contaminated was as pure as any to be obtained anywhere in the country. There was no better water in existence than that with which Perth was supplied. As to the effect of impurities on the public health, that was a matter for a chemist, and not an engineer; but speaking as an engineer and not as a chemist, he did not believe there were any grounds whatever to fear pollution. On the motion of Lord Provost Richardson, Mr. Bateman was thanked for his explanations. The extended water supply scheme for Perth is capable of providing a population of 30,000 inhabitants with 900,000 gallons per day. Since Mr. Bateman's interview with the Commissioners, the medical men of Perth have held a meeting for the purpose of considering the present unhealthiness of the city. There were ten doctors present, and after some discussion they passed the following resolution:—"That, in the opinion of the undersigned medical men in Perth, the present excessive sickness and death-rate in the city are due to pollution of the water supply, possibly aggravated by atmospheric influences and defective drainage; and that until the well and pipes are absolutely water-tight, and the general sewage carried beyond the filter-bed, matters cannot be permanently rectified." A Committee was appointed to confer with the Local Authority on the subject.

The Town Council of Hawick, at a meeting held last Thursday, resolved to introduce an additional supply of water from Dodburn, about six miles distant from the town. The new scheme provides for a supply of 600,000 gallons per day, at an estimated cost of £15,592, or about 4d. per pound on the rental. This, with the present supply, will raise the total to about a million gallons for 15,000 people.

It is reported that the new water supply scheme from the Dhu Loch, for meeting the wants of the inhabitants of the higher parts of Rothesay, is giving the most thorough satisfaction.

The Shareholders of the Forres Water Company, at their annual meeting recently held, declared a dividend of 5 per cent., as against 6 per cent. last year. Forres is one of the very few Scotch towns where the water supply is still in the hands of a private Company.

Last week's Glasgow pig iron market was dull, and only a limited amount of business was done at gradually receding prices. The highest price was 46s. 4½d. cash on Monday, and as low as 45s. 6d. cash was accepted on Friday afternoon. Manufactured iron is excessively quiet, and manufacturers are usually willing to meet the demands of buyers for lower prices.

No improvement is yet showing itself in the coal trade.

WELLS (SOMERSET) GAS COMPANY.—The annual general meeting of this Company was held last Tuesday, when the notice convening the meeting having been read by the Secretary (Mr. Edward Padfield), the Chairman announced that the Directors had resolved that full dividends should be paid on all classes of shares, and, in addition, 2 per cent. upon all stock except the preference shares. Other matters were then dealt with, and in the end a hearty vote of thanks was given to the Chairman.

THE HOLYWELL GAS ORDER OF THE BRITISH COMPANY.—At a special meeting of the Holywell Local Board last Wednesday, it was unanimously agreed to oppose the confirmation of the Provisional Order granted by the Board of Trade for further powers to the British Gaslight Company in respect to their Holywell undertaking. A public meeting of the owners and ratepayers of the town will now have to be held, to sanction this resolution, if the costs of the opposition are to be paid out of the borough rates.

LIVERPOOL GAS FITTINGS COMPANY, LIMITED.—The fourth annual meeting of this Company was held last Tuesday—Mr. S. H. Thompson in the chair—when the Directors report on the operations for the twelve months ending March 31 was presented. It congratulated the Shareholders on the satisfactory result of the year's work, the net profit for that period being £1418 2s. 4d., which, with £693 14s. 2d., the balance brought from the previous year, left the sum of £2111 16s. 6d. to the credit of profit and loss.

The Directors recommended that a dividend be declared for the year at the rate of 10 per cent., with a bonus of 1s. per share (free of income-tax), which would leave £611 16s. 6d. to be carried forward to next year's account. The Chairman moved, and Sir Thomas Earle seconded, the adoption of the report, which was agreed to; as was also the dividend recommended in it. On the motion of Mr. J. Darcie, seconded by Mr. J. F. Robinson, a vote of thanks was accorded to the Chairman and Directors for the satisfactory way in which they conducted the affairs of the Company; and a similar compliment was paid to the Secretary and Manager (Mr. Samuel Haynes) and the Officers, for their services.

DEATH OF MR. J. BARCLAY, OF BRECHIN.—We regret to announce the sudden death of Mr. James Barclay, the highly-respected Manager to the Brechin Gaslight Company, and one of the oldest gas managers in Scotland, if not, indeed, the very oldest. Mr. Barclay, who was in his seventieth year, died last Wednesday morning. Our correspondent writes: "Appointed Manager to the Gas Company so long ago as the year 1842, he continued to discharge the duties of his office single-handed until about eight years ago, when the increasing business of the Company rendered necessary the appointment of a Collector in addition to the Manager. Advancing years led Mr. Barclay during last winter to resign the management, and arrangements had been completed by the Directors to relieve him at this term, and he was to have left the Company's house in a day or two in order to make room for his successor. Mr. Barclay was, however, fated to breathe his last on the premises of the Company whom he had served so long and so well during the whole period of his management. It is no exaggeration to say that the deceased had the prosperity and welfare of the Company continually in his mind both by night and by day."

Register of Patents.

APPLICATIONS FOR LETTERS PATENT.

- 1980.—WISCHEN, G., Prague, Austria, "Improvements in and appertaining to the distillation of anthracene from coal tar." May 14, 1880.
2001.—URQUHART, J., Manchester, "Improvements in meters or apparatus employed in measuring the flow of fluids." May 15, 1880.

2018.—LAKE, W. R., Southampton Buildings, London, "Improvements in the manufacture of gas, and in apparatus therefor." A communication. May 18, 1880.

2039.—HOWORTH, J., Farnworth, Lancs, "Improvements in and connected with ventilators or apparatus for exhausting, forcing, or compressing air, gases, or other products." May 19, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

4712.—FRANKS, M., Blaenavon, South Wales, "An improved reflector or distributor of light for lamps or other similar lighting apparatus." Nov. 19, 1879.

4820.—EDMONDS, E., Fleet Street, London, "A new or improved gas motor or engine, and new arrangements of mechanism employed with the same." A communication. Nov. 25, 1879.

4917.—DEHAYNIN, F. G. C., Paris, "Improvements in apparatus for the simultaneous production of steam, hydrogen, and oxide of carbon, in order to produce a gas proper for supplying gas-movers, singeing fabrics, heating apartments, and other similar applications." Dec. 1, 1879.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

1805.—DÜLKEN, A., "A new mode of constructing water-meters, capable of serving at the same time as prime movers." May 9, 1877.

1822.—MILNE, J., "Improved appliances to railway and tramway carriage gasholders, whereby they may be automatically charged." May 10, 1877.

PATENTS WHICH HAVE BECOME VOID

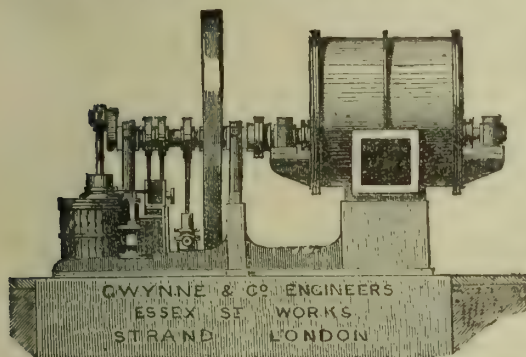
BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

1285.—ELLIS, A. W., "Improvements in the utilization of waste products of ammoniacal liquor." April 8, 1873.

1287.—ROWLAND, T. F., "Improvements in apparatus for supplying and measuring coal and charging and emptying gas-retorts." April 8, 1873.

1533.—COLLS, F. W., "Improvements in the manufacture of gas for heating and lighting purposes, and in the apparatus employed therefor." April 28, 1873.

The **GRAND MEDAL of MERIT** at the **VIENNA EXHIBITION**, **TWO MEDALS** at the **PHILADELPHIA EXHIBITION** and **TWO MEDALS** at the **PARIS EXHIBITION**, have been **AWARDED** to **GWYNNE & CO.** for **GAS-EXHAUSTERS, ENGINES, and PUMPS**; Also **27 OTHER MEDALS AWARDED** at all the **GREAT INTERNATIONAL EXHIBITIONS.**
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce machinery of the very highest quality, and most approved design and workmanship. The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

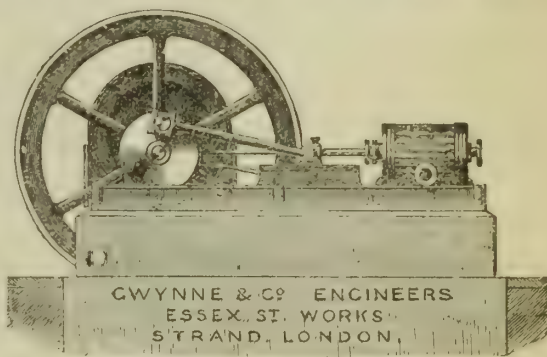
Exhausters, with or without Engines combined, can be made to pass the gas **WITHOUT OSCILLATION OR VARIATION** IN **PRESSURE** Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, **GWYNNE & CO.,** Hydraulic and Gas Engineers, **ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.**

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship."

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

BEALE'S IMPROVED PATENT GAS EXHAUSTERS,

WITH

Wrought-Iron Spindles and ENGINES COMBINED.

SOLE MAKERS,

GEORGE WALLER & CO.

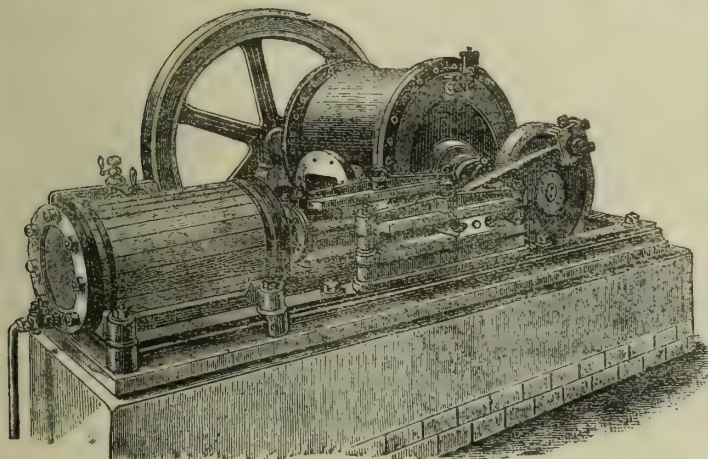
MAKERS OF ENGINES, EXHAUSTERS, INDEX AND DISC GAS-VALVES, HYDRAULIC MAIN VALVES, BYE-PASS VALVES, TAR, LIQUOR, AND OTHER PUMPS, SCRUBBERS AND PURIFIERS, CONDENSERS, BOILERS, &c.

G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

[SEE ALSO ADVERTISEMENT, PAGE 814.]

Phoenix Engineering Works:

HOLLAND STREET, SOUTHWARK, S.E.



WANTED, Readers of the NEW Edition,
"Cooking & Heating by Gas;" on Burners, &c.
Copies, by post, Threepence, direct from the Author,
MAGNUS OEHREN, Assoc. M.I.C.E., Gas-Works, SYDENHAM.

TO GAS COMPANIES AND OWNERS OF GAS-
WORKS.

THE Advertiser offers his Services as
MANAGER or Manager and Secretary of small, or
Assistant in large Works. Having had several years ex-
perience (two years as Manager of a Works making 20
millions), is well acquainted with every detail of Manu-
facture, Office Work, &c. Unexceptionable references as
to character and ability.

Address No. 656, care of Mr. King, 11, Bolt Court,
FLEET STREET, E.C.

TODMORDEN GAS COMPANY.

WANTED, an Energetic Man as Col-
lector and Meter Inspector. Salary £65 per annum.
Security required.

Address, on or before the 27th inst., in own handwriting,
stating age, qualifications, &c., to

HENRY A. COLES, Manager.
Gas-Works, Todmorden, May 14, 1880.

WANTED, a Working Manager for
the Wigston Gas-Works, near Leicester. Eight
retorts in use last winter. Will be required (with assistance
in winter) to do all Stoking, Main and Service Laying,
Meter Fixing, &c. House, coal, and gas provided.

Applicants to enclose testimonials, and state age, where
and when last employed, and wages required.

JAMES SHARP, Secretary.
Wigston Magna, May 22, 1880.

THE Corporation of Birkenhead are
prepared to receive APPLICATIONS for the Office
of ENGINEER, to Take Charge of the Gas-Works in that
town. The candidate appointed would be required to
devote the whole of his time to the duties of such office.

He must be thoroughly experienced in the manufacture
and distribution of Gas, and must be competent to design
and carry out additions to and extensions of Gas-Works.

The quantity of Gas at present made in the Birkenhead
Gas-Works is about 250 million cubic feet per annum.

Applications, stating age, qualifications, and salary
required, not exceeding £500 per annum, together with
testimonials, addressed to the Chairman of the Gas and
Water Committee, Municipal Offices, Birkenhead, and Dip-Pipes.
and endorsed "Gas Engineer," must be sent in on or before
Monday, the 7th day of June prox.

By order,

ANDREW WALN, Town Clerk.
Municipal Offices, Birkenhead, May 22, 1880.

WANTED, a good Second-hand
EXHAUSTER, about 2000 ft. per hour.
State price and condition to D. J., 3, Queen's Terrace,
MIDDLESEX-ROUGH-ON-TEES.

TO ENGINEERS AND MANAGERS OF GAS-WORKS.

WANTED, good Second-hand Gas
PLANT, viz.:-

One Purifier, 9 ft. by 7 ft., Wood Sieves, &c., complete,
with 6-in. Inlet and Outlet; 500 yards of 3-in. Socket and
Spigot Pipes, in 9 ft. lengths.

Retort Mouthpieces, 15-in. Circular, Cross-Bars and
Lids, Ascension-Pipes, Saddle-Pipes, and Dip-Pipes.

Apply to Mr. BENJAMIN FARMER, Secretary to the Gas
Company, SHIFAL, SALOP.

SLEAFORD GAS COMPANY, LIMITED.

FOR SALE—Single Gasholder, 32 ft. by
14 ft., Counter-balanced, Connections and all com-
plete, in good condition. Reason for removal, ground
wanted.

Particulars to be had of HARRY WIMBURST, Manager.

FOR SALE—A Second-hand Square
STATION-METER, to pass 40,000 cubic feet per
hour. Erected about 12 years. Made by Messrs. J. and
J. Braddock, Oldham. Now in use at the Plymouth Gas-
Works. To be removed to make place for a larger sized
Meter. To be sold a bargain.

For price and particulars apply to W. W. ANDREWS, 238,
Kingsland Road, LONDON.

A BARGAIN.

FOR IMMEDIATE SALE—A Round
STATION-METER, capable of passing 2500 cubic
feet per hour (clock in centre), three 4-in. Bends, and one
5-in. Four-way Valve, which have been taken down to
make room for a larger one.

Apply to Mr. W. C. DAWSON, Gas-Works, ARUNDEL.

EXHAUSTER FOR SALE.

THE Malton Gas Company have for
Disposal an EXHAUSTER and ENGINE, erected
by Messrs. Dempster in 1873, capable of passing 7000 cubic
feet per hour.

It may be seen in operation, and further particulars
obtained on application to the undersigned.

HENRY TOLBY, Secretary.

FOR IMMEDIATE SALE.

SIX MOUTHPIECES, with Morton's
Lids, for 21 in. by 15 in. Oval Retorts, Ascension,
Arch Dip-Pipes, and Wrought-Iron Hydraulic Main.

Combined Engine and Exhauster, to pass 5000 ft. per
hour.

10-ft. Square Purifier, with Wrought-iron Cover and
Lifting ear.

Gasholder to contain 7000 feet.

Station-Meter to pass 3000 ft. per hour.

One Wrought and One Cast-Iron Coffey's Still or
Washer

Exhauster Governor, Throttle and Bye-Pass Valves.

Steam, "Special," and Force Pumps; Rope Hoist.

Small quantity of 6-in. Cast-Iron Pipe and Connections,
and 4-in. Hot-Water Pipe, and Sundries.

Apply to C. E. BOTLEY, Gas-Works, Wormwood Scrubbs,
KENSAL TOWN, W.; or to the SECRETARY of the New Gas
Company, Limited, 16, George Street, MANSION HOUSE,
E.C.

CAMBRIDGE UNIVERSITY AND TOWN
GASLIGHT COMPANY.

TO MANUFACTURING CHEMISTS AND OTHERS.

THE Directors of the above-named Com-
pany have for Sale about 190 tons of Spent OXIDE
OF IRON.

The same may be seen and samples taken upon applica-
tion to

JAMES WEEKS, Manager.

Gas-Works, Cambridge, May 21, 1880.

CAMBRIDGE UNIVERSITY AND TOWN
GASLIGHT COMPANY.

THE Directors of this Company have
for Sale the undermentioned PLANT:-

18 Lengths of Hydraulic Main, each 9 ft. long, 18 in. by
15 in. diameter.

Three Lengths of Hydraulic Main, each 10 ft. long, 19 in.
by 17 in. diameter.

125 Mouthpieces, with Ascension-Pipes, complete.

One Condenser, formed of 52 9-in. Pipes.

One Scrubber, 20 ft. high, 5 ft. diameter.

One Purifier, 11 ft. 6 in. square.

One " " 14 ft.

One Travelling Crane for the above.

One Meter to pass 15,000 cubic feet per hour.

One Governor to pass 30,000 " "

Two 9-in. and eight 12-in. Valves. " "

Four Wrought Girders, each 44 ft. long by 17 in. by 6½ in.

Two Cast Columns, each 21 ft. long by 13 in. by 10 in.

Two " " 14 " " 10 " 8 "

Two " " 11 " " 9 " 7 "

One " " 10 " " 12 " 10 "

The above may be seen and further particulars obtained of

JAMES WEEKS, Manager.

Gas-Works, Cambridge, May 21, 1880.

GAS PLANT FOR SALE.

THE Coventry Gas Company have for
SALE:-

SCRUBBERS.—One 5 ft. 6 in. diameter, 15 ft. high. One
5 ft. diameter, 20 ft. high; with or without 8-in. Connec-
tions and Valves.

STEAM-JET VENTILATOR.—One No. 2 Körting's
Patent Jet Ventilator, with Chest. One No. 3½ Körting's
Patent Jet Blower.

VALVE.—One 12-in. Cathels's Four-way Valve.

The above are being replaced by larger apparatus, and can
be removed at once. Also a 100-light Gas Apparatus
(Porter's make); this includes a Gasholder, 14 ft. diameter
and 10 ft. high, which could be sold separately.

For particulars and prices apply to

W. L. ROBINSON, Manager.

Gas-Works, Coventry, April 17, 1880.

THE Sheffield United Gaslight Company

OFFER for SALE the following lots of Retort-
House FITTINGS, which they are now taking down at
two of their Stations:-

54 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft.
6 in. by 18 in. by 18 in.

16 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft.
6 in. by 18 in. by 15 in.

4 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft.
6 in. by 16 in. by 15 in.

320 Cast-Iron Mouthpieces, D-shaped, 21 in. by 15 in.

160 Lengths 4-in. Cast-Iron Ascension-Pipes, straight,
7 ft. 6 in. long.

215 Lengths 4-in. Cast-Iron Ascension-Pipes, straight,
5 ft. 6 in. long.

50 Lengths 4-in. Cast-Iron Ascension-Pipes, curved,
5 ft. 6 in. long.

60 Lengths 4-in. Cast-Iron Ascension-Pipes, curved,
2 ft. 8 in.

37 Lengths 4-in. Cast-Iron Ascension-Pipes, curved,
10 ft. 2 in.

40 Lengths 4-in. Cast-Iron Ascension-Pipes, straight,
5 ft. 10 in.

17 Lengths 4-in. Cast-Iron Ascension-Pipes, straight,
5 ft. 5 in.

431 Lengths 4-in. Cast-Iron H-Pipes.

506 Lengths 4-in. Cast-Iron Dip-Pipes.

The above apparatus has been in use up to a recent date,
and is adapted for re-erection.

The Company will be prepared to receive an offer for
the whole or any portion of the above. Price £4 per ton,
loaded into trucks at Sheffield.

Applications to be addressed to the undersigned.

THOS. ROBERTS, Manager.

Gas Office, Sheffield, March 25, 1880.

THE Gloucester Gas Company, ceasing
to manufacture gas at their old works, will have the
undermentioned APPARATUS for Sale about the beginning
of August, viz.:-

About 150 feet of D-shape Wrought-Iron Hydraulic
Main, size 19 in. by 19 in. Also about 38 ft. of D-shaped
Wrought-Iron Hydraulic Main, size 20 in. by 20 in. An-
nular Condenser, consisting of six Vertical Pipes, 24 in.
diameter, 19 ft. high, with three 12-in. Slide-Valves and
12-in. Connections.

Scrubber (round), 5 ft. by 20 ft., with three 12-in. Slide-
Valves, and 12-in. Connections.

Exhauster (Jones) to pass about 15,000 feet per hour.

Exhauster (Beales) to pass about 25,000 feet per hour.

Two Vertical Steam-Engines, each about 6-horse power,
with Pulleys, and Shafting used for driving the above.

Boiler 14 ft. 6 in. by 3 ft. 6 in., with Centre Tube, and
four Galloway Patent Tubes.

4-horse power Horizontal Steam-Engine.

Three 4-in. Pumps, with cranked Shafting and a pair of
Mitre Wheels.

Two Purifiers, 16 ft. by 8 ft., with six 12-in. Slide-Valves
and 12-in. Connections.

Gasholder, Double Lift, with Cast-Iron Tank, capacity
37,000 feet.

Gasholder, Double Lift, capacity 100,000 feet.

Gasholder, Double Lift, capacity 240,000 feet.

One 12-in. Governor, by Wright, London, with 12-in.
Valves, Bye-Pass, and Connections.

Two 12-in. four-way faced Valves, by Cockey.

For further information, &c., apply to the undersigned.

R. MORLAND, Engineer.

GUILDFORD GASLIGHT AND COKE COMPANY.

THE Directors are prepared to receive
TENDERS for the TAK and LIQUOR produced at
their Works for the year ending June 30, 1881.

Tenders to be delivered to Mr. LONGWORTH, Gas Offices,
GUILDFORD, on or before Tuesday, June 8, and from whom
any required particulars may be obtained.

GAS PLANT FOR SALE.

THE Maidstone Gas Company having
enlarged their Works, offer the following Apparatus
for Sale in good condition:-

SCRUBBERS.—One Tower Scrubber 30 ft. high by 10 ft.
diameter, with Distributor, and partly fitted with Livezey's
boards.

CONDENSERS.—One Set of Annular Condensers, con-
sisting of 9 Pipes 17 ft. high, outer diameter 2 ft. 6 in.,
fitted with 12-in. Valves, complete.

ENGINES.—Two 12-Horse Power Horizontal Engines
in very good condition.

STATION-METER.—By Milne and Son, in first-class
condition, ornamental case, with Valves and Bye-pass
complete; to pass 20,000 cubic feet per hour.

HYDRAULIC MAIN.—Six 8 ft. by 18 in. Hydraulic
Main D wrought iron; 24 8 ft. 9 in. by 18 in. Hydraulic
Main D wrought iron. Nearly new.

BRIDGE AND ASCENSION PIPES.—90 6 in. by 4 in.
Bridge-Pipes, and a quantity of 6-in. Ascension-Pipes and
Bends.

RETORTS.—31 Rounds, 15 in. diameter and 9½ ft. long,
in two pieces. 2 Ovals, 21 in. by 15 in. and 9 ft. long, in
one piece. All of Stourbridge Fire-Clay, and in good
condition.

For further particulars and price apply to

JOHN WEST, Engineer and Manager.

Gas Works, Maidstone, April 21, 1880.

THE Directors of the Shelley and Shepley
Gaslight Company, Limited, invite TENDERS for
BRICK RETORTS, Two Beds of 5 each, and other
Extensions.

Further particulars may be obtained from the Manager
to the above Company.

Tenders to be sent in on or before May 27, 1880, and
addressed to WM. PEACE, Chairman.

SALFORD CORPORATION GAS-WORKS.

THE Corporation of Salford invite
TENDERS for the Supply of CANNEL and COAL
required at the various Gas Stations in Salford for One,
Two, Three, or more years, commencing on 1st September
next.

Forms of tender (upon which only tenders will be re-
ceived) and all particulars may be obtained on application
to the Engineer, Mr. Samuel Hunter, Gas-Works, Lamb
Lane, Salford.

Tenders, endorsed "Cannel and Coal Contract," to be
delivered to me on or before the 22nd of June next.

The Corporation do not bind themselves to accept the
lowest or any tender.

By order,

CHRIS. MOORHOUSE, Town Clerk.

Town Hall, Salford, May 14, 1880.

CITY OF LIMERICK.

TO ENGINEERS.

THE Town Council of Limerick will
receive PLANS for the Construction of Works to
give, either by gravitation or otherwise, a Continuous
Supply of Pure Water (assumed to be One million gallons
daily at the least), proper and sufficient for all purposes
and requirements—public, domestic, and otherwise—to
the City of Limerick and its suburbs. The pressure to be
such as will command at all times the highest elevation of
all buildings.

An estimate of the expense of constructing the proposed
Works to accompany each plan, and the probable time
stated within which same can be completed.

The Council will not bind itself to accept or pay for any
of the plans.

Plans, &c., under cover and seal, addressed to the
"Town Council," to be delivered at the Town Clerk's
Office, Town Hall, Limerick, before the 15th day of
July, 1880.

JOHN ELLIARD, Town Clerk.

Town Hall, May 10, 1883

THE SHREWSBURY GASLIGHT COMPANY.

AMMONIACAL LIQUOR.

THE Directors of the above Company
are desirous of receiving TENDERS for the Pur-
chase of the Surplus AMMONIACAL LIQUOR made at
their Works during the Three years commencing July 1,
1880.

The estimated quantity for disposal is about 1200 tons
per annum, delivered into tanks on the London and North-
Western Railway, or into boats on S.U. Canal (the latter
preferred) at Shrewsbury.

Payments to be made monthly, net.

Tenders to state a separate price per Ton for Liquor of
5°, 6°, and 7° Twaddell, and to be sent in to the undersigned
not later than June 7, 1880.

The Directors do not bind themselves to accept the
highest or any tender.

By order,

WM. BELTON, Secretary and Manager.

Gas-Works, Shrewsbury, May 10, 1880.

TO COLLIERY OWNERS, &c.

THE Directors of the Barnsley Gas Com-
pany hereby invite TENDERS from parties willing
to Contract to Supply and to Deliver into the Retort
Houses at their Works, situated at Old Mill and Pontefract
Road, Barnsley, respectively, any quantity not ex-
ceeding 12,000 tons per annum of Screened Soft COAL
or NUTS of the best quality, suitable for Gas-Making, that
they may require for a period of One, Two, or Three years,
as may be agreed upon, from Oct. 1, 1880. The said Coal
to be delivered in a dry condition, free from smudge, dirt,
shale, pyrites, or other impurities, at either of the said
Works, in such quantities and at such times as the Man-
ager may direct. There are railway sidings into both
Works.

Scaled tenders, stating respectively the price of Coal or
Nuts delivered as above, endorsed "Tender for Coal," and
addressed to the Chairman, must be left at the Gas
Company's Office on or before Thursday, the 3rd of June
instant.

Any further information required may be obtained on
application to the undersigned.

The Directors do not bind themselves to accept the
lowest or any tender.

By order,

JOHN HUTCHINSON, Manager.

Gas Offices, Pontefract Road, Barnsley,

May 12, 1880.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 1, 1880.

Circular to Gas Companies.*

WE make no apology for recurring to the topics with which we have dealt in our last two "Circulars." It is, in our judgment, better, if questions of policy or conduct must needs be considered and discussed, that they should be looked at rather in times of quiet, such as the present, than left till those periods—usually about the parliamentary session—when they form the themes of more or less angry disputation between opposing parties. The true idea of the system of gas supply, as practised for many years past, has been that of co-operation between the Companies and their consumers. When competition was discarded as a wasteful failure and a nuisance, and the exclusive right of supply practically, though not with absolute legal right, granted in its place, the change was made because it was seen that not one party only, but both, should be gainers. The consumers undertook to deal only at one shop, and to prevent the setting up of a rival, while the Companies were pledged to conduct their business as economically as possible, to charge only a certain percentage as their share of the profit, and to return any balance that might remain over, in the form of a reduction in the price of the article sold. The dealer was entitled to his fair but defined share, and to certain securities for its regular maintenance; the purchaser was equally entitled, without any question of grace or favour, to all the rest. It is singular that such an understanding, so judicious as it appears to be, and although fenced about by conditions designed to secure its loyal obser-

* In last week's "Circular" two errors occurred, which we are anxious to correct. The first was in the ninth line of the second column of page 785, where "ten and three-quarters" should have been printed as "ten and a half." The second was the use of the word "conjunction," instead of "competition," in the thirteenth line from the bottom of the first column of page 786.

vance, has not only failed to produce a sense of community of interests, but has not diminished appreciably the feeling of distrust with which the consumer regards the producer. Perhaps the habit so common, and so much to be regretted, of looking only at one side of a contract or a question, is largely responsible for the failure. We believe that the interests of Gas Companies are in no way antagonistic to those of the consumers, but rather that they are to a great extent identical with them. It is because we believe this that we feel it is desirable to discuss questions of difference as they become apparent, and to discuss them not with the object of proving one side right and the other wrong, but to find a way of reconciling differences and producing harmonious action.

Accepting, then, the fact that there has been suspicion and distrust experienced generally by consumers as to the treatment they have received from the Companies, to what is it to be ascribed? We believe that it has been in great part due to the neglect by them (the consumers) of means placed at their disposal by the Legislature, whereby they could acquaint themselves with the real position and profits of the Companies, and so ascertain whether the price charged was excessive, and a reduction possible. It is remarkable how slight has been the use made by Local Authorities or others of this power to investigate the accounts; and we can only suppose the penalty attaching to a frivolous application—that of bearing the costs of the inquiry—has had a deterrent effect. A better arrangement would probably be that the investigation, when required, should be paid for out of municipal funds. The basis of all such inquiries being that the Company is entitled to receive its maximum dividends, and to build up a reserve-fund before granting a reduction, there can be small reason why facilities should not be freely afforded, and such inquiries rather encouraged than otherwise. Companies granting such encouragement to investigation would find advantage to themselves as well as their consumers. Bad times will inevitably follow good ones, and the same machinery which proved the necessity for a decrease would equally justify an increase. The materials for constituting a friendly arbitration court are provided; it should be possible to work it to the satisfaction of both parties.

It is a mere truism that the monopoly granted to the Companies was never intended simply to secure full dividends to the proprietors. It was accepted as promising greater advantage to the public generally, and consumers in particular; and it would have been impossible but for the regulations which accompanied it. The Committee which sat in 1867 on the Metropolis Gas Act Amendment Bill expressed not only their opinion but an accepted principle in the first of the series of resolutions they adopted: "That the supply of gas [in London] ought to be controlled in favour of the consumers, either by the means of an effective competition, or if the system of an exclusive supply is maintained, by the means of effective regulation." Competition having proved a failure, being, in fact, a weapon as certain to injure those who wield it as those against whom it is directed, regulation is the more hopeful alternative. The fault is with the parties and not the method when that too fails, and, as we have so often seen, a condition of hostility arises which is only ended with the extinction of the Company. There has, we believe, been little, if any, disposition to evade the conditions. Companies have felt honourably bound to conserve the interests of their consumers in return for the security they enjoyed, and a fuller acquaintance with the facts would probably satisfy most Local Authorities on this head. Hence it is that we would have the most complete information freely granted. Of course, there is an exception to this position in the case of those Companies to whom we referred last week, who, contemplating an early application to Parliament, may well feel afraid of making concessions which are otherwise due. The acceptance of the sliding scale in times like these is unquestionably attended with grave risk. It would be unwise—to use a mild word—on the part of any Company now doing their best to supply gas as cheaply as possible to accept their present price as the initial one under the new arrangement, and yet it is not easy to prove a case for a higher. The cost of almost every commodity used on gas-works is exceptionally low, but there is no immediate prospect of a considerable rise. When such a rise does come it will press heavily on the Companies, and it will be hard indeed if, from no fault on their part, the dividends to which they have for years been accustomed are reduced. It is difficult in times of great prosperity to realize the possibility of adversity; but such times will recur, and in the case under notice may even be very close at hand.

Thus, then, two opposite evils are before us—the one to

which we referred in our last "Circular," resulting from the obtaining of a high initial; the other from too low an one. In the first case, high dividends will excite the greed of Local Authorities, leading probably to purchase and extinction; in the second, a low initial will lead to reduced dividends. Avoiding Scylla we encounter Charybdis; but it is certain that if, in this case, a choice between the two evils is possible, most Companies would prefer the former, and none could blame them. There is yet another contingency. The evil time of diminished profits may follow upon a period of high dividends. In this case those who have bought shares at high premiums will find themselves heavy losers; they will naturally cry out for economies, bad times may be experienced by Directors and Officers, a system of "rigid economy" set in, and bad be thus inevitably made still worse. The advantages attaching to constancy and stability of dividend are great, and should not be lightly surrendered. There is, at least, a danger that under the operation of the sliding scale there may be considerable fluctuations of dividends, and temptation thus held out to speculation in gas property to which hitherto it has offered no inducement.

The introduction of the sliding scale will, in fact, vary the character of gas business, not in one particular but in several. That it has advantages all those who believe in the frailty of human nature will admit. We, for our part, express a hope that the old safeguards against that frailty may be more fairly tried before they are finally surrendered as failures. The central idea of the sliding scale, as well as the arguments by which it was recommended, justify a suspicion of it, and suggest the necessity, where its adoption is proposed, for great care in fixing an initial price. There are few Gas Companies who would have the courage deliberately to ask for larger dividends than their present maximum; there are none who are, or should be, willing to accept less. The suggestion has been made—and, especially in view of the difficulty of arriving at a fair initial price, we think it still worthy of consideration—that there should be a range of price within which the dividend should not alter. Say, for instance, that the present price is 3s. 6d.; then, if it were reduced below 3s. 3d., the dividend should increase, and it should not diminish till the price went above 3s. 9d. While such an arrangement would not nullify the arguments of those who advocate the sliding scale, it would, in our opinion, render its adoption more simple in many ways, and minimize the objections that may fairly be raised against it.

For ourselves, we may be glad to see Gas Companies before Parliamentary Committees willing to carry on their duties upon the terms which have hitherto been considered satisfactory, and which have so much to commend them. If the sliding scale is to be adopted, let the suggestion come from the opponents of the Companies, and every effort be made to obtain a liberal initial price; further, we would say, let provision be made in good years for times of possible famine which may follow. The accumulation of a good reserve-fund will prove of the utmost value, tending, as it would, to check the early division of large profits should they be earned, and also removing the liability to those considerable fluctuations of dividends which are so undesirable, and which must attend the operations of a Company without a reserve. Above all, let the desire to make large profits not clog or impede the effort to make the supply of gas both economical and satisfactory to the consumers. There is a large field yet for increased business, and every reduction in price or improvement in quality makes competition less possible, and the property proportionately more secure.

Difficulties and hard times were the lot of Gas Companies until comparatively recent days, but their strength has only increased with the exercise of it in fighting through. The coal famine and the electric light scares are too recent to allow of our assuming that such times cannot recur. Our hope is that, if they should, the old vigour will be found unabated, either by length of days or extreme or unbroken prosperity.

For some time past a very large and unusual amount of attention has been given to experiments upon the best means of obtaining in ordinary use the fullest possible proportion of the illuminating value of gas as supplied to the public. Experiments, correspondence, lectures, have been published to help consumers to see their way out of wasteful dimness into economic light, and last week an important addition was made to these efforts in the form of an article of three columns length in *The Times*. Though travelling over well-known ground, and dealing for the greater part with familiar facts and illustrations, it was a contribution of much value, not only from its own intrinsic merits, but because of the wide circle to which,

either directly or indirectly, in whole or in part, it will be sure to reach. The article was suggested apparently by, and is principally devoted to a criticism of various experiments in the direction of improved street lighting, and the practical outcome of them. The writer had evidently taken pains to inform himself well upon the subject on which he had undertaken to write, and the facts are consequently stated with a correctness often conspicuously absent from contributions on technical subjects to the public journals.

We think that in such a notice, which is largely of a historic character, it would not have been out of place if there had been accorded to one gentleman the credit which is usually given to him who leads the van in difficult work. To Mr. Sugg, undoubtedly, is due the honour of having been first to see the need that existed, and then to take in hand those improvements, both in burners and lanterns, which have borne such excellent results. Others have entered the same field, and are cultivating it with much success; but we should be sorry if the credit due to Mr. Sugg for the inception of the idea of competing with the electric light, burner for burner, was in any danger of being lost sight of. The success which has attended these efforts to improve the lighting of our streets is not only very gratifying from the standpoint of the public and the Gas Companies, but it has also removed or modified an erroneous opinion generally entertained as to the objection of Local Authorities to any improvement which costs more money. Considering how young the movement is as yet, we think it reflects credit on those bodies that large lights, costing from £30 to £40 each per annum, are to be seen so liberally dispersed over London and in many provincial towns. We do not doubt but that the unwonted pleasure of finding their action generally approved by the public and the press will be to them a grateful reward, and will stimulate them to merit it still further.

There is one passage in the article which we reproduce, because it deals with an acknowledged evil—one that is being grappled with by many Companies, and we hope will soon be recognized by all. After speaking of the wasteful character of many of the burners in use, and the ignorance of the fitters who supply them, the writer says: "Nor should the 'action—or rather inaction—of the Gas Companies pass 'without notice here. They remain perfectly apathetic 'under the circumstances, and although it is not compulsory 'that they should show their customers how to use in an 'economical manner the gas they supply to them, they at 'least lay themselves open to suspicion when they knowingly allow them to waste it from sheer ignorance.'" There is, we know, a prejudice in the minds of many consumers against advice given to them by agents of the Gas Companies. We have known frequent cases where good and economical burners have been refused, though offered gratuitously, from the fear that they were intended to consume more gas. It is, however, certainly the fact that the comfort of the users of gas could be greatly increased, and their bills in many cases lightened, if the Companies would take some pains to direct them in these matters. We believe that the idea has been seriously entertained by several of the London Companies, of opening permanent show-rooms, if not sale-rooms, of gas apparatus, burners, and fittings such as they would recommend. The examples of the Paris Gas Company and the Liverpool Fittings Company should give great encouragement to such an intention, and we heartily hope that before long the purpose will have matured into action. The bright possibilities which *The Times* sees before Gas Companies, arising from the application of gas to the purposes of heating, cooking, engine-driving, and for railway carriage lighting are all fast becoming accomplished realities. For our part, we gladly welcome every fresh development of the uses of gas, and rejoice to see it established more and more firmly as one of the indispensable necessities of modern life. At the same time there is an enormous field for this increase of the business in the immediate future, in the vast number of houses still in the darkness of lamps and candles, and from the more perfect lighting of premises generally and of public ways. Gas light has so vast a field before it yet, that we anticipate the anxiety will shortly be, not how is an increased rental to be obtained, but, rather, where is the gas to be obtained from. Sufficient to the day is its own perplexities; but the growth of the Beckton works during its still short life is suggestive.

The seventeenth annual meeting of the members of the British Association of Gas Managers will be held on the 8th, 9th, and 10th inst., at the Institution of Civil Engineers,

Great George Street, Westminster, and there is every indication that it will be attended with at least as much success as any of its predecessors. The presidential chair will be filled by Charles Hunt, Esq., C.E., of Birmingham, and the programme of papers to be read is highly promising. Mr. Travers, of Cork, will deal with the subject of the Thermal Power of Gas Cooking and Heating Apparatus—a subject which affords wide scope for illustration from points of view other than the manufacturers, whose advertising statements form the great bulk of the literature of this subject. Mr. G. E. Stevenson will discourse on Regenerative Furnaces for Heating Retorts—a question of the internal economy of gas-works that is rapidly coming to the front, and on which Mr. Stevenson is qualified to speak with some authority; while Mr. F. Livesey will deal with the subject of Retort Furnaces generally. Mr. George Livesey and Mr. W. Romans both address themselves to the matter of Gasholder Tanks, while Mr. G. Baker, of Birmingham, will treat of Gasholders, chiefly with relation to their construction. Mr. Harrison Veevers is to give his experience of Testing Gas Coals, and Mr. G. E. Stevenson has a second innings for the purpose of bringing up the subject of Working Statistics. The Chemistry of Spent Lime will be elucidated by Mr. Wm. Foster, of London; and another point of internal administration will be touched upon by Mr. J. Somerville, who will describe “An Apparatus for Preventing the Oscillation caused by the Exhauster, and for the Removal of Tar.” Mr. F. W. Hartley will find himself at home in treating of Standards for the Estimation of Illuminating Power, and a lively discussion is likely to follow the reading of Mr. George Bray’s paper, which bears the somewhat combative title of “Some Fallacies Regarding Gas-Burners, with Remarks on Street Lighting.” It is scarcely to be expected that the whole of these papers can be read and adequately discussed in the two days set apart for the purpose; and when all appear so promising of interest, the Committee will have no easy task in arranging the order in which they will be taken. The lecture to be given at the evening meeting on the 8th inst., by Greville Williams, Esq., F.R.S., “On the Past, Present, and Future of Coal Tar,” promises to be, in the hands of such a master of this particular department of practical chemistry, a highly interesting and instructive account of one of the most wonderful substances known in the whole range of the Industrial Arts, and which has given modern analytical chemistry a field whereon some of its most brilliant triumphs have been achieved. A steamboat trip to the Beckton works of The Gaslight and Coke Company, where great additions have been made, and extensive works established for the manufacture of residual products, since the last visit of the members of the Association, will terminate the proceedings of the meeting.

The Lincoln Gas Company have consented to sell their undertaking to the Town Council, on terms to which the latter were not slow to agree. The Council are to pay the Shareholders annuities equal to maximum dividends on all the Company’s shares and stock, amounting to a yearly charge of £5024, and also a sum of £2500 as compensation to retiring officers. For this consideration the Town Council will become possessed of a fine property, which has been well managed by its present owners, and has paid full dividends with a low selling price. The works are in good condition, no extraordinary immediate outlay for manufacturing or distributing apparatus being needed; and the reserve-fund, which goes with the other property, is £8457, out of which the compensation payment already mentioned can be taken. Thus, without having to meet any charges worth mentioning, the Town Council will become the owners of a concern yielding a profit of about £2000 annually, which let us hope they will administer truly for the benefit of the ratepayers, not forgetting that the majority of the gas consumers are numbered among the new proprietors, and will probably expect to be considered when the profits are distributed.

The Alliance and Dublin Consumers Gas Company are about to raise the additional capital authorized by their existing Act of Parliament, by issuing 5000 new shares of £10 each, the dividend on which is to be limited to 7 per cent., and will be controlled in the same way as the older stock. The Chairman, at a meeting of Shareholders in the Company held last week, in proposing the resolution authorizing the Directors to issue the new shares, took occasion to express his conviction of the continuance of the present favourable state of the Company’s business, and said he had no fear that the old stock would fail to pay full dividends. The Company may, in fact, be described as having only recently entered into their inheritance, and their operations will probably extend without interruption for many years,

while the principles of management which have infused new life into the concern are adhered to in their integrity.

The Bedford Gas Company have had a lively passage of arms with the Town Council, respecting the manner in which the Company have fulfilled their statutory obligations. The Company, it is alleged, have not furnished the Corporation with yearly statements of their accounts, and have not provided a proper testing-station; besides which there are the usual complaints of high price, low illuminating power, foul gas, insufficient supply, &c. As to the first offence, to the commission of which the Company practically pleaded guilty, at the same time sending in copies of their balance-sheets for the past fourteen years, we hold that undue secrecy in such matters is a great mistake in the interests of Gas Companies themselves, for where the working statements of such undertakings are kept in the dark, extraordinary opinions respecting them are always formed by the public, whose overheated imaginations frequently represent a Company as gorged with wealth, when perhaps the object of their unjust suspicions can only just make both ends meet. So it is with testing. Regular notifications of the illuminating power of the gas supplied are very useful; not that they prevent grumbling, for nothing will do that, but they supply a ready weapon for demolishing the loudest malcontents, who are almost invariably the worst-informed members of a community. In Bedford, for instance, one of the levers which moved the Town Council was a memorial—signed by about a score of persons, among whom ladies and clergymen were conspicuous—which alleged, among other things, that the Company’s mains are insufficient in size, and frequently become choked, and that the consumption of gas is accordingly increased. Again, it was stated at the Council meeting that the consumers wanted to get rid of the “stuff that blacked their ceilings.” Against the rising tide of indignation the Company submitted a statement to the effect that their full dividends had only been paid during the past four years, and that they had continually expended money in renewing and enlarging the mains, and in other works for improving the distribution of gas throughout the town, and that the price at which they sold gas—3s. 9d. per thousand feet—was fair and reasonable. Perhaps, however, when their larger mains are laid, the Company will see their way to a reduction in price which will keep matters going pleasantly again when the present agitation has spent itself.

The meeting of the Liverpool Gas Consumers Defence Association, which was held recently, appears to have been the occasion of the exchange of much mutual congratulation among the members present. Dr. Cross is evidently held in high honour by such of his fellow-citizens as have enrolled themselves in this body, on the ground of his having *suo Marte* brought the price of Liverpool gas down from 4s. 6d. per thousand feet in 1875, to 3s. 4d. at the present time, the general satisfaction at which result was only tempered by the reflection, on the part of the Chairman, that there was still something radically wrong with the Gas Company, and that the struggle with that erring corporation was in reality only begun. To what extent the indignant Chairman and the magnanimous Dr. Cross—who, as we learn, declined the testimonial inevitably offered—are prepared to drive the Gas Company in the way of reduction is not indicated, but probably depends upon the state of the funds, which, however, all parties agreed to take especial care of, as the Committee had experienced great difficulty in collecting the money, and were evidently doubtful as to the willingness of an ungrateful public to subscribe any more. In case Liverpool should prove unsympathizing, Dr. Cross should beat a retreat to the banks of the Irwell, and attack the great “monopoly” which, under a different title, he will there find maintaining prices as high as the rates of which he now complains.

Gasholders and tanks show a remarkable tendency to grow with the times. Every year produces a yet more gigantic example of this department of gas engineering than had been in existence before—the greatest diameter of one season’s triumph paling before the commanding height of the next; and this, again, enjoys but a short-lived supremacy before it in turn passes into the second rank. Mr. Corbet Woodall’s Kennington Lane monster is no sooner an accomplished fact, than Mr. George Livesey’s interesting bantling engages general attention; or the Stepney holder takes the precedence, only to yield to provincial rivals in girth. The Corporation of Birmingham, acting under the advice of Mr. Charles Hunt, their Engineer, are about to construct two tanks at their Windsor Street works, each of which will be 240 feet in diameter and 51 feet deep. Messrs. John Aird and Sons are the contractors for this great work, an idea of the magnitude of which may be formed from the fact that six million bricks will be required in carrying it out, and seventy thousand

cubic yards of surplus soil and rubbish will have to be removed from the land belonging to the Corporation. These tanks will exceed in diameter anything of the kind that has ever been constructed, and the action of the Gas Committee shows that Birmingham is determined not to drop behind the age, even in gas apparatus.

The papers read at the recent meeting of the members of the West of Scotland Association of Gas Managers were fairly divided, as to their subjects, between theory and practice. Mr. Niven's paper on thermometric and barometric calculations was very ingenious, and his two rules for making corrections of volume for temperature and pressure, if not altogether independent of pencil and paper in ordinary hands, are still commendably brief, although it would have made the demonstration of them clearer, and rendered them easier of remembrance, if Mr. Niven had condensed them into algebraic formulæ, in which they would have appeared much simpler than in the verbal rules. Mr. Mayer's explanation of Painter's hydrostatic joint for main-pipes was the occasion of much discussion, which seemed to be strongly imbued with the spirit of opposition to all novelty. Nothing is more difficult than to induce a fair trial of any improvement which involves fundamental change in the methods of doing everyday work, such, for instance, as main-laying; and although the defects of the caulked lead joint are well known, a tremendous amount of *vis inertiae* must be overcome before people who have grown accustomed to its rough-and-ready character can be persuaded to look seriously at any proposal for doing away with it. We do not express any opinion respecting Painter's joint in remarking that only after proof of its reliability and economy after severe trial, under conditions to which persons accustomed to the ordinary systems of main-laying are familiar, could its advocates hope to meet with a different reception than appears to have been Mr. Mayer's experience.

In a communication which will be found in another column, Mr. R. H. Patterson draws attention to the lessons which the study of the blowpipe may teach respecting the principles of gas illumination. There would not at first sight appear to be any two applications of the power of gas more widely distinct than the instances of a blowpipe and an Argand burner, yet slight reflection will at once show that in their dissimilarity of action, resulting from different combinations of the same agents, there should be something deserving of study. Mr. Patterson exposes the fallacy of the idea, so generally held, that a blowpipe flame is necessarily hotter than any other flame, the truth being that the heat is only concentrated; but, being concentrated, why is not the flame intensely brilliant? And since concentration alone will not suffice, under what special conditions must the heat of a gas-flame be produced, in order that brilliancy may also be secured? These are the questions which Mr. Patterson sets himself to answer, and he could not do the cause of gas illumination better service than by enunciating the practical relations of heat and light in gas-flames.

The Municipal Council of Paris have not yet had enough of the electric light, but, as it appears, they are having too much gaslight to please them. The "Phare" lamps in the Rue du Quatre Septembre are to be curtailed, the illumination of the street by those improved burners being considered excessive, and consequently one-half their number will be dispensed with. Until the introduction of the electric light in the streets, such excessive illumination was not considered necessary; but when it was so much admired, and Gas Companies, in order to keep in the fashion, set themselves to meet the newly-discovered want, it was not long before first London, and now Paris, awoke to the fact that the necessity did not after all exist; and, strangely enough, it is gas which is always suppressed first. Sufficient, however, has been done in both capitals to prove that when high illumination is required the electric light will not be quite alone in the field, and with this assurance the advocates of gas lighting on a grand scale will probably rest contented.

We shall probably for some years to come hear as much about Mr. Thomas Alva Edison and his wonderful talents and consequent rise in life, as in former times was repeated about Watt and the tea-kettle. The American inventor's habits, his candour to strangers, his laboratory, and the marvellous work he does in it, form a never-failing theme for the padding of newspaper columns and the pages of popular magazines. Recently it has been more the grand discovery of gold where nobody thought of looking for it, or rather where everybody had overlooked it, than the making of untold wealth out of the ruin of the Gas Companies, where everybody thought it might be done, which serves to rivet the attention of the public upon the proceedings of this extraordinary man. For an extraordinary man Mr. Edison most

decidedly is, if only for the ease with which, without any apparent effort of his own, he keeps all the civilized world looking at him. We do not begrudge Mr. Edison any of his notoriety. He has earned it, and we hope will continue to enjoy it for some years to come, for there are many dark places in the world which he can illuminate with the light of his genius and perseverance, and still leave gas people to earn their pittances by following their profession, and to train their sons to do likewise.

Water and Sanitary Notes.

THE views of the Home Secretary on the question of the Metropolitan Water Supply were freely expressed on Friday afternoon to a deputation from the Metropolitan Board of Works, headed by the Chairman, Sir James McGarel Hogg, M.P. The Bill of the late Government was declared by Sir William Harcourt to be "dead," and he knew of no intention to revive it. But certain agreements which had been provisionally entered into were not altogether extinct, and Sir William found that opinion was very much divided as to whether those agreements were favourable to the interests of the public or not. From his own point of view, it seemed that the public were not at present in a position to form a judgment as to the value of these agreements. An examination of the scheme of purchase was, therefore, necessary. The agreements would be laid before Parliament, and Sir William, together with Mr. Dodson, would bring the subject under the consideration of the Cabinet. His own idea was that a Select Committee should investigate the matter, so as to discover whether the terms of purchase were fair or otherwise. In his remarks, the Home Secretary betrayed an impression that the terms of purchase were too high, and that it would be for the public to consider whether they could do better for themselves in another way. "The Water Companies have no monopoly in the supply of London," said Sir W. Harcourt; and the deputation cheered the statement. "No doubt," continued the Home Secretary, "there may be difficulties and inconvenience in introducing a new supply, but these may be overcome." Concerning the dangers of delay, Sir William was not alarmed, and the assessment cry did not distress his nerves. On this point the new Home Secretary has shown considerable discernment from the first. As to the question of monopoly and a new supply, Sir William was more brilliant than profound. But he pleased the deputation amazingly, saying, among other things, that "the Government would look to the Metropolitan Board as one of the most powerful engines for assisting them" in getting out of any difficulty in devising an alternative to that of purchase. One declaration made by Sir W. Harcourt in reference to the purchase calls for special notice. "If the terms are reasonable," said the Home Secretary, "then we have to consider whether the thing is worth buying upon reasonable terms." This extraordinary policy, we apprehend, is not likely to be approved of, either in the Cabinet or by Parliament. Sir W. Harcourt speaks like Cæsar, but he is not Cæsar.

In the course of his address to the deputation from the Metropolitan Board, Sir W. Harcourt referred to the communications which the Government had received from the City Authorities on the subject of the Water Supply, and he remarked that these were very much in accordance with the statement made on behalf of the Board by Sir J. McGarel Hogg. On this point we may observe that the Commissioners of Sewers, after their somewhat inglorious interview with the Home Secretary a week or two ago, proceeded to consider what they might best propose with regard to the Water Question. Having done so, they quickly arrived at the conclusion that the Bill of Sir Richard Cross is worth looking into, and that it had better go before a Select Committee. A large majority of the Court of Common Council thought so too, and it was decided that the civic authorities should co-operate on that line of policy. At the same time certain other things are asked for, and the question is raised whether the cost of purchasing the existing works "might not be more advantageously applied in procuring a new and better supply." As usual, a desire is expressed that the Companies shall be prevented from making any progress, or in any way improving their position, while the subject is being investigated. The attention of the Home Secretary is also directed "to the need of re-considering and revising the basis of the water-rate." There is a call for a "re-adjustment," which appears to mean that offices shall pay less, and dwellings no more than they do at present.

In the House of Commons last evening, in reply to questions from Mr. Brand and Mr. Ritchie on the subject of the Metro-

politan Water Supply, the Home Secretary made a prolonged statement, informing the House, in reference to the terms of purchase, that the Government would appoint a Select Committee to "inquire into the real character of the agreements, and their actual relation to the value of the property to be acquired under them." The inquiry into the agreements, it was considered, could "be brought into a moderate compass, so as to be disposed of in the present session." On the other hand, "an investigation of the whole question of water supply would evidently extend to far wider limits." In his subsequent remarks, Sir William seemed rather to enlarge the proposed scope of the inquiry, especially when he included a consideration of "whether it might not be more desirable to obtain from other sources a better supply at a cheaper rate." He expressed his satisfaction at the assistance which would be rendered by the Corporation and the Metropolitan Board, especially in the absence of "a Central Metropolitan Authority for the general government of London." The Committee would be moved for in a day or two.

Mr. Charles Ekin, of Bath, has written a little work on "Potable Water."* The author's object is to promulgate what he considers to be sound views on the question of water analysis. He contends that the Rivers Pollution Commissioners have fallen into a fatal error by judging chiefly of the wholesomeness of water from the amount of organic matter it contains, quite irrespective of the nature and origin of the organic matter in question. Hence, Mr. Ekin asserts that many water supplies of undoubted wholesomeness have been condemned, whereas others of more than doubtful purity have been classed as unpolluted. All the existing methods of analysis fail to distinguish satisfactorily between organic matter of a vegetable character, and that which is animal. As the latter is dangerous, while the former is harmless, the lack of the requisite distinction is declared to be both "unscientific and misleading." Concerning the presence of nitrates, while admitting these salts to be harmless, Mr. Ekin still considers that if they exist to any large extent in a sample of water, they indicate a dangerous degree of pollution. Nitrogen as nitrites he considers should always be absent from a good water, and he is not altogether prepared to give up this rule even in the case of deep chalk wells. Mr. Ekin claims to know something of his subject by the fact that he has analyzed nearly two thousand samples of water, and that he has enjoyed the good fortune to practise as an analyst in a district where, within a radius of thirty miles, every geological formation, from the chalk down to the Silurian, is represented, thus giving him considerable experience as to the diversities in the composition of water taken from various strata. While stricter than Dr. Frankland on some points, he is willing to admit "the self-purifying power" of rivers, and the destruction of poisonous germs. "Of course," says Mr. Ekin, "there are many rivers so impure as to be entirely unfit for human consumption; but there is no evidence that the health of towns that take in turn their water supply from such rivers as the Trent and Thames, and again pour their sewage into them, is injuriously affected by the use of such water, however repugnant and nasty the idea must be of drinking water that has been mixed with sewage, and however desirable it may be to obtain water, if possible, from purer sources." We would observe that the actual discharge of sewage into the Thames above the intakes of the London Water Companies is now becoming so rare and remote that even the sentimental objection is fast losing its force. Mr. Ekin's book is clever and suggestive, and his practical experience gives it weight.

A confused kind of discussion has arisen in the daily papers as to the nature and origin of sundry disagreeable odours prevalent in some of the leading West-end thoroughfares. Sewers, drains, dust-bins, gas-mains, and roadways, have all come under suspicion, the attack being directed chiefly against the sewers and the roads, the latter being deemed a probable cause of offence, owing to the heat of the weather, and the foulness of their surface. One gentleman who writes to *The Times* declares that he can smell the odour "four miles" off. Mr. W. H. Teulon says that when he leaves the West-end and enters St. Pancras, Holborn, or the City, the effect "is almost like a change into country air." Remembering what dismal things have lately been said as to house drainage in Kensington, we are led to conclude that the West-end is not entirely a happy place.

The annual report of the Metropolitan Board, recently presented, concludes with a warning statement that London must not again expect to have a consolidated rate of less than

sixpence in the pound. Were it not for the coal and wine duties, the rate would be nearly threepence in the pound more than it is; and as the Board are only empowered to receive aid from that source up to July, 1888, the outlook is somewhat dark, unless an extension of those duties in favour of the Board can be obtained. "The increasing wants of the growing population of the Metropolis," it is stated, "necessarily bring with them increased expenditure and increased financial responsibilities."

It is to be hoped that the Metropolitan Board will be able and willing to carry out the wishes of the Kyrle Society and sundry other friends of the poor, by acquiring the gardens of Lincoln's-Inn-Fields, and throwing them open to the public, so that the hapless children who are packed away in the neighbouring alleys may no longer be compelled to seek their pleasure in the gutter, while seven acres of green earth, with flowering shrubs and graceful trees, are locked up for the exclusive benefit of a chosen few. In the interests of health and civilization, it is time the gates were opened. Yet many difficulties are started, and two deputations went before the Metropolitan Board last Friday to present memorials deprecating any interference with the existing arrangements.

The Sanitary Institute of Great Britain has just held its annual meeting. Dr. B. W. Richardson, F.R.S., who presided, complained that they had been "sorely disappointed" by the supineness of the late Government. Great hopes had been excited by "the voice then supreme in command," which declared solemnly and loudly "*Sanitas sanitatum, omnia sanitas.*" But "the years had passed," and there was nothing save the voice. Expectation was now fixed on the new Government; but a new basis was required, such as would be afforded by a responsible Minister of Health presiding over a department comprehending all those sanitary functions which are now scattered and divided between the Local Government Board, the Home Office, the Privy Council, and the General Register Office. "A new Government, strong, ambitious, and powerful," is invited to undertake this task.

APPARATUS FOR PUMPING GAS FROM LINACRE TO LIVERPOOL.

With this week's number of the JOURNAL is given a double-page plate showing the arrangement of the engine and exhauster house, with boiler-house attached; also a plan, side elevation, and end elevation of one of the four sets of engines and exhausters employed for pumping gas from Linacre to Liverpool. As already explained to our readers, this apparatus was designed by Mr. William King, C.E., the Engineer of the Liverpool United Gaslight Company, and constructed by Messrs. Gwynne and Co., of Essex Street Works, London.

Two pairs of engines and exhausters were put in hand in April, 1878, the other two are at present being erected. Each of the engines—of the non-condensing single cylinder type—has a crank-shaft with double bearings, to which are attached direct two 63,000 cubic feet per hour exhausters. By this arrangement a steady vacuum and pressure are maintained; in fact, to quote Mr. King's own words, "the machinery has worked very satisfactorily, the gauge on the outlet hardly showing any perceptible oscillation, and has in all respects accomplished the purpose for which it was designed."

Messrs. Gwynne and Co. write us: "In addition to the non-fluctuating steady exhauster, erected by us at Linacre, we have at work at the Bromley station of The Gaslight and Coke Company a pair of 105,000 feet exhausters with engines on our new patent, and after severe trials we found that the steady gauge was maintained at any variety of pressure. We have also erected one for the European Gas Company, under Mr. Bates, their Engineer, at Soubeville, near Rouen, and the gas is drawn through a main of about 2 miles in length, from which numerous factories are supplied, taking their supply direct from the pumping main. We have also supplied this apparatus to the Salford Corporation Gas-Works and the Hackney station of The Gaslight and Coke Company—a pair of 63,000 feet exhausters and engine, capable of passing 126,000 cubic feet of gas per hour. Some of these have been at work a considerable time, and have given the most satisfactory results."

INSTITUTION OF CIVIL ENGINEERS.—The concluding meeting of the Institution for the session 1879-80 was held on Tuesday last—Mr. W. H. Barlow, F.R.S., the President, in the chair. During the past session there has been an effective increase of 78 Members, 80 Associate Members, 1 Associate, 1 Honorary Member, and 79 Students; bringing up the numbers of these several classes to 1218, 1301, 583, 18, and 663 respectively, or a gross total of 3783, and representing an increase in the past twelve months at the rate of 5 per cent.

URQUHART'S PATENT DRY GAS-METER.—In the "Applications for Letters Patent" published in last JOURNAL was one—No. 2001, dated May 15—by Mr. J. Urquhart, of the Gas-Meter Testing Office, Manchester, for "Improvements in Meters or Apparatus employed in Measuring the Flow of Fluids." Part of this invention, we understand, consists in substituting flexible metal for leather measuring chambers in dry gas-meters, thus making what has long been a desideratum—an all-metal dry meter. The advantages claimed in consequence are far greater durability and more permanent correctness in registration. The meter is said to work at 2-10ths pressure. Mr. Urquhart was the inventor of the "Reliance" wet meter, adopted by the Manchester Corporation Gas Committee about three years ago, and now being manufactured by the Gas-Meter Company, Limited.

* "Potable Water: How to Form a Judgment on the Suitableness of Water for Drinking Purposes," addressed to Medical Officers of Health and Sanitary Authorities, &c., by Charles Ekin, F.C.S. London: J. and A. Churchill.

Communicated Articles.

THE ACTION OF THE BLOWPIPE
CONSIDERED WITH REFERENCE TO THE PRINCIPLES
OF GAS ILLUMINATION.

By Mr. R. H. PATTERSON, F.S.S.

The action of the blowpipe may, at first sight, appear to have very little practical interest to members of the gas profession; but it seems to me that a correct knowledge or interpretation of its phenomena lies at the very root of a correct ascertainment of the principles of gas illumination. I have already treated of the effects of *heating* both the gas and the air supplied to gas-flames; but a still more important matter (inasmuch as it is a universal condition of ordinary gas illumination) is the varying effects of the air supply, at the ordinary temperature, upon the illuminating power of gas-flames.

An "excessive" air supply, however occasioned, has long been recognized as injurious to the light of gas-flames; and it is to this cause that the manifestly bad effects of "pressure" upon illuminating power have been assigned. I have seen it lately denied that pressure in the gas is injurious to illuminating power; but this allegation is manifestly owing to a misconception on the part of the sceptic. It is quite true that a certain amount of gas pressure is not only useful but indispensable in the gas consumed in "naked" or "flat-flame" burners, such as bat's-wings and fishtails. That is because, without pressure, these burners cannot produce their appropriate flames; some pressure is necessary to compel the gas to expand and present a requisite surface of flame to the air. Without this amount of pressure, both a bat's-wing and a fishtail will give only a tall and shapeless column of flame, which smokes from lack of air supply. Pressure, then, is indispensable for such burners. But the question is, firstly, is it not the case that a bat's-wing or fishtail which produces its appropriate shape and size of flame with little pressure is, *ceteris paribus*, a better burner than one which requires more pressure to develop its proper flame? Secondly, does not a burner like the Argand, which does not require any pressure, give a higher illuminating power than any burner which requires pressure? To prevent misunderstanding, I may say that I here speak of single burners; combinations of burners depend for their results not merely upon the excellence of the individual burners, but equally upon the mode of combination. And, so speaking, I maintain that, *ceteris paribus*, of flat-flame burners that one is best which requires the least amount of pressure; and, further, that no single burner which requires pressure can surpass, or even equal, a burner like the Argand, which needs no pressure. But next, assuming the injurious effect of pressure upon illuminating power, how is it that this injurious effect is produced? Granting the fact (as probably all your readers will do), what is the correct explanation of it? This is the question with which I desire to deal in the present paper.

First, as to the *manifest* effects of pressure; that is to say, those as to which there is no question. Coal gas, on the average, has a specific gravity of about 450 compared with air as 1. In other words, it is half as light as the atmosphere; and accordingly it will ascend from the burner of its own accord, just as oil rises up through water. And its velocity of ascension may be roughly, or in a manner suitable enough for popular illustration, computed by placing in a tube of water a coloured oil or other liquid having only one-half the specific gravity of water, and observing its velocity or rate of ascension to the top of the tube. Thus, in the Argand, where the proper desired flame is simply perpendicular, the gas of its own accord ascends with sufficient velocity, so that no pressure is needed. And it is universally acknowledged that, in the Argand, any application of pressure to the gas is disadvantageous to the illuminating power. I may remark, in passing, that, were some amount of pressure unavoidable with the Argand (which, thanks to Mr. Sugg's arrangements in his "London" Argands, is not the case), the bad effects of this pressure might be, to a considerable extent, removed by altering the height and width of the chimney. But, taking Argands as at present used, there is no fact in gas illumination more generally acknowledged than that pressure is damaging to the illuminating power of these burners.

The best kind of burner for showing the effects of pressure is the simple jet-burner; and any one who has tried it knows that, as the pressure is increased, the light is diminished, and indeed may be all but destroyed. What is *seen* is that the jet of flame swirls and roars, losing its smoothness of surface, and it also loses a great portion of its illuminating power. Another of the *manifest* effects of pressure is that the gas-flame is brought into increased contact with the air. Partly, perhaps—and in the case of "flat-flames" certainly—this is because the gas, owing to its increased velocity of issue, is driven to a greater distance, whether perpendicularly or laterally, from the burner, presenting a larger surface of flame to the air; and in all cases because the increased rush of gas tends to draw in upon the flame a greater draught of air; just as a current through a pool, in proportion to its velocity, produces eddies, and draws in upon itself the otherwise quiescent water. Indeed, the steam-jet exhauster furnishes the best of all illustrations; the rapid current of steam imparting its own motion to the surrounding gas, and drawing the gas along with it.

Thus the manifest, direct, and acknowledged effects of pressure are that, whether by enlarging the flame or by increasing the draught upon it, the burning gas is brought more in contact with air. But the important and, as it seems to me, still undetermined question, is, How or in what manner does this increased air supply to the flame produce a diminution of its illuminating power?

The long-established and, so far as I know, the universally received

explanation is that, in consequence of this excessive air supply, the gas, or the illuminating portion of its substance, is too rapidly consumed. The writers on this subject—Dr. Letheby and many others—define the process as "over-combustion," or "over-oxidation." Roscoe, adopting and scientifically explaining the universal opinion, describes the phenomenon thus: In the process of combustion the solid carbon particles of the olefant part of the gas are separated out of it, and burn separately, producing the luminous part of the flame; but when there is an excess of air these solid particles are consumed "at once"—converted into carbonic acid without any intervening stage of combustion, and therefore without developing their ordinary luminosity.

During my investigations ten years ago, a different explanation of this phenomenon suggested itself to me. But, in the first place, let us see how far the above doctrine, as expressed by Roscoe, is undoubtedly correct. Any one who considers a gas-flame must agree with Roscoe that there is, more or less, a separating-out of the solid particles of carbon; although whether he is right in confining this separation to the olefant gas, and excluding the carbon in the marsh gas, might be questioned. But it is a point of merely abstract interest, the olefant gas constituting the only really luminous part of the flame. And that this portion does not burn along with the hydrogen, or while incorporated with it, seems visible to the eye; the luminous part of the flame holding a separate place above the blue and non-illuminating part. There cannot be a doubt, then, that a process of "dissociation" takes place, the high temperature of the burning gas breaking up the chemical compounds of the olefant gas (C_2H_4), and the hydrogen burning first, in the lower part of the flame. There is a much more striking instance of such dissociation under the influence of a high heat—viz., in the case of carbonic acid, which is usually spoken of as a non-combustion-supporting and totally incombustible substance. Even with sulphur and phosphorus, carbonic acid does not support combustion, maintaining its integrity as a wholly incombustible substance; but certain metals, such as magnesium and potassium, when heated in carbonic acid, *burn in it*. The heat, combined with the extraordinary attraction of these metals for oxygen, breaks up the carbonic acid into carbon and oxygen, whereupon the oxygen goes to support, or rather to produce the combustion of the metals (burning with them and forming oxides), while the carbon is liberated. Accordingly, and also from the spectacle presented by a gas-flame, there is no reason to doubt that the carbon is separated out of the olefant gas in a solid form (in consequence of the hydrogen part of the compound having previously been burnt), and burns separately in the upper and white portion of the flame.

But is the other, and, as regards the present question, more important part of Roscoe's doctrine or explanation (which is the ordinary or universal one) equally correct? Is it true that the decrease or destruction of luminosity from an excessive air supply is owing to the carbon particles being so suddenly consumed that they are "at once" converted into carbonic acid—the ordinary product of combustion? Were this statement taken literally, the inference would be that there would be no light at all. But, despite the word "at once," the fair meaning is that the carbon particles are in a state of combustion for a shorter time than usual, and that, therefore, they give out less light. The explanation is not a readily intelligible one. When the carbon is burnt in a shorter time, must not the intensity of combustion be greater? The result which one would expect from a briefer time of combustion of an equal quantity of illuminating gas would be a hotter, smaller, and brighter flame. The illuminating substance is admittedly as completely consumed in this case as in ordinary gas consumption; and it is difficult to conceive that the rapidity of consumption, however great, can suffice to take from the gas its illuminating property. If you burn a pound of coal in two minutes, will it not give out as much heat as if it were consumed in four minutes? Or if you burn gunpowder, or other such like explosive substances, however rapidly, can you thereby (by converting it "at once" into the products of combustion) lessen or destroy its explosive power? Both these illustrative cases suggest a different result from that stated by Roscoe relative to the rapid combustion of gas. Gunpowder may be consumed so slowly (by damping it) that it virtually loses its explosive power, and the more rapidly it is consumed the greater is the explosive force which it generates. Also, as regards coal, if it be consumed slowly, it emits little light; whereas its luminosity is increased in proportion to the rapidity with which it is consumed. In fact, the more rapidly a body is burnt the higher necessarily is its temperature of combustion; and the higher the temperature of an illuminating substance—in other words, the higher its temperature of combustion—the greater is the amount of light which it emits.

If, then, or in so far as, these considerations are well founded, one would expect that the effect of a more rapid combustion of the gas, owing to an increased air supply, would be, not a destruction of light, but (although with a smaller flame) an increased intensity of the light. Yet we know as a fact that this is not the case. The light is destroyed, be the cause or explanation what it may.

It will be observed that, in the above considerations, it is assumed that the more rapid combustion is attended, and indeed produced by a greater intensity of combustion—in other words, a hotter flame. And what is here assumed is accepted as a fact by chemists and men of science generally. The commingling of air with a gas-flame in the blowpipe is universally held to produce a higher temperature in the flame. And there can be no question that gas used with the blowpipe melts substances which remain unfused when exposed to an ordinary gas-flame.

In his able lecture "On the Combustion of Gas for Economic Purposes," delivered before the British Association of Gas Managers in

1866, Dr. Letheby was stating the received opinion, illustrated by well-known or fully-acknowledged facts, when he said:

A pure white light is never attained but by the intense ignition of solid or molten matter. . . . In the case of coal gas the light is never pure unless it is intensified by very energetic combustion. If the combustion of a gas-flame is intensified by a proper supply of air, the temperature of the ignited carbon increases, and the light becomes purer and purer—giving a spectrum like that of solar light, with all tints of the rainbow.

And now I will briefly describe the contrivances which are used for increasing, or rather I should say for fully developing the temperature of burning gas. I have shown you that the light of a flame depends on the presence of ignited carbon; if, therefore, by any contrivance we can at once burn this carbon, and not permit it to stand as it were idle in an ignited condition, the temperature must be considerably increased. This is the principle concerned in all the contrivances for developing the heat of gas.

One of the simplest means of accomplishing this is to mix a sufficient quantity of air with the gas before it reaches the place of combustion; and this is easily done by putting a cap of wire gauze upon the chimney of an Argand burner, and setting fire to the gas above it. The effect of this arrangement is that as the gas passes from the burner to the top of the chimney, it draws in a quantity of atmospheric air, which freely mixes with it and burns the solid particles. The same is the case with the burner of Bunsen, which I have already described; and you will note how strongly it ignites this platinum crucible.

But we shall find that a still higher temperature is obtained by blowing air into a large volume of flame. This is the plan adopted by Mr. Herapath in the blowpipe jet. Observe how intensely it ignites a mass of platinum wire, &c., &c.

The sequence of ideas, or of statements, is here very singular. It is only by a high temperature of combustion that white or perfect light is obtainable. This is obtainable by increasing the air supply. Next, says Dr. Letheby, I shall show you how, in this way, a high intensity of combustion is obtained. Nevertheless these processes (the blowpipe and Bunsen burner), instead of giving greater light, give none at all! How does this happen?

The power of the blowpipe to melt metals unfusible by the simple gas-flame is beyond question. Hence it is a natural inference that the commixture of air or an extraordinary air supply, while consuming the gas more rapidly, consumes it also at a higher temperature. But is this a necessary and certain inference from the facts? That the heat of the flame *as applied to the metal* is increased is certain; but it does not follow that the heat of the flame *as a whole*—the total heat of the gas combustion—is augmented. The effect, or purpose of the blowpipe is to greatly *reduce* the ordinary size of the gas-flame, and to concentrate it upon a small point of the substance operated on. Hence the total heat of the gas combustion may be no greater than in the ordinary flame—indeed, it might be considerably less; in other words, the gas might really be consumed at a lower temperature, and yet the same high melting power might be obtained. There may be no increase of temperature throughout the flame, but simply a concentration of the heat. For example, if the metal of a cannon ball be flattened and extended into a disc, then, although projected with the same force, it will strike harmlessly against a substance (say the side of a ship) which would be easily penetrated by the ball itself—that is, by the same weight of metal concentrated, spherically or still better conically, so as to bring the whole projectile force against the smallest possible portion of the surface to be penetrated. This is just what the blowpipe does. It reduces and concentrates the flame into a pencil of fire, bringing its whole power to bear upon a mere point of the substance to be melted. Thus the operating heat is greater, while the resisting portion of the substance is less than occurs when the simple gas-flame is employed. Accordingly, as it seems to me, the vastly increased melting power of the gas-flame when applied by the blowpipe does not *necessarily* prove that the gas is being consumed at a higher temperature. It may be so; but there is no intellectual necessity to believe it. On the contrary, it seems to me that, so far as the results show, there might actually be a decrease in the general or total heat of the flame; the vast melting power (or the degree and effects of the *applied* heat) being due to a concentration of the heat of the flame, and its application to a very small part of the metal operated upon.

In fact, is not the action of the blowpipe similar (not wholly, but to a large extent) to the action of the common glass lens, whereby the sun's rays are made to ignite paper or wood? If so, then the blowpipe does not raise the temperature of the burning gas, but simply applies it more effectually. Further, if the power of the blowpipe be simply due to its concentrating action, for all we know the gas combustion may actually take place at a lower temperature than usual; the decrease being far more than compensated by the concentration and its result—viz., the smallness of the surface acted upon.

The Bunsen burner is another apparatus quoted to show that the temperature of gas combustion is raised by commingling air with the flame. But the blowpipe is so far the superior apparatus that I have preferred to deal with it; and if, as I have suggested, the facts of the blowpipe do not prove a higher gas combustion, and even admit of the possibility of a lower temperature than in the ordinary flame, the Bunsen burner need not demand much consideration. Moreover, it is a fact that at times I have succeeded in melting a piece of platinum wire in an ordinary gas-flame, yet have never been able to do so in the flame of a Bunsen burner. Other experimenters may have obtained different results; but certainly such is what I have found. This fact, as I found it, is quite discordant with the established opinion that the flame of the Bunsen burner is much hotter than that of any ordinary gas-flame. Of course there may have been something exceptional in my experiments, although I am not aware of it; but such testings are easily made by any one; and perhaps some of the readers of the JOURNAL will do so.

Now, if my own experience in this matter be supported by that of others—as it will be unless (unknown to me) there was something

exceptional in it—it makes an end altogether of the superiority of temperature claimed for the Bunsen burner. There is plenty of reason why the Bunsen burner should be so highly valued irrespective of any (real or supposed) superiority in the temperature of its flame. In the first place, the flame is concentrated—the gas burns within less space than an ordinary gas-flame; and the great advantage of this concentration has already been shown in the case of the blowpipe. Secondly, the Bunsen burner is the cleanest and handiest kind of flame or fire which can be used in the laboratory. Thirdly, it does not smoke, and deposits no soot on the substance operated upon. And this really gives to it a greater heating power. An ordinary gas-flame quickly covers the (colder) substance against which it is directed with a deposit of soot, which at once impairs and gradually destroys its own power as a heating or fusing agent. Hence, even if (as I believe) the Bunsen flame is not superior in temperature to the ordinary gas-flame, it will *appear* to possess that superiority because its heat is *entirely* available, whereas in actual operation that of the gas-flame is not.

May it not be, then, that the blowpipe-flame, likewise, has no superior temperature; but, like the Bunsen burner (although on a greater scale), only appears to possess it, owing to the more efficient manner in which the heat is applied?

I have but a few words more to say, in which, before endeavouring to draw conclusions, I must first add a little to the preceding facts and considerations, relative to the varying and somewhat puzzling effects of the air supply (at the ordinary temperature) upon the illuminating power of gas.

THE REMUNERATION OF GAS MANAGERS.

By MR. W. WHITE, of Abersychan.

Almost every profession, trade, or calling has some peculiarity connected with it which defies explanation; and it frequently happens that if attempts be made to ameliorate the condition of those who are unable to understand, with any degree of satisfaction to themselves, the anomalous position in which they are placed in consequence of such peculiarity, they are peremptorily regarded as the irrepressible outgrowth of discontent. In commenting upon the above subject, it is not intended to follow the lucubrations which were served up for the delectation of gas managers a short time since.

To some minds, doubtless, it is difficult to approve of the lugubrious ideas of those who argue that the status of the gas manager can be raised by a more complete theoretical training and extended technical education than that to which he has hitherto been accustomed. Upon this latter consideration there seems to be ample ground for a wide divergence of opinion. Many points of importance are involved in the problem; and that the remuneration doled out to many in the profession to-day is ridiculously inadequate for the services of a highly-trained gas manager, is as palpable as the fact is monstrous. It appears that much is involved in taking the first step towards improvement, and while not declaring that the educational movement should strike upwards in the way of gas directors and gas committeemen, the fact cannot be ignored that amongst those gentlemen a change of opinion on this subject is highly desirable. Advertisements (with their sanction) often appear in newspapers, offering terms and conditions of engagement which are, to say the least of them, a reflection upon the respectability and utility of the gas profession. Can it be expected that really good men will apply for such appointments, or that such announcements offer encouragement for young men to qualify themselves for the higher grades of the profession? It is idle to complain of the non-progressiveness of the science and practice of gas manufacture, so long as the legitimate incentive to the exercise of genius be wanting.

While admitting that gas directors and committeemen are unable to do everything required to help on improvements in gas manufacture, it cannot be denied that in too many instances the remuneration of gas managers is not only not sufficient to enable the latter to enjoy repose and comfort, and afford them an opportunity of exerting themselves for improvement, but is so narrowed as to reduce life to a perpetual struggle for existence. Many gas managers have but little comfort to glean from a comparison of their own position with that of others who are not connected with the gas industry. The records of many limited liability companies prove that in management the directors of such concerns are liberal to those who have a responsible connection with them. This is also frequently the case notwithstanding the shareholders are not only not reaping benefit upon the capital invested, but have the disagreeable assurance conveyed to them in the statements of account that their principal, too, is fast sinking away. Very few readers of the JOURNAL there are who will be unable to call to mind many such instances.

The members of the gas profession, on the other hand, are, as a body, miserably underpaid; although, forsooth, they represent the genius and active principle of one of the most flourishing industries in the kingdom. It may with safety be averred that were a man of ordinary ability to transfer his interest to any undertaking other than gas management, and pay the shareholders one-half as much dividend as may be realized from a gas supply, the manager of the concern would in all probability receive for his services double, if not treble the remuneration that would be tolerated by gas directors or committeemen. Some advertisers appear to have regard for the sensitiveness of their victims, and allow applicants to name their own salary. There is one redeeming feature in such cases—there is either a sense of shame which the advertisers cherish; or, on the other hand, motives of economy prevail, and the lowest offer is regarded with favour. It would be interesting to the curiously minded to learn how some of these snug little appointments are filled up, and the amount of remuneration which follows the fulfilment of the

duties of the post. Over these dark recesses, luckily, the veil of secrecy is drawn, and the public eye is saved from beholding a picture more calculated to fill the mind with serious and unhappy reflections upon the case than with any feelings of satisfaction which should accompany the issue of such struggles in life.

Men who are entrusted with onerous duties to fulfil, and with grave responsibilities resting upon them, should, in all conscience, receive adequate remuneration for the faithful discharge of them. The ghost of poverty should not be the constant companion of any gas manager, so long as he does his duty to his employers, and is enabled to bring his abilities to bear for their benefit. All right-minded men have a little ambition, and when a man ought to be able to hold his own amongst his compeers in life, he deserves to be dealt with as liberally as others who cannot have more claim to just recompense for the faithful discharge of responsible duties than the gas manager, no matter what his position may be. Generally, it may be said that the gas manager of to-day is intelligent, painstaking, and frugal; and yet he is about the most underpaid of professional men in the United Kingdom.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE BRITISH ASSOCIATION OF GAS MANAGERS.

SIR,—In the course of a few days the great event of the year—in the gas world—will take place. The British Association of Gas Managers will hold its annual meeting; papers will be read, addresses given, opinions interchanged, and it may reasonably be expected that much good will result. But whilst so much may be said, it must be generally admitted that the scope of the Association is at present far too limited. As now constituted, any one with authority to append the mystic words "Manager" or "Secretary" to his name may become a member, and partake of its benefits, no matter what his attainments in the profession may be, or what the interest he takes in its advancement. But, without that qualification, though his experience may be wide and varied, and his knowledge extensive, the unfortunate assistant must for ever remain an unconsidered outsider, with no *locus standi* whatever. And yet it is this latter class that the advantages of the Association would most beneficially affect. It is to the present assistants we must look for the future managers and engineers; and in proportion to the technical education and training they receive will accrue the future advancement of the science of gas engineering. The great need for scientific and technical education is apparent to any one who considers the hap-hazard arrangements which too often obtain in even well-conducted gas-works; and its urgency was acknowledged in a long correspondence in the JOURNAL during the latter half of the year 1878. At the last meeting of the Association attention was called to the question by Mr. Warner, in his presidential address; but no legislation followed. My object in writing this letter is to draw attention once more to the position of persons occupying responsible positions in gas-works, who are neither managers nor secretaries (but whose interest in the profession is excelled by neither); and to ask that another meeting may not be allowed to pass by without something having been done on their behalf.

There should be no difficulty in framing a scheme for admitting such persons to the benefits of the Association, as associates. I would propose that they receive the Transactions of the Association, but do not attend its meetings; but that they contribute papers on subjects chosen by the Committee, for the best of which prizes should be given, the subscriptions of the associates furnishing ample means for this latter purpose. Provision might also be made for associates becoming members as the highest distinction attainable.

Trusting that something will be done to improve the lot of my fellows, and that speedily, I beg to subscribe myself

AN ASSISTANT.

May 26, 1880.

MR. PATTERSON ON THE AIR SUPPLY TO STREET-LAMPS.

SIR,—In the third part of Mr. Patterson's article on the "Effect of Temperature in the Gas and Air Supply upon the Illuminating Power of Gas-Flames," he refers, as an application of very recent data (except in the case of oil-lamps), to the method of making use of the natural currents of gas and heated air, by feeding the cold air through the upper part of the lantern, and down its sides to the flame, without impinging upon the upward current of the products of combustion, thus avoiding the necessity for an opening at the bottom of the lantern; whereas all street-lamps were closed at the bottom previous to the introduction of the new lighting torch, and are still practically so, taking in all the air through the top of the lamp in accordance with the principle described by Mr. Patterson.

PRACTICAL.

May 28, 1880.

MR. SUGG AND THE HOLLOW-TOP BURNER, ETC.

SIR,—When I intimated to your readers that I should not again intrude on your space anent this controversy, I had not the remotest idea that Mr. Bray was going to indulge in such a Parthian shot as the revivification of the controversy on "low-pressure burners," which was thoroughly thrashed out in the pages of the JOURNAL and several other papers in March, 1879. Mr. Bray then invented a system of manifold-ing his letters, so that, like the army of the Grand Duke of Seidlitz von Stinkinggen, in Tom Taylor's play, they did duty in several places at once.

In his letter of the 8th of March, 1879, which appeared in page 359 of the JOURNAL for that month, and in the *Journal of the Society of Arts*, he acknowledges my title to be the inventor of the hollow-top steatite burner, for he says, "If Mr. Sugg had simply claimed in his original statement the invention of the hollow-top steatite burner, my first letter [to the *Journal of the Society of Arts* denying my title] would not have been penned." It is true that having made this frank admission he feels called upon to say something pleasant afterwards, and he continues, that "to call this invention is playing with language." He, however, forgot to say that he himself had been "playing with language" to

exactly the same tune when he rushed into the Patent Office, and declared himself the true inventor of the "hollow-top burner," rechristened the "slit union," made in "adamas," rechristened "enamel." My invention having the precedence of his by some years, made it awkward for his would-be invention; hence, doubtless, the expression above quoted. "The grapes were sour."

The burners shown in section in your last number are metal burners (Wadsworth's patent), and, therefore, have nothing to do with the hollow-top steatite burner, which has proved itself so superior to every other burner (of the flat-flame type) as to have decided your correspondent, Mr. Bray, to adopt it as his own, notwithstanding his boast about the number of his "union jets" which are used in England.

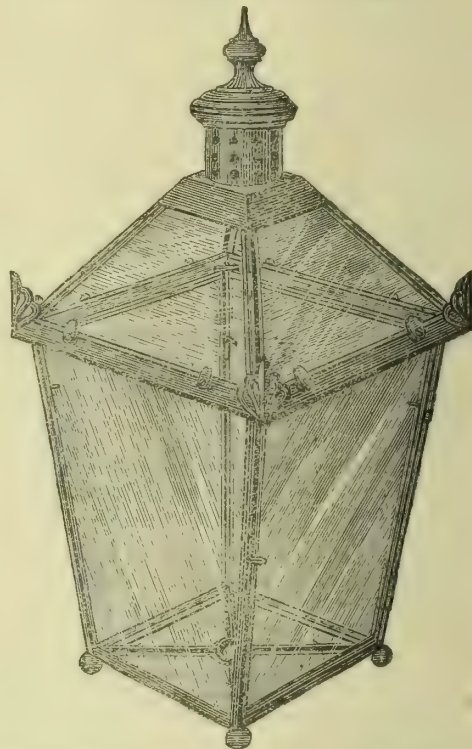
In conclusion, I thank you very much, Sir, for your kindness and forbearance during this long and wearisome controversy, and I sincerely hope that it may never be my lot to be led into such another. If at any time I can be of service to your readers in affording them information, I shall always do it with the utmost readiness and pleasure; but of such "horse at the mill," round and round on the same track controversies, in which reiteration takes the place of argument, I'll have no more.

Vincent Works, Westminster, S.W., May 29, 1880. WILLIAM SUGG.

[We can thus congratulate our readers on the close of this controversy.—ED. J. G. L.]

QUANTUM asks—(1) What would be the average discharge, in gallons per hour, of water from a 4-inch cast-iron pipe under the following conditions:—Water to be supplied for 8 hours. The 4-inch cast-iron pipe is 5 yards long, out of a 9-inch main. The pressure at the junction of the main and pipe at the commencement is 150 feet, gradually falling to, and remaining at 84 feet after two hours service? (2) What would be the discharge if the head was 84 feet throughout?

BOX'S IMPROVED STREET-LAMPS.



The above illustration shows a street-lamp glazed according to the invention of Mr. W. W. Box, of the Crayford (Kent) Gas-Works, and which is secured by a patent taken out on the 24th of October last.

The specification of the patent—which is for "Improvements in Securing Glass and other Surfaces in Frames for Lamps, Lanterns, and other Articles and Structures"—states that the object of the invention is to dispense with the use of putty, so that lamps may be repaired by unskilled workmen; and, at the same time, the frames will not be injured by the continued chipping off of the hard putty.

According to one arrangement, the corners of the frame are made with angle pieces, and the base with diagonal pieces extending nearly up to the angle pieces. The glass (cut to the exact size of the frame, as usual) is placed against (or in) the angle pieces; and, to secure the glass, a strip of angled metal is fitted against it; while, to grip the two adjacent plates of glass at one and the same time, the angle strips of metal are held in position by being slipped under a loop or staple at the top of the frame, and by being inserted at the bottom between the diagonal pieces and the angle corner pieces in the space left for their reception. A hooked projection is connected to the angle strips, so as to take hold of and put them into position, and to remove them when required to insert a new pane of glass. The bottom panes are secured by pins inserted in the diagonal pieces, and the panes themselves rest on flanges formed by the base of the diagonal pieces. By taking out the pins the panes can be replaced.

The invention also consists in securing the top glasses or plates by inserting them into grooves or recesses formed for the purpose in the frames, and there securing them by studs or clips, which, when turned in one direction, hold the glass or plates, and when turned in the contrary direction the plates are free to be removed. These clips may be made of soft metal, such as copper, so as to be easily fastened and unfastened as desired. The groove or recess is preferably made with a wire edge and groove, so that the glass rests on the wire, and a space is then formed for the passage of water. The plates can, of course, be glazed or enamelled on the under side when desired, so as to act as reflectors.

REDUCTION IN THE PRICE OF GAS BY THE CRYSTAL PALACE DISTRICT COMPANY.—Notice has been given by the Directors of the Crystal Palace District Gas Company that, from and after Midsummer, the price of gas will be reduced to 3s. 8d. per 1000 feet.

Parliamentary Intelligence.

PRIVATE BILLS RELATING TO GAS, WATER, ETC.

SESSION 1880.

PROGRESS MADE TO SATURDAY, MAY 29.

Title of Bill.		Petition for Bill Presented.	Bill Read the First Time.	Bill Read a Second Time.	Bill Reported.	Bill Read the Third Time.	Bill Received Royal Assent.
Ackworth, Featherstone, Purston, and Sharlston Gas Bill	Lords	Feb. 9	Feb. 10	March 8	..	..	..
Birkenhead Borough Bill	Commons	Bill with-	drawn	..	..	..	..
British Gaslight Company, Limited (Staffordshire Potteries), Bill	Lords	Feb. 10	Feb. 10	Feb. 23	..	..	..
Burton-upon-Trent Corporation Bill	Commons	Feb. 10	Feb. 10	Feb. 23	..	..	..
Cardiff Water Bill	Lords	Comms. Bill	May 27	..	..	..	..
Chester Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 16	March 11	May 25	..
Cork Gas Bill	Lords	Feb. 10	Feb. 10	Feb. 20	March 6	March 11	..
Cork Improvement Bill	Commons	Lords Bill	March 11	..	..	..	..
Dagenham and District Farmers (Optional) Sewage Utili- zation Bill	Lords	Comms. Bill	March 12	March 19	..	..	..
Dartford Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 24	March 2	March 11	..
Dearne Valley Water Bill	Lords	Feb. 9	Feb. 10	March 1	..	..	..
Denton and Haughton Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
Doncaster Corporation Water Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Eastbourne Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
Edinburgh and District Water Bill	Lords	Feb. 9	Feb. 10	March 15	..	..	..
Exmouth and District Water Bill	Commons	Feb. 10	Feb. 10	March 15	March 16	May 25	..
Gaslight and Coke, Commercial Gas, and South Metropolitan Gaslight and Coke Companies Bill	Lords	Lords Bill	May 28	..	..	..	..
Great Yarmouth Water Bill	Commons	Feb. 9	Feb. 10	Feb. 16	March 12	May 25	..
Hinckley Local Board Gas Bill	Lords	Feb. 10	Feb. 10	Feb. 16	..	..	..
Huddersfield Tramways and Improvement Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
Hull Lighting Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Hyde Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
King's Lynn Corporation Bill	Lords	Feb. 9	Feb. 10	Feb. 16	..	..	..
Lancashire County Justices (Water, &c.) Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
Lancaster Corporation Bill	Lords	Feb. 10	Feb. 10	Feb. 16	March 11	March 13	..
Lincoln Gas Bill	Commons	Lords Bill	March 16	..	..	..	..
Liverpool Corporation Water Bill	Lords	Feb. 9	Feb. 10	Feb. 16	March 12	..	..
Liverpool United Gas Bill	Commons	Feb. 9	Feb. 10	March 12	..	..	..
London Gaslight Company Bill	Lords	Feb. 9	Feb. 10	Feb. 24	..	..	..
Maidstone Gas Bill	Commons	Comms. Bill	May 28	..	..	..	..
Malton Gas Bill	Lords	Feb. 9	Feb. 10	Feb. 21	March 12	May 27	..
Oldham Improvement Bill	Commons	Feb. 9	Feb. 10	Feb. 21	..	..	..
Phoenix Gaslight and Coke Company Bill	Lords	Feb. 9	Feb. 10	March 1	..	..	..
Portmadoc Water Bill	Commons	Feb. 9	Feb. 10	Feb. 23	..	..	..
Prescot Gas Bill	Lords	Feb. 9	Feb. 10	Feb. 23	..	..	..
Preston Improvement Bill	Commons	Comms. Bill	May 28	..	..	..	..
Rathmines and Rathgar Township (Vartry Water Supply) Bill	Lords	Feb. 9	Feb. 10	Feb. 23	March 12	May 27	..
Rathmines and Rathgar Township Water Bill	Commons	Feb. 16	Feb. 16	March 11	..	..	..
Reading Gas Bill	Lords	Feb. 10	Feb. 10	Feb. 16	..	..	..
Rochester Corporation Bill	Commons	..	..	..	..	..	..
Sea Water Supply to London Bill	Lords	Feb. 9	Feb. 10	March 1	..	..	..
Sligo Borough Water Bill	Commons	Feb. 9	Feb. 10	Feb. 16	..	..	..
South Metropolitan Gas Company Bill	Lords	Feb. 10	Feb. 10	Feb. 16	..	..	..
Southwark and Vauxhall Water Bill	Commons	Feb. 9	Feb. 10	..	..	..	..
Stafford Borough Bill	Lords	Feb. 9	Feb. 10	Feb. 23	..	..	..
Wakefield Corporation Water Bill	Commons	Feb. 9	Feb. 10	Feb. 23	March 17	..	..
Wandsworth and Putney Gas Bill	Lords	Feb. 10	Feb. 10	Feb. 16	March 11	March 16	..
Wigan Improvement Bill	Commons	Lords Bill	March 18	..	..	..	..
Wrexham Water Bill	Lords	Feb. 9	Feb. 10	March 2	..	..	..
Yeadon and Guiseley Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 17	..	..	..
"	Lords	Feb. 9	Feb. 10	March 4	..	..	..
"	Commons	Feb. 9	Feb. 10	March 10	..	..	..

HOUSE OF LORDS.

MONDAY, MAY 24.

A petition in favour of the Rathmines and Rathgar Township (Vartry Water Supply) Bill, which was also against the Rathmines and Rathgar Township Water Bill, was presented from Ratepayers, owners, &c., of property within the township of Rathmines and Rathgar, and others, in public meeting assembled.

TUESDAY, MAY 25.

The Sligo Borough Water Bill, the Rathmines and Rathgar Township Water Bill, and the Rathmines and Rathgar Township (Vartry Water Supply Bill) were referred to a Select Committee, consisting of Earl Powis, Viscount Gordon, Lord Elgin, Lord Lawrence, and Lord Methuen; to meet on Monday, May 31.

HOUSE OF COMMONS.

FRIDAY, MAY 21.

The petitions against the following Bills have been withdrawn:—Liverpool Corporation Water Bill, of Upper Mersey Navigation Commissioners; London Gaslight Company Bill, of Metropolitan Board of Works; Southwark and Vauxhall Water Bill, of London and South-Western Railway Company; Wandsworth and Putney Gas Bill, of Metropolitan Board of Works; Wrexham Water Bill, of Great Western Railway Company.

A petition against the Wakefield Corporation Water Bill was presented from Henry Savile; and two petitions against alterations in the Bill were presented from (1) Corporation of Halifax, (2) Owners, &c., of mills, &c.

LOCAL GOVERNMENT (GAS) PROVISIONAL ORDER BILL.—This Bill, to confirm a Provisional Order of the Local Government Board under the provisions of the Gas and Water Works Facilities Act, 1870, and the Public Health Act, 1875, relating to the borough of Conway, brought in by Mr. Hibbert and Mr. Dodson, was read the first time, and referred to the Examiners.

MONDAY, MAY 24.

GAS AND WATER ORDERS CONFIRMATION BILL.—This Bill, for confirming certain Provisional Orders made by the Board of Trade under the Gas and Water Works Facilities Act, 1870, relating to Chew Magna Gas, Garstang Gas, Halstead Gas, Harrogate Gas, Holywell Gas, Long Eaton Gas, Trowbridge Gas, Broadstairs Water, East Blatchington and Seaford Water, Gisborough Water, Harrogate Water, Luton Water, Newhaven and Denton Water, Norwood (Middlesex) Water, and Pwllheli Water, brought in by Mr. Ashley and Mr. Chamberlain, was read the first time, and referred to the Examiners.

TUESDAY, MAY 25.

The petition of the Malton Local Board against the Malton Gas Bill was withdrawn.

THURSDAY, MAY 27.

The petitions of (1) Cheshire Lines Committee, (2) Sheffield and Midland Railway Companies Committee, (3) Mersey and Irwell Navigation and Bridgwater Navigation Companies, against the Liverpool Corporation Water Bill, were withdrawn.

Miscellaneous News.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

The Forty-second Quarterly Meeting of this Association took place last Saturday. The members met at the Ashton-under-Lyne Gas-Works—Mr. W. CARR, the President, in the chair.

The HONORARY SECRETARY (Mr. R. Hunter) read the minutes of the previous quarterly meeting, which were confirmed, and the following gentlemen were elected members of the Institution:—

Mr. Joseph Hall, Manager of the Corporation Gas-Works, St. Helen's.
Mr. Henry Hawkins, Manager of the Local Board Gas-Works, Hindley, near Wigan.

After inspection of the Ashton Gas-Works, the members adjourned to one of the retort houses, where Mr. D. Clarke, the Manager of the works, had provided luncheon, to which about fifty members and friends sat down. The members then went in two four-in-hand coaches to the Mossley works of the Stalybridge Gas Company; after the inspection of which they proceeded to view the water-works in course of construction, at Greenfield, for the Ashton and Stalybridge Corporations and District Joint Committee, where they were courteously received by Mr. Bateman, the Resident Engineer, who personally conducted them over the works, in which great engineering difficulties have been met and conquered. Mr. Bateman afterwards joined the members at a spread provided at the inn known as "Bill-o'-Jack's," and to which ample justice was done.

A hearty vote of thanks to Mr. Bateman was carried with acclamation, for his kindness in conducting the members over the works; and votes of thanks to the President and to the Sub-Committee, for the satisfactory arrangements made for the day, were carried with applause.

The members and other friends then returned to Ashton, and thence by rail to their respective destinations.

METROPOLIS WATER SUPPLY.

CITY COMMISSIONERS OF SEWERS.

A Meeting of the Commissioners of Sewers of the City of London was held last Tuesday—Mr. T. RUDKIN in the chair—when the following report from the Finance and Improvement Committee was presented:—

Agreeably to your references to us of Feb. 3 and March 16 last, we have from time to time had under consideration the question in regard to the projected sale of the Metropolitan Water-Works to a Metropolitan Water Trust. We were about to confer with the Joint Gas and Water and Local Government and Taxation Committee upon the Bill introduced in the last session of Parliament to give effect thereto, when the said Bill was for the time dropped, and shortly afterwards Parliament was dissolved.

Immediately on the formation of the new Government, we sought a conference with the Secretary of State, with a view to ascertain what course Her Majesty's Government proposed to take in reference to the matter, when the Home Secretary expressed a desire to have the views of the City Authorities as to the desirability of purchasing the Water Companies interests, the proposed terms of transfer, and the formation of the Water Trust.

We have since conferred with the Joint Committee of the Corporation with a view to harmonious action, and having further considered the question generally, we, without expressing any judgment on the provisional agreements entered into for the purchase of the Water Companies supplying London with water, are of opinion that as those agreements have been made, after lengthened negotiations, on the assumption that they are beneficial to the consumers, it is expedient that they should be carefully inquired into by a Select Committee of the House of Commons, with a view of ascertaining whether all or any of them are beneficial to the inhabitants of the Metropolis, and should be carried into effect, or whether the expenditure contemplated under the agreements for acquiring the existing supply might not be more advantageously spent in procuring a new and better supply of water for London.

We are also of opinion that the Corporation should be prepared to take part in the inquiry, and co-operate therein.

Mr. MANNERS (Deputy-Chairman of the Committee) having moved the

adoption of the report, a discussion on the subject took place, in the course of which

Mr. J. S. SCOTT moved as an amendment, but it was not seconded, that no further steps be taken in the matter; believing, he said, that it was inexpedient, in the interests of the citizens, for the Commissioners to take the initiative in the settlement of the question.

Mr. BEDFORD then moved, and Mr. SCOTT seconded, an amendment to the effect that the inquiry into the Water Supply of the Metropolis should be local rather than parliamentary; whereupon another discussion ensued, the result being that a show of hands was taken, and it was negative. Meanwhile, however,

Mr. ASHLY had proposed the following addition to the report:—"That amongst the many defects at present existing in regard to the water supply, the Commissioners desire to draw particular attention to the basis of charge for water as requiring reconsideration, and they suggest that the attention of the Select Committee should be called thereto."

Some opposition was shown to this proposal; but, eventually, on another show of hands being taken, the report of the Committee, with the addition proposed by Mr. Ashly was adopted by a large majority.

COURT OF COMMON COUNCIL.

Last Thursday a meeting of the Court of Common Council, under the presidency of the Lord Mayor, was held, at which the report referred to in the above-mentioned proceedings was brought up for adoption.

Mr. RUDKIN formally moved that the Court agree with the recommendations of the Commissioners of Sewers, upon which

Mr. McGEORGE moved, and Mr. STAPLETON seconded, as an amendment—"That, however important and desirable it may be to deal with the Water Supply of the Metropolis, yet, in the opinion of this Court, it is inexpedient to proceed further at present with the preliminary agreements entered into by the late Government with the Companies;" but on a show of hands the motion for the adoption of the report was carried by a large majority.

DEPUTATION TO THE HOME SECRETARY.

On Friday last a deputation from the Metropolitan Board of Works had an interview with the Home Secretary (with whom was Mr. Dodson, President of the Local Government Board) on the subject of the Water Supply of the Metropolis.

Sir J. M. HOGG, M.P., the Chairman of the Board, in introducing the deputation, read a document setting forth the views of the Board on the question. It stated that the transfer of the Metropolitan Water Supply from the control of trading companies to a body representing the consumers had for many years been advocated by those who had been specially concerned in promoting the health and well-being of the people; but the question had now taken such a firm hold on the minds of the public at large as to make its settlement a matter of public urgency. There was a strong and general conviction that the time had come when the settlement of the water question should cease in any way to depend on the interests of trading companies, and should be viewed in the interests of the consumers. There was, however, a clear perception of the fact that the change, if further delayed, would increase the cost and the difficulty, and that if the change had been effected a few years ago millions of money might have been saved. The Metropolitan Board found themselves in a difficult position. It would be remembered that expenses incurred by the Board in promoting their Water Bill were last year disallowed by the Government Auditor, and the effect of this disallowance was only removed by an Indemnity Act, which, while authorizing the expenditure already incurred, confirmed the decision that the Board, in incurring it, had exceeded their legal powers. In these circumstances, the Board had come to the conclusion that the proper course was to bring their decision under the notice of Her Majesty's Government. The Board claimed to have the management of the water supply. This claim did not arise solely from the fact of their having the management of the whole Metropolis; it was also justified by the consideration that important functions already entrusted to them by statute could be discharged with greater benefit to the Metropolis if the supply of water were under their control. By the Metropolitan Fire Brigade Act of 1875 the Board were made the authority for extinguishing fire and the saving of life and property in case of fire in the Metropolis. It was unnecessary to show how much the efficiency of the fire-extinguishing service depended upon the pressure of the water supply, and how desirable it was for the authority that had control of the one to have control also over the other. The Board were of opinion that the ratepayers of the Metropolis would not be satisfied unless the water supply were placed under the authority of a representative body over which they would have complete control. With respect to the objection that the area of the supply of water extended beyond the Metropolis, and that it would be unjust to the inhabitants of the districts outside to place them under an authority representing the Metropolis alone, it would surely be possible to find some means of reconciling the rights and interests of those districts with the necessity of placing the water supply under the control of a representative body. But even if this could not be done, the inhabitants of the water districts would be placed in a better position by the change. They were now supplied by Companies who wished to make a profit for their Shareholders. The first object of the Board would be to give the public the best supply of water, and the condition under which an outer district would be supplied would be more favourable than that which now existed. The Board were ready to consider whatever course might be deemed necessary by the Government. Should the Government be of opinion that it would be well for the Board to devise a scheme, and lay it before Parliament, the Board were ready to do so if the Government would obtain for them the necessary enlargement of their powers. If, on the other hand, the Government would prefer to introduce a Bill, the Board would be ready to give careful consideration to any plan which might be proposed. In conclusion, the Board suggested that there should be an inquiry by a Select Committee into the terms of the provisional agreements made between the late Home Secretary and the Metropolitan Water Companies, and into the legal rights of the Companies and their relations with the consumers. This inquiry the Board would be happy to assist in every way, both by appearing before the Committee upon their right to do so being made clear on an order of the House of Commons, and by laying before the Committee all the information in their possession on the subject.

Mr. RICHARDSON, the Chairman of the Parliamentary Committee of the Board, having, at some length, supported the proposals contained in the foregoing statement,

The HOME SECRETARY, in reply, said: I need hardly state that I regard it—and Mr. Dodson, I am sure, will concur in the sentiment—as a very great advantage to the Government to have the presence and the advice and assistance of a body representing so large a proportion of the ratepayers of the Metropolis as the Metropolitan Board do. In any remarks I may make you will quite understand that it is necessary for me to be extremely cautious, because anything I may say might possibly affect pecuniary interests of great value. Nobody can doubt the great complication in which the whole of this question at present stands. It is left in

a state of chaos from which nothing can extricate us except a good deal of "bear and forbear" upon all sides of the question, with a view to bring the matter to a satisfactory solution. Certainly, as far as the Government are concerned, their object is to act upon this principle in securing the co-operation of all parties with a view to an early settlement of the question. An observation dropped from the gentleman who has just sat down was not strictly accurate, when he spoke of a Bill now before the House of Commons. There is no Bill in the House of Commons. The Bill of the late Parliament and the late Government is dead; and certainly, as at present advised, and with my present state of information, I know of no intention to revive it. But, apart from that Bill—I do not say independently of it—there are certain agreements which have been made. Now, opinion appears to be very much divided on the subject of these agreements. There are naturally some persons—the persons who negotiated the agreements, and those who are their friends and supporters—who think they are very good agreements, and favourable to the public. There are other persons, whose opinions are entitled to quite as much weight, who think they are not good agreements, and that they are very unfavourable to the public. In these circumstances, of course, the Government might undertake for themselves an official, departmental, and private inquiry; but I do not think this would be a desirable course. It is necessary that the public and the ratepayers who are interested in the matter should be thoroughly satisfied, by a public inquiry, as to the value or the non-value of these agreements; and I believe nothing short of this would meet the present exigencies of the case. One of the great embarrassments and difficulties in the way is the intricate character of the question, and so the public are perfectly unable to form a judgment of the value of these agreements. Well, then, this certainly must be the first preliminary step. If upon an examination of the agreements they should turn out to be as extravagant as some people suppose, of course there would be at once an end of the whole of the present—I should, perhaps, call it the late—scheme of purchase, and there would be one point finally settled. If upon examination they should turn out to be more favourable and better terms than many persons suppose, it would then have to be considered what should be done with them. It is said that there has been considerable delay. This is perfectly true; but it is nobody's fault. Great political exigencies cannot yield even to Water Bills. If we come to the conclusion that neither these terms nor any that the Companies will consent to accept are reasonable, then we must look to some other course. I do not think it is possible that things can revert to their former state, or remain as they are at present. The public will not, and ought not to consent to give an unreasonable price, even for one of the first necessities of life; neither will they put up with a supply inadequate in quantity and defective in quality. If the Water Companies will not deal with the ratepayers on reasonable terms, the ratepayers and Parliament are not impotent to find some other resources. The terms amount, as it is estimated, to 80 millions; but upon information which reaches me, and which I believe to be well founded, they would turn out to be considerably more; and it is for the public and those who represent them to consider whether this is a price which it is worth while to give for the article, or whether at that cost, or even at a less cost, they could not supply themselves with a better article. The Water Companies have no monopoly in the supply of London. That is a clear proposition. No doubt there may be difficulties and inconveniences in introducing a new supply, but these may be overcome. It is not beyond the resources of legislation or of science. I have heard something said on the danger of delay. It is urged that we must take the terms, whatever they are, without stopping to consider them, lest the water-rents should be raised; and there has been an alarm on the subject of assessment. I wish to remove an error upon this subject. The water-rents do not rise according to the assessment; the assessment is only an element of evidence. The legal right that the Water Companies possess is to take the rents upon actual value, whether the assessment corresponds to it or not. But I am not myself disposed to be very much alarmed upon this subject. The Companies have not generally raised their rents according to their powers, and I do not think it is very likely, when we are asked to be in a great hurry upon the subject, that the Companies would challenge public opinion upon it. If they did so, of course that would make the course of the ratepayers and Parliament quite clear. I am only referring to these matters as possible alternatives. It would be a very proper subject of inquiry, as your memorial suggests, first of all to see what these agreements are worth, and whether reasonable terms of purchase are offered. If the terms are reasonable, then we have to consider whether the thing is worth buying upon reasonable terms. But if the thing be not available upon reasonable terms, or if, even upon reasonable terms, it be not worth the acquisition in perpetuity by the public, well, then, as I said before, some other course must be sought, and, if so, I need not say that the ratepayers and the Government would look to the Metropolitan Board of Works as one of the most powerful engines for assisting them in the difficulty. The Government have received from the bodies representing the City of London—from the Commissioners of Sewers and the Court of Common Council—an application very similar to that of the Metropolitan Board of Works. These bodies also desire that the agreements should be examined. They ask that a Select Committee of the House of Commons should be appointed to examine the agreements, and also to ascertain "whether all or any of them are beneficial to the inhabitants of the Metropolis, and should be carried into effect, or whether the expenditure contemplated under the agreements for acquiring the existing supply might not be more advantageously spent in procuring a new and better supply of water for London." They also state that they are "prepared to take part in the inquiry, and co-operate therein." They end by saying that, amongst the many defects at present existing in regard to the water supply, they "desire to draw particular attention to the basis of charge for water as requiring reconsideration, and they suggest that the attention of the Select Committee should be called thereto." This I understand to refer to the system of charge by which the Water Companies are authorized to raise their water-rents without increasing the accommodation, so that without any new or better service their receipts are augmented by the growth of the wealth of the Metropolis. This, I think, as the Corporation suggest, is a very fair subject of inquiry. The Government have not adopted these agreements. They do not promote or support them. They find them existing, and they are very willing that they should be inquired into. I think I may say the opportunity which the Board of Works desire will be furnished. The agreements will be placed upon the table before the Committee, and those who are responsible for them will, of course, explain them, and the Metropolitan Board and the Corporation of London, who also desire to take part in the investigation, will have an opportunity of thoroughly examining them and discovering what they are worth. You cannot call the Water Companies, in other circumstances, to your bar and examine them, but you have the agreements made with the Companies. You are entitled to examine these, and to see what relation they bear to the actual condition of those Companies. This in itself will be a great public advantage. As to whether the scope of the Committee should be extended, that is a matter upon which I must ask you to allow me to reserve my judgment for the present. It is a matter which it would be my duty, and also Mr. Dodson's,

to bring under the consideration of the Cabinet. It is evidently not desirable that the Committee should be embarked in an inquiry of an extremely protracted character. But the first step, I think, is perfectly clear. The Government are extremely desirous of, and extremely grateful for the co-operation of the Metropolitan Board of Works. Any assistance which the Government are enabled to offer to the Board to enable them to take their legitimate and natural part shall be freely given.

Sir J. M. Hogg thanked the right honourable gentleman, and then the deputation withdrew.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary Meeting of this Association was held at the City Terminus Hotel, Cannon Street, London, on Monday, the 24th ult.—Sir JULIAN GOLDSMID, Bart., in the chair.

The SECRETARY (Mr. R. S. Gardiner) read the notice convening the meeting, and the following report of the Directors:—

The present half-yearly ordinary meeting of the Proprietors has been convened, agreeably to the Company's Act of Parliament, for the purpose of receiving a report from the President and Directors upon the affairs of the Association, and for declaring a dividend for the half year ended Dec. 31, 1879.

Gas Made.—The quantity of gas made at the fourteen old stations in the half year ended the 31st of December last was 2822 million cubic feet. The quantity made in the corresponding half year of 1878 was 2766 million cubic feet, showing an increase of 56 million cubic feet, or at the rate of 2.02 per cent. The quantity of gas made at the sixteen new French stations in the half year ended the 31st of December last was 74 million cubic feet, giving a total increase of 130 million cubic feet, or at the rate of 4.70 per cent., and showing a total make of 2896 million cubic feet.

Lights.—The number of lights at the fourteen old stations, on the 31st of December last, was 1,232,346. The number on Dec. 31, 1878, was 1,195,908. These figures give an increase of 36,438 lights, or at the rate of 3.05 per cent. The number of lights at the sixteen new French stations on the 31st of December last was 41,623, giving a total increase of 78,061, or at the rate of 6.53 per cent., and showing a total number of lights of 1,273,969.

Mains.—The length of mains laid at the fourteen old stations on the 31st of December last was 1181 miles. The length of mains on Dec. 31, 1878, was 1162 miles, being an increase of 19 miles. The length of mains laid at the sixteen new French stations on the 31st of December last was 85 miles, giving a total increase of 104 miles, and a total length of mains of 1266 miles.

Rental.—The rental for the half year ended the 31st of December last was somewhat augmented, and the profit about the same, when compared with the corresponding half year of 1878.

Coal.—The cost of coal employed at the fourteen old stations during the half year now under review was 1s. 3.9d. per ton less than that of the coal used in the corresponding half year of 1878.

Secondary Products.—There was an increase in the value of coke of nearly 9 per cent., and a slight increase in the value of tar. The returns for ammoniacal products were fairly satisfactory.

General.—The outlay during the half year for alterations and extensions was less in amount than in recent half years.

New condensers were erected at Berlin, Lille, and Erdberg (Vienna), and the purifiers at Haarlem and Frankfurt were improved at some expense.

Considerable progress was made with the new buildings at Baumgarten (Vienna), and with the retort factory at Erdberg. At the close of the half year the Baumgarten works were nearly completed.

The necessary expenditure was incurred for the extension and enlargement of mains at all the stations.

The Directors regret having to announce the death, on the 19th of July last, of Mr. George William Drory, who for upwards of 54 years rendered such valuable service to the Association, and who, upon his resignation of the office of General Superintendent in 1878, was appointed Consulting Manager. It is also with regret that the Directors record the death of their late Secretary, Mr. Albert Francis Jackson, which occurred but a few months after his retirement. They have appointed as his successor Mr. Robert Septimus Gardiner.

The contract with the Municipality of Ghent for the public lighting will expire on July 1, 1881. Negotiations have, at intervals, been going on for many years past between the Authorities and the Association, for the purpose of renewing this contract, and the Board has done all in its power to come to terms; but finally, in October last, the Municipality decided to obtain tenders by public advertisement. The Board, which had determined to make all possible concessions, sent in a very low tender; but, unfortunately, one of the numerous financial companies which act as promoters of other companies offered a lower price, which was accepted. The result is that a lawsuit is likely to arise between the Municipality and the Association, whose contention is that, under its original powers, it has the right to continue to supply gas to private consumers, although it is no longer the contractor for the public lighting.

The President and Directors desire, in conclusion, to draw the attention of the Proprietors to the accounts for the half year ended the 31st of December last. These have been duly audited, and from them the Directors have, in accordance with the provisions of the Companies Clauses Consolidation Act, prepared a scheme showing the profit of the Association for the half year, and the portion thereof applicable to the purposes of dividend, which the President and Directors recommend now to be declared—namely, a dividend of 5 per cent. for the half year ended the 31st of December last, and a bonus of 1 per cent., payable, free of income-tax, on and after the 15th day of June next.

The Directors who go out of office by rotation are Sir Julian Goldsmid, Bart., Nathaniel Montefiore, Esq., and Francis Bassett, Esq. These gentlemen are all eligible for re-election, and offer themselves accordingly.

The Auditor who goes out of office is Thomas Newton Stokes, Esq., who is also eligible, and offers himself for re-election.

The CHAIRMAN: Gentlemen, there are several observations which I shall have to make on behalf of the Board with reference to the report you have just heard read. Before, however, I do so, I desire to say, on behalf of Sir Moses Montefiore, who has been very unwell, that he exceedingly regrets, as we all regret, that he is unable to attend this meeting, and he joins with us in deploring the loss which the Board have sustained since the date at which the report closes—the loss of my predecessor in this chair, Mr. Twells, who died a very short time ago, and who, as you are aware, rendered long and valuable services to the Association. I am quite sure that all the Proprietors will remember the constant courtesy and kindness which they received upon every occasion from Mr. Twells; and, therefore, they will share with us the feelings I have ventured to express. Now, gentlemen, with regard to the report, the most serious point in it is the one to which I desire to refer at the outset, and that is the question with regard to Ghent. Those of the Proprietors who have attended on the occasions when I have occupied the chair will remember that I have frequently said that our great difficulty is that we are not freeholders at the different stations we occupy, or which we light, and that from time to time we have to enter into fresh contracts with the Municipalities, who sometimes make enormous demands, and whose expectations cannot always be realized. I must say that this has been the case with regard to the town of Ghent. Some years ago we prepared a contract which I believe was an exceedingly favourable one to the town, and we thought that practically the business was concluded, when suddenly, almost without notice, it was broken off by the town. From time to time, too, when attempts have been made to renew negotiations, I cannot say they have always been received as we could have wished; and last year, when we were asked to make fresh proposals, which we did most willingly, other persons were also invited at the same time, of which we knew nothing till afterwards, when we heard that some tenders had been sent in. But apart from this difficulty, I believe we should have been able to settle the contract with the town if it had not been for the recent practice of certain French financial companies of cruising about all over the world in the endeavour to find something out of which to make a considerable profit, perfectly regardless of what happens afterwards to the new company they may have formed. You all know that some years ago I had to make similar remarks with regard to Bordeaux. The town of Bordeaux had made a contract with the Gautier Company, which was

subsequently disapproved of by the Council of State; and orders were sent from Paris to the Municipality of Bordeaux to put up the lighting of the town to public tender. The Municipality adopted a *cahier des charges* which was totally unreasonable for any gas company, but was acceptable to a financial company, and that company was the Société Financière. They did not take it for themselves, but for a company that was to be established, and that has been established for some years, called the Gas Company of Bordeaux. Of that Company I do not wish to say much. Up to the present time it has paid dividends—I do not know that they have been of any large amount—but I believe it has always had many difficulties to contend with, as it would have, with the *cahiers des charges*, and it is at present occupied with the conduct of 40 lawsuits. That is the sort of thing which occurs. As to what the future of that Company will be, I could make a prophecy, but I decline to do so. I may say, however, I am glad I am not a shareholder in it, and if I were I should follow the shrewd advice of those who say "Sell at a profit if you can," and not keep my shares long. It is, as I have said, the practice for certain financial companies on the Continent to look about for something out of which they can make a profit, and this has occurred at Ghent. The financial company went in at a price which cannot be considered to be remunerative, having regard to the working of a gas company, and it has not taken it for itself, but for a company which is going to be, or is established, and the company is to be called, in the same manner as in the other case I have mentioned, the Gas Company of Ghent. I could also prophesy what the future of that Company will be, but I decline to do so. All I say is that we have a very awkward and disagreeable state of affairs indeed to face when we have a contract coming to an end. On this occasion I believe the Board of Directors have done all they could to meet the wishes of the Municipality. Mr. Wood and Colonel Wilkinson have been over to Ghent, and the late Mr. Wingfield, our Inspector of Accounts on the Continent, also went; but the business has not turned out at all satisfactorily, and we shall have to carry on a lawsuit with the town. The matter in dispute is this: We say that under the original powers granted to us we have the right to continue to supply private lighting, although no longer the contractors for public lighting. The town say we have not a leg to stand upon, and that is the question to be decided. In considering this matter we have to provide for all possible eventualities, both for success and failure, and before we declared the profit this year we put aside a certain amount to go towards meeting the possible eventuality of some considerable loss at Ghent. I do not say that we shall or shall not incur loss—this will be revealed afterwards; but before you strike your profit you must consider all the circumstances of the business, and I think you will see that in this respect we have exercised a wise discretion. If there is any one who likes less than another a lawsuit, it is one who has been brought up a lawyer; and I was brought up a barrister. I have the greatest distaste for anything like a long lawsuit, and I believe the Board have the same feeling; but we must vindicate our rights, and try as far as we possibly can to protect your property and interests. This is the great difficulty that a gas company on the Continent has to deal with. We have not, and cannot have, the position which in England is acquired under an Act of Parliament, and although we may do all we can to meet the authorities, we know that on more than one occasion a gas committee has been appointed and has thought certain proposals made were eminently satisfactory, but which, when submitted to the general council, have been rejected by them by every vote excepting those of the gas committee, and rejected by them not because they knew more of the subject, or that the proposals were unreasonable, but because the popular voice was against accepting them—the popular voice, which I think is frequently the voice of ignorance, and which, on a scientific and technical question, could not consequently fairly express any opinion. It is not like a question with regard to general politics, on which we are all supposed to know something; but as to the arrangements of a gas business, I believe there are very few in a Town Council who can say that they know much. With regard to the general business of the Association, all I have to state is that, during the past six months, it has been very satisfactory. We have concluded very good contracts for our secondary products and our coal, and if this were not so, as we have had to make the provision we have made with respect to Ghent, we should not be able to declare the present dividend, but after allowing for this business, we find we can pay the same dividend as before. I therefore think our position in this respect is strong and satisfactory. We have done another thing which I believe it was mentioned on a previous occasion was intended to be done by the Board. We have written the amount for which our works at Toulouse stood in our books, down to the amount that is fairly represented by the property there—the land. We intend to keep the capital account fairly in proportion to what we consider to be the value of our property. I believe this is a view which every sound man of business would say is right, and as we have difficulties to contend with, I think if we ever err at all, erring on the side of caution is the right thing. To turn to another matter. We have constantly brought before us fresh concessions—sometimes for places utterly unknown to the outside world, where there is some individual who wishes to make profit out of us, the profit to the Association being very doubtful. The number of such concessions brought before us surpasses my memory; but every now and then we think there is an opportunity for getting something useful, and, if you remember, it was upon this principle that we two years ago added to our business what we call the new French stations. They are improving very considerably, and no doubt the view we entertained when we bought them is a sound one—that they will form a valuable part of the business of the Association. There are one or two other places—I will not say where they are, they are not very big—with regard to which we are at present carrying on negotiations. We hope that in course of time we shall be able to bring them to a satisfactory result; but I think if I told you where they are it would be the best way of settling the point that we should not have them. This is a position which probably all those who have been frequent attendants at these meetings will thoroughly understand—that where competition is so keen, not between gas companies alone (we are not afraid of that), but between gas and financial companies and other speculators, you must be very much alive to your own interests, and give as little information as possible. Therefore, with the permission of the meeting, I will not say any more on this subject. As far as regards the concern generally, I do not know that there is anything further of importance to tell you. You all know of the death of Mr. Drory, and also of the death of Mr. Jackson, who was for 13 years the Secretary of the Association. We have replaced him by a gentleman who we thoroughly believe will make a most active and efficient Secretary. He has very considerable duties to perform—duties of great importance in carrying on our business. I have also to announce that since the date of our report Mr. Wingfield, who was our Inspector of Accounts on the Continent, died very suddenly in the month of January last. He had only been a short time—about two years and a half—in the service of the Association. It was an office which we established after the most mature consideration, because we thought it was very desirable that all the accounts upon the Continent should be carefully investigated by an independent authority from London; and not only this, we desired—a desire which Mr. Wingfield carried into effect—to establish an absolutely uniform system of keeping the accounts at all the

stations. It has very much facilitated the conduct of our business, and has much assisted the different officers in making their reports for the Board in London. There were many other matters which fell on Mr. Wingfield's shoulders from time to time—matters he had to investigate, and negotiations he had to carry on, all of which he conducted with great activity and zeal, and with the desire to serve the interests of the Association. It was with great regret, therefore, that we had to face the position in which we were placed by his unexpected death. We had numerous applications for the office, and we hope we have selected in Mr. Lindon, who has been appointed to succeed Mr. Wingfield, a gentleman who will act with the spirit which his predecessor always displayed. Mr. Lindon has already been three times to the Continent, and is at present in Vienna looking after the affairs of the Association, and I trust the loss we have sustained by Mr. Wingfield's death will be repaired by the appointment we have made. I do not know that there is anything more for me to say. The Board have had, and have now, a number of most anxious questions to consider. Our work is not very easy, for we have such widely different interests to meet and views to contend with; but we shall always do what we can not only for the interests of the Shareholders, but for the interests of the public we serve, because we do not believe for a moment that those interests are antagonistic. We think that if we can make fair reductions in price, and try to meet the local authorities in the spirit we desire to see them display towards us, this is the way in which we should carry on the business of the Association. The confidence of the Shareholders in the Board has added very strongly to our position. I see no reason to doubt that this will be the case in the future, and therefore I trust this confidence, which I fully acknowledge, will continue to be displayed towards all my colleagues and myself. I know that as vacancies occur—and one has just occurred through the death of Mr. Twells—we have many applications from gentlemen wishing to join the Board; but as the business of the Board requires not only a very considerable amount of knowledge, but a large devotion of time, and on the part of many of its members frequent journeys to the Continent, it is not always easy to fill up a vacancy. It is, therefore, only after most careful consideration that we recommend any gentleman for a seat at the Board under the powers we have. The present vacancy will be filled up in this manner, after mature consideration, and after taking the advice of Sir Moses Montefiore. If there are any other matters on which, consistently with the interests of the Association, I can give you information, I shall be ready to do so; but, as I have on more than one occasion ventured to point out to you, not only is the *salus* of the Shareholders our *suprema lex*, but very often the supreme law urges us not to tell them everything. I constantly trust to that discretion which I believe they have always exercised towards us, and I am sure they will not ask questions which it will be inconvenient for us to answer. I now move—"That the report upon the affairs of the Association now read be received, adopted, and entered on the minutes."

Mr. VVYAN (a Shareholder) seconded the motion.

Mr. KEENLYSIDE asked when the Ghent concession expired.

The CHAIRMAN: In July, 1881.

Mr. KEENLYSIDE observed that the Directors had taken a very large sum of money to provide for anything in connection with the expiration of the concession. Did they intend to take three sums of money to make up what might be wanted, or had they fully provided?

Mr. DUFF FILER said he had been connected for 53 years with gas companies. He endorsed every word that had fallen from the Chairman as to the propriety of as much as possible keeping their affairs from becoming known on the Continent.

Mr. ROKEBY PRICE said he requested on a former occasion that the names of the Directors might be notified to the Shareholders, and he regretted that this had not been done in the notice convening the meeting. He thought they ought to know who the Directors of the Association were when they were called together. All gas and railway companies gave this information, and he thought it should be given to the Shareholders in this undertaking. It was one of the old relics of the past not to do so. The report had been read very well by the Secretary, but it was quite impossible for all present to carry the figures in their heads, and make any remarks on them. He had in his hand the figures of the accounts, which every Shareholder had the opportunity of taking when he went to the offices of the Association; but the statement was not one which could be criticized with any degree of accuracy or certainty. It was put in a particular form, no doubt because their enemies should not know more than they ought to; but he could not help seeing that the contingency-fund and the investment-fund were very large. With regard to the amount which the Directors had put by against Ghent, it did strike him that to put by enough out of 1879 for what might occur in 1881 was rather bordering on what was unnecessary. He should like to know whether they had put by enough for all that might occur in 1881.

The CHAIRMAN: Oh, no.

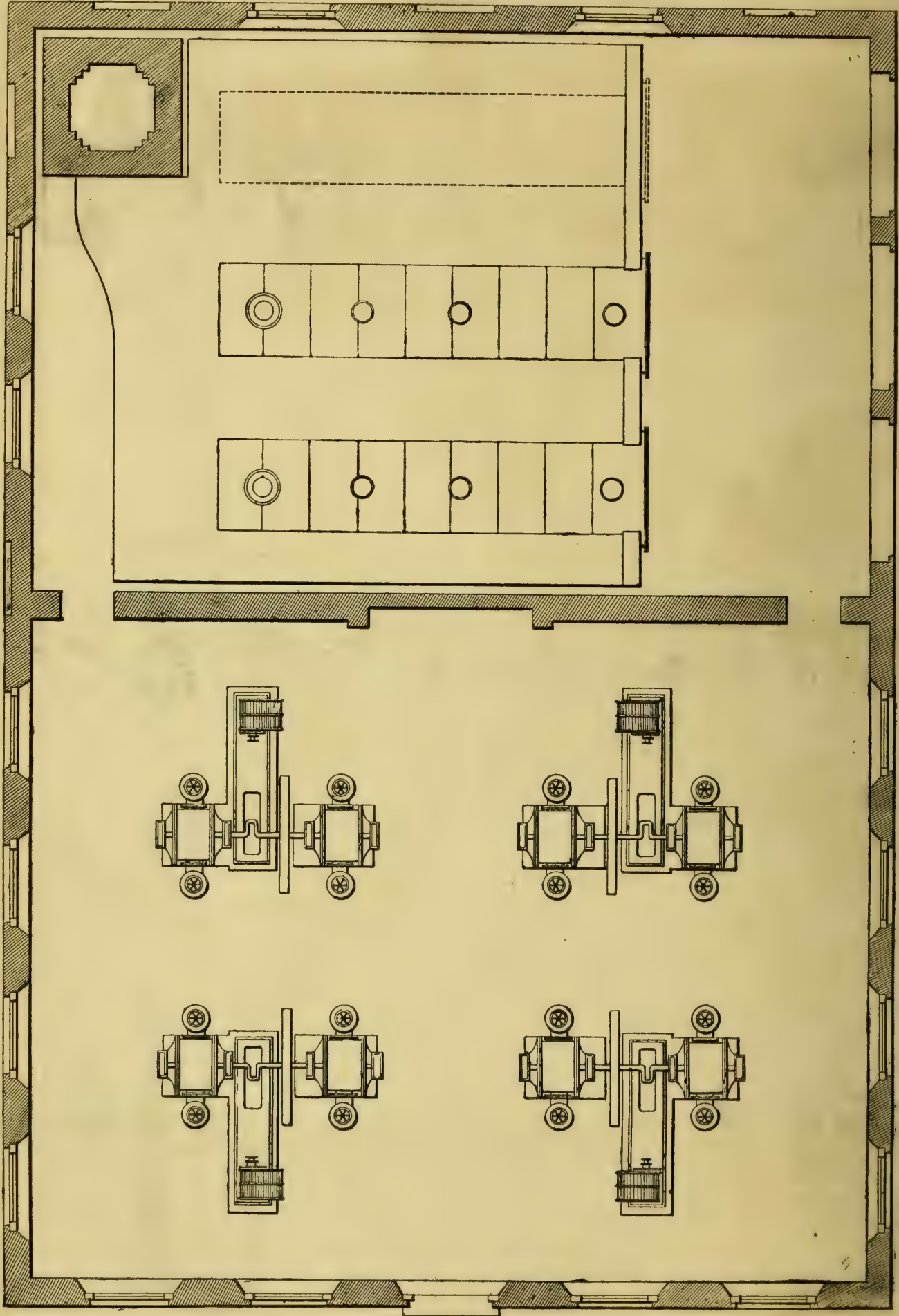
Mr. PRICE said he was glad to hear this. There were no figures given in the report as to the amount of expenditure at the various stations; but he did not know why these should be kept back. It was very important to the Shareholders to know how much had been spent out of the revenue for capital purposes at all the stations. He did not wish to press the Directors too far, but he should like to have this information. There was one other question he desired to ask. When the Cologne contract expired, he understood from the Chairman that if the Municipality refused to renew it, there was to be a valuation of the works, and that they were to take them at such valuation. He should like to know whether this was the case with regard to Ghent. Then as to the reserve and contingency fund, he should like to know how much more that was, comparing the past half year with the corresponding period of 1878—what the difference was, say, in the items of sundry debtors, cash at the bank, and other investments, and the contingency and reserve fund—how much more there was there than in the corresponding half of 1878, because he really thought the Shareholders ought to have a larger dividend than they were to receive. He did not think the Directors ought to make too large a provision for 1881. They had three half years before the Ghent contract expired, and should this period not be very nearly long enough to provide all that was required? If they thought that the year 1879 should put something towards the necessary amount, he still urged that they should not take too much. With regard to the deaths of the different gentlemen mentioned, no one could regret it more than he. He believed that for Mr. Drory the Shareholders all had very great respect. With regard to Mr. Jackson, he was equally good in his place. As to his friend Mr. Twells, he was very sorry that he was gone. He was a most valuable, sound, painstaking, and honourable man, and he knew no person in the City of London in whom he had more confidence.

The CHAIRMAN: I have had the pleasure of hearing very much the same speech from Mr. Rokeby Price on two or three former occasions, excepting with regard to the mention of the gentlemen whose services we have lost, and I shall be very glad to give him very much the same answer as before—that is, that the Board very wisely, even before my time, and also during the 12 years, I think it is, that I have been a Director of the Association, have from time to time increased the dividend when they thought they could fairly do so, and could maintain that increase. The

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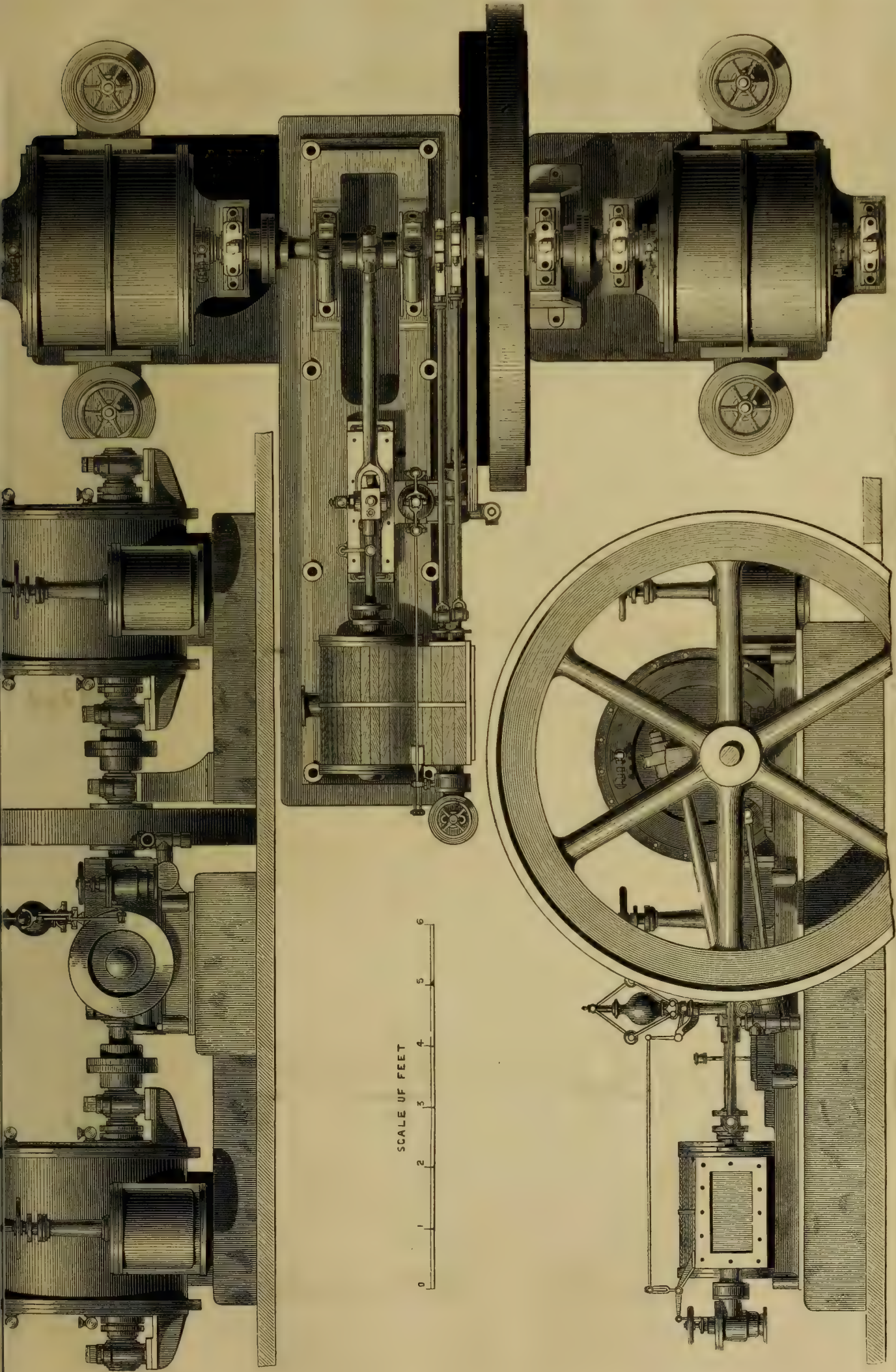
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PLAN SHOWING THE ARRANGEMENT OF THE FOUR PAIRS OF EXHAUSTERS AND ENGINES; ALSO OF THE BOILER-HOUSE—TWO BOILERS BEING FIXED, WITH SPACE FOR A THIRD.

SCALE $\frac{1}{4}$ INCH = 1 FOOT.



SIDE AND END VIEWS AND PLAN OF ENGINE AND EXHAUSTERS.

APPARATUS FOR PUMPING GAS FROM LINACRE TO LIVERPOOL.
DESIGNED BY MR. WILLIAM KING, C.E.; AND MANUFACTURED BY MESSRS. GWYNNE & CO., OF ESSEX STREET WORKS, LONDON.



The CHAIRMAN: There has been very little change in the business of the Company, further than a general progress towards putting itself in a better position, and being much more comfortably conducted than has been the case for some time past. On looking to the accounts and balance-

sheet, you will see the item of acceptances has alone diminished by £9850. About two years ago they were over £9000, while now they stand at £2080. On the other side of the account, you find that the capital has been increased. The money laid out, as compared with this time last year, is £1934 more; while the other items are considerably reduced—such as the money owing for public lighting, private rentals, &c. There is always some doubt in foreign countries whether you will get your money, and it is, therefore, all the more satisfactory to see these items so much reduced. The amount of stores is also considerably reduced. This item is always a source of some anxiety to us, who are a long way off. The value of the stores is exposed to so many contingencies that it is always agreeable to find the amount is less. The item of goods in transit is £1400 less, and altogether I think the items are of a favourable character, so far as the balance-sheet is concerned. With regard to the trading account, I think it is equally satisfactory, inasmuch as we find almost all the charges against the Company are less, with the exception of exchange. The rate of exchange is a matter over which we have no control. I am very sorry to say that the money lost in exchange in the last six months amounted to no less than £1375, or £912 more than this time last year, that sum alone being very little less than equal to 2 per cent. per annum. The exchanges are better than they were, but are still a subject of great loss to the Company. We are, however, obliged to submit to it, as we cannot help ourselves in the matter. On the other side of the account you will observe that there has been some increase in the business, though not very much. The increase in the public lights is £233 in the half year, and in private consumption £246, making together nearly £500, which is something; but there is a small diminution in the receipts from public establishments. Bahia, like some other places, has not been very flourishing. The amount realized for the gas is not quite so large as it was previously. This time last year it was 127s. 9d. per ton of coal; in June last it was 112s. 9d.; and now it is a little better than that—115s. 9d. You observe in the accounts that the extraordinary disbursements and the suspense accounts have entirely disappeared. I am very happy to say that the circumstances of the Company have been such that we have been able to entirely obliterate the extraordinary disbursements and write off the suspense accounts, and I hope that the amounts which have been deducted for this purpose for some years past will go to still further increase the dividends we are enabled to pay you on this occasion. The sum for suspense account, over and above what we have written off, amounted to no less than £2374, which we have cleared off entirely this half year, in addition to the ordinary sum; and if you add this to the profits made, the amount for the half year would be £6049. I therefore think that the accounts are highly satisfactory. Our liabilities are less, our assets are very good, and the business of the Company is increasing, though slowly. You will naturally expect me to make some reference to our position with regard to the Brazilian Government; but really matters have not at all changed since we last met. Fortunately for us we have not had occasion to send out any large quantity of piping, or anything that would have to pay duty; but we have not had any redress. We are, at any rate, no worse off than we were, and we hope, although there is no great prospect of it, that there may be some possibility of getting the matter fairly settled. We have been in communication with the Government, but have advanced no farther than we were before. I will move—"That the report and statement of accounts now submitted be adopted."

The DEPUTY-CHAIRMAN (Mr. H. Brothers) seconded the motion, and it was carried unanimously.

The CHAIRMAN then moved the payment of dividends on the 10 and 7½ per cent. preference shares in full, and at the rate of 5 per cent. on the ordinary shares, reminding the Shareholders that the latter compared with 4 per cent. last time.

The motion was agreed to.

Mr. BLUNDELL moved, and Mr. Fogg seconded a vote of thanks to the Chairman and Directors, and it was carried unanimously.

The CHAIRMAN having briefly responded, a vote of thanks was passed to the Secretary and the Auditors, and the proceedings terminated.

THE PURCHASE OF THE LINCOLN GAS COMPANY'S WORKS BY THE TOWN COUNCIL.

A Meeting of the Lincoln Town Council was held last Wednesday—the Mayor (Mr. F. J. Clarke) presiding—"to consider the terms upon which the Directors of the Gas Company are willing to recommend the Shareholders to sell their undertaking to the Corporation; and, in case such terms shall be agreed on, to pass such further resolutions for carrying the sale into effect as may then be deemed necessary."

It has been already noticed in our columns that a Committee of seven members of the Council was, early in March, appointed to "consider and report as to the desirability of purchasing the works and property of the Lincoln Gaslight and Coke Company, by the Corporation as the Urban Sanitary Authority," and this Committee have just issued a short summary of their proceedings, setting forth the principal facts attending the negotiations with the Directors of the Company.

At the first meeting of the Committee, held on the 5th of March, the Clerk was directed to inquire whether the Company were willing to sell their undertaking to the Corporation; and, if so, on what principle they would agree to the purchase-money or equivalent being fixed. An opinion of counsel as to the powers of the Corporation under section 162 of the Public Health Act, 1875, was also ordered to be taken; and a Mr. Teesdale, an auditor, was requested to make a report on the financial condition of the Company, and on any other matters which he might think it would be useful to bring to the notice of the Committee.

After this meeting the opinion of Mr. Littler, Q.C., was taken, and he advised that as the Company's Acts of Parliament extended to places outside the city, there would be a difficulty in effecting a purchase of the undertaking under section 162 of the Public Health Act. An offer was also received from the Directors of the Company, and a report from Mr. Teesdale, which we give below. On the 15th of April these documents were considered by the Committee, and the Clerk was directed to inquire on what terms the Corporations of Birmingham, Leicester, and Nottingham had purchased the gas-works in those boroughs.

On the 3rd of May, the Committee resolved not to recommend the Corporation to purchase the undertaking of the Company on the terms contained in their offer, but they directed the Clerk to confer with the Solicitor of the Company, and endeavour to obtain an amended offer. The Clerk, therefore, had an interview with Mr. Dale, but he declined to advise the Directors to make any amended offer, and stated that, having made an offer, a counter proposition must come from the Committee.

On May 5, the Committee met, and the following resolution was agreed to:—" (1) That in the opinion of the Committee it is desirable to purchase the undertaking of the Lincoln Gas Company if reasonable terms can be arranged. (2) That in case the Gas Company are willing to transfer their undertaking and all their assets, including the reserve-fund, to the Corporation, in consideration of the grant by the Corporation of perpetual annuities (to be secured on the undertaking and gas-works, and collaterally by a charge on the general district rates), in amount equal to the

maximum yearly dividends now payable on the several stocks and shares of the Company, and of the payment of the sum of £2500 in cash, as compensation to Directors and Officers as mentioned in the Company's offer, the Committee would be willing to recommend the Corporation to effect the purchase on those terms, the Corporation undertaking the Company's present bond debt (if any), and current liabilities reasonably incurred up to the time of transfer; but the purchase to be conditional only, and not binding, unless sanctioned by Parliament, and not unless the Corporation are satisfied with the state of the Company's works."

On the 10th of May, the following communication was received from the Directors of the Company:—"That the offer of the Lincoln Corporation Committee to purchase the undertaking of the Lincoln Gaslight and Coke Company be accepted, subject to the words 'which shall include the preference stock, representing £20,000, authorized to be raised by the Act of 1873,' being inserted after the words 'stock and shares of the Company,' in the resolution of the Corporation Committee of the 3rd or 5th day of May inst., and to the confirmation thereof by the Shareholders of the Company;" the Directors thus, in substance, agreeing to the terms suggested by the Committee, the improvement stock being a stock which they intended to include in their resolution.

The total maximum dividend paid on all the different shares and stocks of the Company amount to the yearly sum of £5024. By the terms proposed the Corporation will become entitled to all the Company's works, property, and effects, including the whole of their reserve-fund, by securing the payment of perpetual annuities to this amount (£5024) and paying £2500 in cash and the current liabilities of the Company. The £2500 the Corporation would be able to pay out of the reserve-fund to be handed over by the Company.

The minutes of the Committee concluded thus: "It will be gathered from what has already been stated, that the Special Committee are of opinion that, in case the Company's works are found to be in a satisfactory state, it will be to the advantage of the Corporation to effect a purchase on the terms contained in their resolution, and they have endeavoured to supply to each member of the Council the principal grounds and reasons for their opinion."

The following are the terms (signed by Mr. T. G. Dale, the Solicitor to the Company), considered at the meeting of the Committee on April 15, upon which the Company agreed to transfer their undertaking to the Corporation:—

Each £25 original share to bear interest at 5½ per cent. on £50.
Each £50 new share to bear interest at 5½ per cent. on £70.
Each £114 of improvement stock to bear interest at 5½ per cent.
The preference stock to continue at 5 per cent.

All shares and stocks to be redeemable at 25 years purchase of the interest after six months notice from the Corporation.

Value of each at 25 Years purchase.

£25 original shares . . .	£2 15 0	× 25 =	£68 15 0
50 new shares . . .	3 17 0	× 25 =	96 5 0
114 improvement stock . .	6 5 5	× 25 =	156 15 5
100 preference stock . . .	5 0 0	× 25 =	125 0 0

The Corporation to create debenture stock to bear a fixed and perpetual interest at 4 per cent. per annum, payable half yearly, on £68 15s. for each £25 original share, on £96 5s. for each £50 new share, on £156 15s. 5d. for each £114 improvement stock, and on £125 on each £100 preference stock. The sum of £2500 to be retained by the Directors of the Company in compensation to the Directors and other Officers. The compensation to be paid thereout to the Clerk to be in lieu of, and in full satisfaction of an annuity or retiring pension which he might have received, or be entitled to, under clause 28 of the Bill now pending before Parliament. The costs, charges, and expenses of and incident to the obtaining and passing the Bill now pending before Parliament, and of the winding up of the affairs of the Company, to be first paid out of the profits of the Company. After retaining the sum of £2500, and paying the costs and expenses as aforesaid, the Corporation to take over the mortgage debts, if any, and also the liabilities and assets of the Company. The vendors and purchasers shall endeavour to obtain, in the present or future sessions of Parliament, powers authorizing and confirming the sale and purchase. If not confirmed on or before the 6th day of October, 1881, the sale agreed to be made shall on that day be determined null and void.

The report referred to above of Mr. E. Teesdale, the Auditor appointed to investigate the Company's undertaking, and submitted to the Committee on the 15th of April, was as follows:—

Statement of Capital.

320 shares of £25 each, dividend 10 per cent. . . .	£8,000 0 0
400 shares of £50 each, dividend 7 per cent. . . .	20,000 0 0
320 shares of £114 each, called improvement stock, dividend 5 per cent. . . .	36,480 0 0
Preference stock, dividend 5 per cent. . . .	20,000 0 0
Premium on sales of shares and stock not bearing interest	265 10 0
	£84,745 10 0

Spent in new buildings, plant, storage works, and other structures connected with manufacture (capital account), 1875, £4177 10s. 1d.; 1876, £18,327 8s. 10d.; 1877, £848 6s. 11d.; 1878, £48 4s.

Spent in new mains and services, not being in place of old ones, laying same and paving (capital account), 1875, £738 2s.; 1876, £2105 17s. 8d.; 1877, £531 6s. 2d.; 1878, £152 0s. 11d.; 1879, £37 14s. 10d.

Spent in new meters, not in place of old ones (capital account), 1875, £494 6s. 3d.; 1876, £526 8s. 4d.; 1877, £266 7s. 8d.; 1878, £330 19s. 1d.; 1879, £235 3s. 7d.

Spent in repairs and maintenance of works and plant (revenue account), 1875, £964 1s. 4d.; 1876, £406 10s. 6d.; 1877, £955 16s. 3d.; 1878, £1155 4s. 8d.; 1879, £1507 19s. 6d.

Spent in repairs, maintenance, and renewal of mains, laying same and paving (revenue account), 1875, £312 6s. 5d.; 1876, £337 6s. 1d.; 1877, £660 10s. 4d.; 1878, £916 17s. 1d.; 1879, £526 4s. 1d.

Spent in repairing, renewing, and refixing meters (revenue account), 1875, £484 7s. 7d.; 1876, £253 5s. 7d.; 1877, £237 3s. 2d.; 1878, £325 13s. 2d.; 1879, £376 6s. 8d.

Received for gas, private lighting, 1875, £11,540 1s. 4d., at 3s. 9d. per 1000 feet; 1876, £12,370 2s. 5d., at 3s. 9d. per 1000 feet; 1877, £12,977 19s. 1d., three quarters at 3s. 9d. per 1000 feet, one quarter at 3s. 4d. per 1000 feet; 1878, £13,332 13s., at 3s. 4d. per 1000 feet; 1879, £14,056 0s. 7d., two quarters at 3s. 4d. per 1000 feet, two quarters at 2s. 11d. per 1000 feet.

Received for gas, public lighting, 1875, £1350 12s. 9d.; 1876, £1405 10s. 8d.; 1877, £1468 0s. 6d.; 1878, £1350; 1879, £1237 1s. 8d.

Received for rent of meters, 1875, £985 7s. 6d.; 1876, £1053 11s. 11d.; 1877, £901 19s.; 1878, £885 0s. 7d.; 1879, £932 4s. 9d.

Received for coke, tar, lime, liquor, &c., 1875, £3026 9s. 9d.; 1876, £3500 15s. 5d.; 1877, £3203 16s. 11d.; 1878, £4227 8s. 3d.; 1879, £4534 8s. 1d.

State of reserve-fund, 1875, £1725 10s. 10d.; 1876, £3374 15s. 11d.; 1877, £5360 19s.; 1878, £7795 9s. 10d.; 1879, £8457.

The reserve-fund now amounts to £8457. For 1879, there stands to the

credit of profit and loss account, £8709 1s. 9d., from which must be deducted the half year's dividends—viz., £2512, leaving a balance of £6197 1s. 9d., which sum added to the reserve-fund shows a sum of £14,654 1s. 9d. as accumulated profits (earned from July 1, 1873, to Dec. 31, 1879). The Shareholders cannot possibly obtain more than the specified dividends; all profit after paying the dividends must go to a reserve-fund. The reserve-fund can only be used for two purposes—(1) to make up the prescribed dividends in case the profit for the year should not be sufficient, and (2) to meet any extraordinary demand which may at any time arise. The Companies Clauses Act of 1845 gives power to the Directors to form a contingent-fund in addition to the reserve-fund. For all extensions the Company have to pay 7 per cent., whereas the Local Board can get money much cheaper. I believe the plant is in good working order, as during the last five years large sums have been expended in the maintenance of plant and mains. The Local Board would save £200 per year Directors fees, and £40 Auditor's fee, and I presume a very large proportion of the rates and taxes, which last year amounted to £532 8s. 9d., would not be paid by the Local Board. Mr. Throsby, the present Manager and Secretary, has £500 per year. I do not think the Local Board would be forced to reduce the price of gas like the Company is, but that could readily be known by applying to Birmingham and other towns; but if that is so, would not the gas consumer be providing benefits for the non-consumer? I am of opinion that the undertaking is a very valuable one, and have no doubt that £1500 or £2000, at the lowest computation, could be saved to the citizens every year, after allowing for another reduction in price.

Statement given after Gas Company's offer received by Corporation.

Annual sum now paid by the Company for dividends.		
£8,000 at 10 per cent.	£800	0 0
20,000 " 7 "	1,400	0 0
36,480 " 5 "	1,824	0 0
20,000 " 5 "	1,000	0 0
	£5,024	0 0

Price which Corporation would have to pay for works, as per Company's offer	£135,666	13 4
Compensations	2,500	0 0
	£138,166	13 4

Annual sum to be paid by Corporation to Company, as per offer.		
320 shares at £50, at 5½ per cent.	£880	0 0
400 shares at £70, at 5½ per cent.	1,540	0 0
Improvement stock, 320 at £114, at 5½ per cent.	2,006	8 0
Preference stock, £20,000, at 5 per cent.	1,000	0 0
	£5,426	8 0

Annual profit to Corporation in case purchase is made on above terms.		
Present profit, say, £2000 more than dividends	£2,000	0 0
Deduct for increased dividends	402	0 0
	£1,598	0 0

Query—Directors fees saved £200
 „ Auditor's fee saved 40

At the meeting of the Committee on May 5, Mr. G. W. Stevenson, C.E., and Mr. H. Teague, the Engineer of the Lincoln Water-Works, were instructed to examine and report upon the state of the Company's works; and the following report was subsequently received from Mr. Stevenson:—

38, Parliament Street, Westminster, May 24, 1880.

To the Mayor, Aldermen, and Burgesses of the City of Lincoln.

Gentlemen,—In pursuance of your instructions conveyed to me through Mr. Hebb, I visited Lincoln on the 21st and 22nd inst., and made a careful examination of the works belonging to the Gaslight and Coke Company, being accompanied by Mr. Throsby, the Engineer and Secretary, who afforded me every opportunity for making my examination, and furnished me with all such information as I required.

With regard to the capacity and condition of these works, I am happy to be able to assure you that they are in every respect satisfactory. The largest quantity of gas manufactured in any one day in midwinter has been, up to the present time, 650,000 feet; whereas the producing power of the retorts is equal to 1,040,000 feet. The condensing and purifying capabilities of the works are also equal to the producing power of the retorts. The storage capacity is about 750,000 feet, which, it will be observed, is about one-seventh more than the present largest daily make, but about one-fourth less than the producing, cooling, and cleansing capacity of the works. The main-pipes are sufficiently large for present and immediately prospective purposes, and were in good condition until somewhat injured by the sewerage works of the city, which I am told have now been completed. The quantity of gas unaccounted for—by which I mean the difference between the quantity actually made, as registered by the station-meters, and the quantity actually paid for, as ascertained by the consumers meters and an estimate of the consumption of the public lamps—was, until the sewerage works commenced, as low as 6 to 7 per cent. It rose during the construction of the sewerage works to as much as 15 per cent., but is now being rapidly brought back to its normal condition.

The condition of the works, both in regard to the plant, machinery, and buildings, is almost equal to new; and this applies without limitation to every part of the works, except to four old purifiers at the Newland works, which ought to come out and be replaced by others, of equal or somewhat increased capacity, of modern design. This will cost about £800.

Mr. Hebb put me in possession of the terms offered by the Special Committee of the Corporation for the purchase of the Company's works and undertaking, and accepted by the Directors of the Gas Company, and has asked me to express my opinion upon the same. I am accurately informed of the facts in respect to every transfer that has taken place from gas companies to local authorities in recent years, and I am able to assure you that in no single instance have the terms agreed upon been so favourable to the purchaser as in this case. There is no bond debt to be taken over; the works are well designed, substantially erected, in first-rate condition, and larger than required for the business at the present time; the Company are able to pay maximum dividends with a very low selling price for gas, and when the leakage shall have been reduced to its normal condition, there will be a surplus profit of at least £2000 a year; a large sum, amounting probably to upwards of £10,000, will be handed over from the reserve-fund account, and yet you are only required to pay the proprietors maximum dividends in perpetuity.

I cannot do otherwise than congratulate you on the exceedingly favourable bargain you have made; feeling assured, as I do, that the purchase will be of very great advantage to the citizens for all time.

(Signed) GEORGE WILSON STEVENSON, C.E., F.G.S.

The above reports and recommendations were first of all submitted last

Wednesday to the Committee of the whole Council, when, after considerable discussion of the terms, the following motion was proposed:—"That the Council, as an Urban Sanitary Authority, be recommended to purchase the undertaking and all the assets of the Lincoln Gaslight and Coke Company, including the reserve-fund, in consideration of the payment of £2500 in cash as compensation to the Directors and Officers for the loss of their offices, and the guaranteeing of perpetual annuities amounting altogether to £5024, being the aggregate amount of the maximum dividends payable on the several shares and stocks of the Company, the Corporation agreeing to pay the current liabilities of the Company, reasonably incurred, up to the time of the transfer, and the annuities to be charged primarily on the gas-works and collaterally on the general district rates; but the purchase to be conditional on the sanction of Parliament." An amendment to adjourn the further consideration of the question till Friday was lost by 13 votes to 3, and the motion carried by a similar majority, after the Deputy Town Clerk had stated that if the matter was to go before Parliament this year there would not be time for the adjournment. It was also resolved—"That the Special Committee be empowered to purchase the Gas Company's undertaking, in the name of the Urban Sanitary Authority, and to do all such acts and things for carrying into effect the completion of the purchase aforesaid, and obtaining the sanction of Parliament thereto." The Council immediately afterwards held a special meeting in public, when their proceedings in committee were approved and adopted.

LEEDS CORPORATION GAS AND WATER SUPPLY.

The Association of Municipal and Sanitary Engineers and Surveyors met for their annual conference last week, the place of meeting being Leeds. The proceedings commenced on Thursday, when, after some preliminary business, the new President (Mr. A. W. Morant, M.Inst.C.E.) took the chair, and delivered an address containing a concise and comprehensive account of the principal undertakings of the Leeds Corporation, to whom he is Borough Engineer.

The parts of the address which will specially interest our readers are those concerning the gas and water works. About the former he said: The gas undertaking of the Leeds Corporation was purchased from two competing Companies in 1870, the price paid being 40 per cent. premium upon the stock and share capital of the Companies, the total cost to the Corporation being in round figures £800,000. Since the transfer there has been a further expenditure of about £150,000, the capital expenditure at the present time being £950,000. In 1870 the gas manufactured was 850 millions of cubic feet, and the sale 650 millions, the loss (including gas consumed upon the works) being 200 millions per annum. In the year ending June, 1879, the gas made amounted to 1250 millions, and the sale to 1063 millions, the loss (including use on premises) being 187 millions. The prices charged for gas per 1000 cubic feet have been as under:—1870 to 1874, 3s. 6d.; 1875 and 1876, 3s. 9d.; 1877, 3s. 9d.; 1878, 2s. 9d.; 1879, 2s. 6d.; 1880, 2s. 2d. The quality of the gas supplied, when tested by the "London" standard burner, is equal to an average of 18½ candles. The length of mains is upwards of 500 miles, the area of lighting covering 35 square miles. The number of meters fixed is 68,777, of which about 85 per cent. are two and three light meters. The manufactories are three—viz., Meadow Lane, containing 792 retorts; New Wortley, containing 380 retorts; York Street, containing 380 retorts—total, 1552. The works at York Street have been almost entirely rebuilt under the direction of Mr. H. Woodall, the Gas Engineer, during the last two years, and their productiveness doubled, the whole cost having been charged against the revenue of the period. New works are also being erected at New Wortley for 400 retorts. The greatest daily make last winter was 6,200,000 feet, and the greatest quantity sent out was on Jan. 7—7,564,000 feet. The gas-holders are situated at Meadow Lane, Dewsbury Road, New Wortley, Kirkstall, Low Wortley, York Street, Stainburn Square, Sheepscar. They have a united capacity of 6 million feet. The largest holder station is at Sheepscar, about 1½ miles from the works at York Street, and 2 miles from those at Meadow Lane. There are two holders at this station, one 180 feet in diameter, and having a united capacity of 1,750,000 feet. At Dewsbury Road there was erected in 1878 a holder, 110 feet in diameter, having three lifts, which has worked most satisfactorily. The increase in gas made and sold for the year ending Dec. 31, 1879, was 100 million feet, which is equal to the largest increase in any one year at Manchester. The streets and roads are lighted by 7000 lamps, at a cost of about £2 7s. per lamp, each one burning 3½ cubic feet of gas per hour.

As to the water-works, Mr. Morant said: Leeds possesses an abundant supply of good wholesome water. The present consumption is at the rate of about 7 millions of gallons per day, of which nearly 2 millions are supplied for trade purposes, and the remaining 5 millions consumed for domestic purposes. The works belong to the Corporation, and are of the most substantial nature, no expense having been spared to make them efficient and durable in every way. The source from whence the water is procured is the River Washburn, a tributary of the Wharfe; and the point where the water is first impounded is about 15 miles from the town hall, measured in a straight line. In the valley are three large reservoirs for the storage of water for the town's use and compensation for the mills. The drainage area from which these reservoirs are fed is about 22,000 acres, and the average rainfall is about 36 inches per annum. The most distant reservoir, known as the Fawcett reservoir, has an area of water surface of 156 acres, and a capacity of 866 millions of gallons. The greatest height of bank is 68 feet, the inner slope is 3½ to 1 and the outer 4 to 1, with a benching 50 feet wide, with a slope of 3 to 1. The water is passed through the bank by means of a culvert 11 feet in diameter. The puddle trench varies from 20 feet to 70 feet in depth, and is 24 feet in breadth. The waste weir is 170 feet in width, and the bye-wash is 100 feet in width at the top, and tapers to 75 feet wide at the bottom. Swinsty reservoir, the next below, has also 156 acres of water surface, but a capacity of 961 million gallons. The greatest height of bank is 67 feet, and the water is drawn off by means of two lines of 30-inch pipes laid in a tunnel 12 feet diameter and 526 yards in length, driven in the solid rock round the east end of the embankment. At about the centre of the tunnel is the valve-shaft, which is 80 feet in depth. The embankment is 500 yards in length, 24 feet in width at the top, with inner slopes 3 to 1 and outer 2½ to 1, with a benching 80 feet in width. The puddle trench varies from 20 feet to 60 feet in depth, and the puddle is 8 feet wide at the top and 24 feet at the bottom. The waste weir is 165 feet in width, and the bye-wash 100 feet, tapering to 75 feet. The third on the line of the valley is the Lindley Wood reservoir. It has a water surface of 117 acres, and a capacity of 749 millions of gallons. The greatest height of bank is 67 feet, and the water is drawn off by means of two culverts through the embankment, each 10 feet in diameter, with valve towers and double valves. Very great difficulties were experienced and expense incurred at this reservoir, the puddle trench having to be excavated on the Farley side of the embankment to a depth of 160 feet. A large landslip also occurred just below the north-east end of the embankment and alongside the bye-wash, and many thousand cubic yards of shale had to be removed. It was utilized by being added to the back of the outer slope. The embankment is about 360 yards in length. The waste weir is 160 feet in width, and the bye-wash 100 feet, tapering to 75 feet wide, and 880 feet in length. The excavation for this bye-wash was very heavy, the cutting

being 35 feet in depth. Swinsty reservoir is about 450 feet above sea level, and the water is conducted from it by two lines of 30-inch pipes, each about 12 miles in length, to the last storage reservoir at Eccup. At present this has only an area of 45 acres, and a capacity of 250 millions of gallons; but an embankment is now being constructed 200 yards in length and 80 feet in greatest height, which will increase the area to 195 acres, and the contents to 1485 millions of gallons, so that the total capacity of the four reservoirs will be 4061 millions of gallons. One great advantage which will ensue from the enlargement of this reservoir will be that in case of accident to the works in the Washburn Valley there would be close to the town a supply of water equal to between six and seven months consumption, supposing that not a drop of water entered the reservoir from the Washburn. A further advantage consists in the greater time in which the water will have to become clear before being sent on to the filter-beds. It is worthy of remark that the Eccup reservoir alone, when enlarged, will be of greater capacity than the whole of the subsiding, storage, and service reservoirs now in use for the supply of water to London. The filter-beds, seven in number, are situated at Weetwood, about three miles from the Eccup reservoir, and the water is conveyed to them in a conduit partly in tunnel under Black Moor and partly by 40-inch pipes. Here the whole of the water supplied to the town is filtered. The greater quantity gravitates to the town, and is distributed through three main-pipes, one of 30-inch diameter, and two each of 18-inch diameter, and the remainder flows to the well of the pumping-station at Headingley, from whence it is pumped to the high service reservoirs at Moortown and Bramley. There are also service reservoirs at Woodhouse Moor, Beeston, and Wortley, but these are filled by gravitation from Weetwood. At the junction of the Washburn with the Wharfe there is a gauge where the 4 millions of gallons of water which have, by Act of Parliament, to be passed into the Wharfe for compensation to the millowners, are measured, and 6 millions of gallons are also measured and sent forward by a 27-inch main to the pumping-station at Arthington. This is situated upon the side of the River Wharfe, from which river the Corporation have power to take 6 millions of gallons per day, and for five years pump this quantity into the Eccup reservoir, the lift being 260 feet. These works are now kept in case of any accident occurring to the works in the Washburn Valley, but at some future time, if the population largely increases, will be required to supplement the supply afforded by the gravitation scheme. The total cost of the water-works up to the end of the last financial year has been £1,343,634, but in spite of this the Corporation are able to give a constant supply of water at very moderate rates; for instance, a house the rental of which does not exceed £20 per annum is charged at the rate of 1s. in the pound; and one not exceeding £50, £2 per annum. Water is supplied for trade purposes by meter at the rate of 6d. per 1000 gallons. Mr. Hawksley has, in speaking of this price, remarked that so charged water is by far the cheapest commodity supplied to us, it being collected, filtered, brought 15 miles, and delivered into our houses for 1½d. a ton. At the end of August last 72,026 houses were supplied, and 11,522 water-closets.

WEST OF SCOTLAND GAS MANAGERS ASSOCIATION.

(Continued from p. 759.)

At the conclusion of the discussion on the amalgamation question, already reported in the JOURNAL, the reading of papers was proceeded with. The first was by Mr. D. C. NIVEN (Dunoon), on

THE ELABORATE AND TEDIOUS THERMOMETRIC AND BAROMETRIC CALCULATIONS RELATIVE TO COAL GAS SIMPLIFIED.

It is with some hesitation that I appear before you to give a paper, however brief, on one of the many ideas relating to gas, about which you are all so familiar. Frank and manly attempts at criticism always bring a reflex benefit upon all interested, and I hope that in the proper spirit you will not spare even this attempt.

The subject implies the use of two instruments now known to everybody. The thermometer measures heat, the barometer measures weight. In regard to the thermometer, it is a matter of dispute, and not yet decided whether it was an Italian or a Dutchman who had the honour of being the inventor; but be that as it may, its rudeness and imperfection required much thought to bring it to its present state of perfection. Now, at least, the mercurial thermometer consists of a tube having a fine bore hermetically sealed, and closing with a bulb, in which is the fluid. Mercury has such a wide range from its freezing point (−39° Fahr.) to its boiling point (350° Fahr.), and also on account of its vaporization being exceedingly little at common temperatures, that its universal adoption is not a matter of surprise. Its principle of construction is that bodies change in bulk by an increase of temperature; and this is a general law of all homogeneous bodies, except water when near to the freezing point, when it then acquires its greatest density. Expansibility is, therefore, perhaps the most convenient effect of heat that could be selected as the means of its measurement. Whether heat be a kind of molecular energy or particles of a substance amongst bodies, does not at present much concern us, and the arguments *pro* and *con*. are such that many a learned man has been unable to give judgment.

In regard to the barometer, Torricelli, a disciple of the famous Galileo, gets the credit of not only being the inventor, but of also being the great refuter of the ancient doctrine that nature abhors a vacuum. It was an easy but lazy answer to the question why water would not rise more than 33 feet. The grand conception struck him that the atmosphere had some connection with it, and hence he was led in the course of thought to carry out the idea that if water can only rise 33 feet, then proportionally a heavier fluid—say mercury—would only require to rise according to its specific gravity. The idea was verified. Pascal, one of the most famous mathematicians of his day, heard of it, and he was led in the course of his thought to try whether, if the air be considered a kind of ocean, and the supernicumbent strata being above the incumbent stratum, there would be greater density at the sea level than on a high mountain. The idea was verified on a high mountain. The nature of the air then became a profound study, and the explanation of many common phenomena was a matter of pleasing but profound surprise. The principle of the barometer in its construction is that there must be a vacuum in the tube, so that the air can only exert pressure from the outside, and thus be properly measured. For this purpose a tube some 33 inches long, closed at one end, is filled with mercury, and then plunged with the fingers closing the open end in a basin or vessel of the same fluid, so that the air is thus excluded from the tube. The mercury will sink to about 30 inches, and that height of mercury shows the weight of a column of air having the same sectional area as the tube. The weight of mercury is about 1 lb. in 2 cubic inches, so that about 15 lbs. to the square inch is the usual pressure of the atmosphere; and, if we consider for a moment that 2000 square inches are the sum total of surface over a man's body, it is easily seen how many tons weight a man must support.

Having given a rapid sketch of the thermometer and barometer, we require to consider a little their uses relative to coal gas. It would be impossible for us ever to compare gases with each other unless we brought them under like condition; accordingly, English writers consider that though the barometer ranges from 28 to 31 inches, yet its mean height is 30 inches. And this is confirmed by Continental philo-

sophers; for, when their language is interpreted, their mean barometer height is only a fraction less. The thermometer is reckoned at 60° Fahr. The idea, however, is rapidly spreading that the freezing point should be the initial point for considering the mean, and hence the phrase is often used, even in English chemical text-books, of 0° Centigrade. Having now the conditions—namely, 30m. bar. and 60° Fahr.—the next matter is to take some gas as unity. Air is selected, and hence the specific gravity of coal gas is its ratio to air. The importance of corrections for pressure and temperature is obvious, for “supposing that gas were adjusted to burn at the rate of 5 cubic feet when the barometer was at 28 inches and the temperature at 84°, the measured volume of the normal value would be only 4.35 instead of 5 cubic feet.” Unless there were some normal conditions, there could be no comparative commercial value in the analysis of coals. I have also often thought that if more use were made of the barometer and thermometer, more light might be thrown on certain points in regard to leakage or to a larger production per ton of coal in some parts of the country differently situated as to sea level.

The law upon which we must consider the action of the barometer is that the volume any gas occupies is inversely proportional to the pressure; that is to say, will be directly proportional to its density. The greater the pressure the greater the density. It follows, then, that simple proportion is the arithmetical principle involved in any barometric corrections.

I shall now quote from Mr. T. Newbigging's “Gas Managers Handbook,” (p. 89) as exemplifying the usual way that such corrections are made:—

First Example.—Ascertain what volume 1000 cubic feet of gas at 28.5 inches will occupy when the mercury stands at 30 inches, the mean barometric pressure—

$$\text{Then } \frac{1000 \times 28.5}{30} = 950 \text{ cubic feet.}$$

Second Example.—What volume will 1000 feet at 30.6 inches occupy at 30 inches?

$$\text{Then } \frac{1000 \times 30.6}{30} = 1020 \text{ cubic feet.}$$

In regard to this last example, in case of any mistake, most persons would extend it thus—

$$\begin{array}{r} 1000 \\ 30.6 \\ \hline 600.0 \\ 30000 \\ \hline 30 \text{) } 30600.0 \\ \hline 1020 \end{array}$$

There are here a good many figures. Now try this conception. Take the first example. The difference between 28.5 and 30 inches is plainly 1.5 or 15-10ths. Multiply each 10th by 3½, and add or subtract from 1000 as unity, according to whether you pass from a higher than 30 to 30 the mean, or the contrary.

- (1) Thus: (30.0 − 28.5) × 10 = 15 × 3½ = 50; then 1000 − 50 = 950
- (2) „ : (30.6 − 30.0) × 10 = 6 × 3½ = 20; then 1000 + 20 = 1020

I shall now refer to Mr. Wright's book, “The Analysis of Coal Gas,” for corroboration of my results; and that there may be no confusion I shall assume the standard temperature of 60° Fahr.

1. When the barometer is at	Tenths.	
28.0 in.,	30 − 28 = 20	= 67, then 1000 − 67 = 933
2. „ 28.1 „	30 − 28.1 = 19	= 63, „ 1000 − 63 = 937
3. „ 28.2 „	30 − 28.2 = 18	= 60, „ 1000 − 60 = 940
4. „ 28.3 „	30 − 28.3 = 17	= 57, „ 1000 − 57 = 943
5. „ 28.5 „	30 − 28.5 = 15	= 50, „ 1000 − 50 = 950
6. „ 28.8 „	30 − 28.8 = 12	= 40, „ 1000 − 40 = 960
7. „ 29.2 „	30 − 29.2 = 8	× 3½ = 27, „ 1000 − 27 = 973
8. „ 29.1 „	30 − 29.4 = 6	= 20, „ 1000 − 20 = 980
9. „ 29.8 „	30 − 29.8 = 2	= 7, „ 1000 − 7 = 993
10. „ 30.4 „	30.4 − 30 = 4	= 13, „ 1000 + 13 = 1013
11. „ 30.6 „	30.6 − 30 = 6	= 20, „ 1000 + 20 = 1020
12. „ 30.9 „	30.9 − 30 = 9	= 30, „ 1000 + 30 = 1030

I have given such a variety of examples, in order to show the ease and expedition with which it may be done. The fact is that no pencil is required for its calculation, only the simplest arithmetic.

I will now consider the correction for the thermometer. The coefficient of expansion of gases is, at 0° C., for every degree .00366, or in vulgar fractional form 3/83, or 1/26 for each degree of Fahr.

Mr. Clegg gives the following formulae:—

Let V₀ be the volume of gas above 32°.

„ T „ the degrees above that point.

„ V „ its volume at 32°.

$$\text{Then } V' = \left(1 + \frac{T}{480}\right) \therefore V' = V \frac{(480 + T)}{480}$$

Now, evidently the first formula should have the letter V, and the second is defective as a formula; for there is implied a remembrance of some steps in the process which should have been indicated. For instance, the subtraction of the degrees of the freezing point should have been inserted. But, independent of the form, the factor 480 can now hold no place in the volume and temperature of gas. Therefore the formula is obsolete. Mr. Wright states the formula in a better manner, thus—

$$V = V_0 + \frac{T - 32}{480} = \frac{480 + T - 32}{480} = \frac{448 + T}{480}$$

The factor 480 vitiates this also. I am rather surprised that I should read in Mr. Newbigging's “Handbook,” “that all aeriform bodies expand 1.480th part of their volume for every degree of temperature above 32° Fahr.” That it may not be considered that I am hasty in my remarks, let me quote Professor Roscoe: “It has been found by exact and laborious experiment that all gases expand 1.273rd part of their volume at 0° C. for every increase in temperature of 1° C.” Dr. Letheby, in one of his lectures, says “that every gas expands 1.491-13th part of its bulk at 32° Fahr. for every degree of heat above that temperature.” Professor Balfour Stewart says that “the dilatation of air between 0° C. and 100° C. is equal to 0.3665 of its volume at 0°.” The proper formula for temperature therefore is—

$$V = V_0 + \frac{V_0(T - 32)}{492} = \frac{V_0 492 + V_0 T - 32 V_0}{492} = V_0 \frac{460 + T}{492}$$

I shall now quote from Mr. Newbigging's “Handbook” the usual mode of correcting pressure. What volume will 1000 cubic feet of gas at 68° occupy at 60°, the mean temperature? A quantity of gas which at 39° is 480 parts will at 60° become 508 (60 − 32 = 28 + 480 = 508), and at 68° 516 (68 − 32 = 36 + 480 = 516); then 1000 × 508 ÷ 516 = 984 cubic feet. In consequence of the factor 480 instead of 492, the process is vitiated.

but I am desirous of drawing your attention to the labour and intricacy involved in this calculation, though, in fact, it is simpler than many that may occur.

I think a very simple plan is the following, and I have used Mr. Wright's book for correction. I have checked a number of the tables, and he is not always correct. I shall take the above example. 1000 feet at 68° Fahr., what should it be at 60° Fahr.? "Multiply the difference between the mean temperature by 2, and for every number of degrees that rise to a number between 20 and 30, add a unit to this product, and add or subtract it from 1000 as unity, according to whether the degrees of temperature be below or above the mean." That there may be no confusion, I assume the barometer at 30 inches, the standard.

1. 1000 feet at 32°, what should it occupy at 60°?

	60 - 32 = 28 × 2 = 56 + 1 = 57 then	1000 + 57 = 1057
2.	34°, 60 - 34 = 26 × 2 = 52 + 1 = 53	1000 + 53 = 1053
3.	40°, 60 - 40 = 20 × 2 = 40 + 1 = 41	1000 + 41 = 1041
4.	46°, 60 - 46 = 14 × 2 = 28	1000 + 28 = 1028
5.	50°, 60 - 50 = 10 × 2 = 20	1000 + 20 = 1020
6.	56°, 60 - 56 = 4 × 2 = 8	1000 + 8 = 1008
7.	58°, 60 - 58 = 2 × 2 = 4	1000 + 4 = 1004
8.	64°, 64 - 60 = 4 × 2 = 8	1000 - 8 = 992
9.	68°, 68 - 60 = 8 × 2 = 16	1000 - 16 = 984

As the last one is the example taken from the "Gas Managers Handbook," it is easy to compare processes. The fact is that no pen or pencil is required for thermometric and barometric calculations.

We can continue the corrections thus:—

"To reduce 1000 feet at 29.5 in. bar. and 70° Fahr. to
30 in. bar. and 60° Fahr."

$$70 - 60 = 10 \times 2 = 20, \text{ then } 1000 - 20 = 980$$

$$30 - 29.5 = .5 \times (3\frac{1}{2} \times 10) = 16$$

964

"To reduce 1000 feet at 29.1 in. bar. and 54° Fahr. to the standard."

$$60 - 54 = 6 \times 2 = 12, \text{ then } 1000 + 12 = 1012$$

$$30 - 29.1 = .9 \times (3\frac{1}{2} \times 10) = 30$$

982

"To reduce 1000 feet at 30.6 in. bar. and 74° Fahr. to the standard."

$$74 - 60 = 14 \times 2 = 28, \text{ then } 1000 - 28 = 972$$

$$30.6 - 30 = .6 \times (3\frac{1}{2} \times 10) = 20$$

992

These examples are quite sufficient as illustrations. I have not had time to fully formulate these rules, but possibly their simplicity makes it needless. I may state, however, that in regard to temperature, I start as the initial rise of volume, not at the freezing point, as is the usual case, but at the mean of 60° Fahr. The following formula is the basis of my rule for corrections of temperature:—

$$\text{Let } V_0 \frac{(60 - T)}{492} = \text{increase for every degree Fahr.}$$

$$\text{Then } V = V_0 + \frac{V_0 (60 - T)}{492} = \frac{V_0 (552 - T)}{492}$$

Or in arithmetical form thus:

Problem: "1000 feet at 50° Fahr., what is the volume at 60° Fahr.?"

$$V = \frac{V_0 (552 - T)}{492} = \frac{1000 (552 - 50)}{492} = \frac{1000 \times 502}{492} = 1020 \text{ feet.}$$

I find, in comparing Wright's tables with Dr. Letheby's, which he produced in his lecture on "Coal Gas," that there is a difference of sometimes 2 units; for example, in the one the number may be 1000, and in the other 1002. I am completely at a loss in regard to the appendix to Mr. Hartley's "Gas Analyst's Manual," for I am unable to follow them; and yet he says what Mr. Wright says of his tables: "Multiply the quantity of gas by the tabular number (Table C, Appendix) due to temperature and pressure, strike off the three right-hand figures, and the remainder is the true bulk." Surely these words convey the idea that the table can be used for corrections of temperature and pressure; and yet, if that be so, there are at least apparent mistakes. The difficulty I feel is that a goodly number of the figures coincide, while others do not. If there were some factor at work that was regular in producing results, it would be plain I had not grasped it; but in regard to tables like these, it is difficult to conceive of an intermittent factor. Mr. Hartley is, in general, such a clear writer, that his present obscurity requires elucidation.

Had time permitted, I purposed in my paper entering more fully into the different kinds of thermometers and barometers; but I dare say you will now feel that the subject has been dry enough.

Discussion.

The PRESIDENT: We are all much indebted to Mr. Niven for showing us this short cut. I know he has been experimenting for a considerable time with these calculations, and it is not matter for wonder that with his knowledge of figures he should have succeeded in discovering errors in the present modes of calculations, and be able to point to a simple mode of correction.

Mr. S. STEWART (Greenock): I am sure we are greatly indebted to Mr. Niven for his useful calculations. It is important to have these matters simplified as much as possible, and his method of treatment renders these calculations easier. The determinations of temperature and barometric pressure are absolutely necessary in testing gas for the purpose of making a comparison of quality at different times; but if these tests were made several times a day, the corrections would be scarcely necessary. Where a gas of, say, 25 candles is supplied, it should simply be stated to be so, without any corrections. I think Mr. Niven deserves our warmest thanks for the calculations he has made, and the trouble he has taken in expounding them, because it is of importance to have a correct form. The tables that give the co-efficient of 480 ought to be corrected to the extent he has indicated. I beg to move a vote of thanks to Mr. Niven.

Mr. NIVEN: In regard to these two rules, I had not time to formulate them, and it is difficult in a public meeting to give the algebraical formula. What I have shown is the results at which I have arrived, and the simple process by which that end is attained. All intricate and roundabout ways are obviated by this method.

Mr. M'GILCHRIST: I also have to thank Mr. Niven for his paper, which I think has been very instructive. He has shown us a remarkably short cut to make these calculations. What I would suggest is that Mr. Niven should publish a card such as that issued by Messrs. Wright, Sugg, Cowan, Grant, and other photometrical apparatus manufacturers, which shows at a glance the tabular number by simply noting the temperature and barometric pressure. As I understand, at the present time comparatively few managers make the calculations Mr. Niven has referred to. For my part, the table being fortified by excellent authority, I never ques-

tion its accuracy. If Mr. Niven can show by the alterations he suggests that they would make any appreciable difference in the illuminating power of the gas, it would be very creditable to him and also to this Association, at which the paper has been read. Mr. Niven has brought forward in his paper other points worthy of consideration, such as the variations in the volume of gas at the level of the sea and on a high hill, and one cannot help seeing that the people of Dunoon must be getting a smaller yield per ton than people living in such places as Lanark. This is an interesting question, and branches off in many directions. I second Mr. Stewart's motion.

The motion was agreed to.

(To be continued.)

THE PUBLIC LIGHTING OF PARIS.

It will be remembered that at the meeting of the Paris Municipal Council on the 26th of February last, a report was presented by M. Cernesson, on behalf of the Third (Streets and Lighting) Committee, recommending the continuance of the electric light in certain parts of the city for a further period of twelve months from March 1, and at the same time suggesting the curtailment of the improved system of gas lighting then in use in the Rue du Quatre Septembre. The Committee were of opinion that one-half the burners in this street might be dispensed with, and probably also the consumption of gas in them reduced. They, however, asked the Council to allow them to further consider the matter in conjunction with the Administration, promising to make known their proposals at an early date.

At the meeting of the Council on Thursday, the 13th ult., M. Cernesson stated that the Committee recommended the Council to temporarily discontinue the trials of improved gas lighting in the Halles Centrales; to continue the lighting as at present in the Place du Château d'Eau; to reduce by one-half the number of burners in the Rue du Quatre Septembre; and to adopt the improved system of gas lighting for the refuges in the Champs Elysées, the inner boulevards, the Place St. Michel, and certain open spaces to be hereafter indicated by the Committee, with the concurrence of the Administration.

The recommendation was agreed to.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

During the past week the coal trade of this district has only been gradually settling down to its usual course after the holidays, many of the pits not having their full complement of men at work as late as Wednesday and Thursday last. There is not, however, any indication of improvement, and for all descriptions of round coal the demand continues extremely dull. House coals move off slowly, and as the iron-works in this district are, as a rule, only kept going on orders secured some time ago, without any fresh ones coming in, the demand for common round coals for forge purposes is also very dull. In the gas coal trade, the tendency, as I have pointed out in previous reports, is decidedly towards low prices. I do not hear of any important contracts having been concluded as yet; but the tenders have now been sent in for the Manchester Corporation Gas-Works, and they are in process of being sent in for Salford. Although nothing definite is yet known as to the prices, I hear that tenders are being sent in freely at low figures; and although some of the large firms are not willing to go beyond the next twelve months, there is no difficulty in obtaining offers for much longer forward deliveries. For good screened cannel at the pits in the Manchester district the quotations range from 13s. 6d. to 16s. per ton, and for good Lancashire screened gas coal from 6s. to 7s. per ton, according to quality; but whether these represent the lowest prices at which tenders will be placed is very doubtful. For round coals generally prices are weak, and there has been some talk of a reduction of the list rates in the Manchester district with the commencement of June; but the leading firms have decided not to make any alterations at present, and quotations remain nominally the same as those given last week. Engine classes of fuel, although still moving off without difficulty, are in less pressing demand, and the advanced rates which were asked about a month ago are not being maintained to the full extent. For good burgy at the pit mouth not more than about 4s. per ton is being obtained, and good slack averages about 3s. 6d. per ton.

For coke the demand continues dull, but prices are without material change; Lancashire cokes at the oven being quoted at from 10s. to 13s. per ton.

The iron trade continues in a very depressed condition, and to secure orders sales have to be forced at under current rates. Lancashire makers of pig iron being unable to secure fresh business, are reducing their output, and another of the local furnaces has been blown out. Nominally, then, quotations for delivery into the Manchester district are still 52s. 6d. per ton, less 2½ per cent. for foundry and forge qualities; but 50s. per ton would be taken if offers were made. Local finished iron makers, who, although in most cases well sold, are unable to get in specifications, are pressing for orders at very low figures, and bars delivered into the Manchester district could be bought at from £6 15s. to £6 17s. 6d. per ton.

THE SOUTH STAFFORDSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

As indicated in last week's report, a general alteration of prices in both raw and finished iron has been the characteristic feature of the business operations in the South Staffordshire district during the past week. Both at Wolverhampton, on Wednesday, and Birmingham, on Thursday, sellers were unanimous in quoting a reduced price of £1 per ton, both on branded and unbranded iron. It is now apparent that prices were unduly forced up at the commencement of the year, and it is considered doubtful if the market has yet found its proper level. The coal trade is, consequently, in an unsettled state, and though no reduction has as yet taken place, a decline is looked upon as certain, whilst buyers hold that there must be a reduction of 1s. per ton. Orders have been given out rather more plentifully during the last few days, though they are in most cases not of a noteworthy class, and emanate from customers who have been withholding in anticipation of a falling market. In the gas coal department matters are looking more favourable, and there is a decided movement noticeable for the better. At most of the collieries the output is greater, and some good contracts have been given. There are, too, a fair number of inquiries, while several local tenders are in the market. Amongst the latter may be mentioned the requirements of the Birmingham Corporation. They are contracting for 200,000 tons, to be placed in lots. The Walsall Corporation are seeking a supply of 24,000 tons, and the West Bromwich Improvement Commissioners a supply of 9000 tons, each to be delivered over within one year. A good demand exists for house coals, especially for the Cannock Chase production. From that district a good export trade is reported. Furnace fuel is plentiful, though prices are unsatisfactory to masters. Some of the pits in this district which have so long been water-logged are said to be in an improved state, though the mines drainage scheme does not work so satisfactorily as could be wished. Another favourable feature of the improved state of mining operations in this locality is found in the report of the Felsall Coal and Iron Company,

which has just been issued. The profit of the Company for the last half year is shown to have been £8829 14s. 8d., as against £219 10s. 2d. in the previous corresponding period. The results are owing to the increased output of coal and iron, and to a higher rate of prices obtained for the same. Operations are now in hand, and are being eagerly pushed forward, for the opening of the Great Wyrley coal mines, and in a very short space of time the machinery for the same will be in perfect working order. Notwithstanding the anticipated reduction, the tonnage raised at nearly all the pits in this district shows no signs of decrease, but rather the contrary, for most of the largest colliery proprietors are increasing the output, and a difficulty is, moreover, experienced in meeting the immediate wants of customers. Engine coal is in good request, and if the slight diminution in the demand for iron-making qualities is excepted, trade is fairly active and prosperous.

The downward movement in the iron trade leaves prices much as follows:—Marked bars, £8; sheets and plates, £10; though the commoner sorts are plentiful, and may be purchased as low as £8 and £7 10s. Hoops are quoted at £9, and tees at £10. Unmarked bars are offered at as low as £6 10s. and £7, and there are plenty in the market to be purchased even lower. The outlook is perhaps best in finished iron, as the export trade in this branch is the most brisk and promising. The price of labour has been reduced in proportion to the reduction in material—say, 1s. per ton, or 10 per cent. Heavy ironfounders and makers of tubes are doing a steady trade.

THE YORKSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The iron trade of this district does not seem to be quite so active as it was, producers of iron being affected by the reduction of prices in South Staffordshire. The finished iron trade is quieter than it was, and many of the local foundries are not over well off for orders. Most of the mills and furnaces used for puddling purposes are kept fairly at work, but fitters and engineers are not so well employed as they were a short time ago. No falling off can as yet be noticed with respect to the output of pig iron, the blast furnaces being still fully at work. Makers of Bessemer steel rails, tires, and axles are doing a fair business, the works at Penistone and elsewhere having a tolerable number of orders on their books. Very little ironstone is being raised at the district pits, the supplies for the most part coming from the neighbourhood of Frodingham, in Lincolnshire.

The house coal trade, if anything, is quieter, whilst prices were scarcely ever so low. The demand for the Metropolis is practically at a stand, owing to the high tonnage rates imposed, 8s. 4d. being charged to London, including City dues. Coalowners in Yorkshire find it utterly impossible to compete with seaborne coal, but the railway companies decline to reduce the rates.

On the other hand, steam coal is in better request, and a large quantity is being sent to both Hull and Grimsby for shipment to the Baltic and other ports. Some pits, including Mitchell's Main, Wombwell Main, and other large concerns, are doing a very good business, chiefly with Grimsby, from which port the shipments of late show a considerable increase. The demand for hard coal for smelting purposes holds well up. The railway companies are drawing large supplies of locomotive coal from the South Yorkshire district, Manvers and Denaby Main Collieries supplying a fair share of the Great Northern contract.

A fair business is being done in gas coal at many of the leading collieries, whilst manufacturing fuel for Yorkshire and Lancashire is rather better to dispose of. Not nearly so much slack and small coal is in the market, owing to the large consumption for coke-making purposes. It may, however, be stated that the make in a short time will be so materially increased that it is feared the market will be overstocked. A great bulk of the coke at present produced in South Yorkshire is being sent by rail to North Lincolnshire.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The general coal trade of the North of England was in a more active and healthy condition last week. The demand for best gas coals for shipment was very well upheld, and the prices for these coals are about as quoted—viz., 7s. a ton. More steam coals were shipped last week than usual. There were somewhat large cargoes for the Baltic. Boats have been freighted to take out gas and steam coals to Cronstadt, and they have loaded up pretty quickly. Merchants in this country made some large contracts to supply gas and steam coals to St. Petersburg, Moscow, and some of the other large Russian gas companies, to be delivered before the close of the first half of 1880. These contracts they have now on hand, and it is pretty clear the contractors will have to pay more money in freight than they anticipated they would have to do. The shipments of gas coals coastwise and to the Mediterranean were pretty good last week. There was considerably more than the average arrivals of small coasting vessels in the Tyne. Several of them were what is known as "gas-house ships," or were vessels which had been chartered to load gas coals in the Tyne before they left the South. The sailings have been considerable. Sailing ships had been taken up last week to load gas coals for Wexford, Cork, Sligo, and other Irish ports at low rates; and 7s. per ton was offered a 2500-ton steamer to load gas coals for Dublin, the steamer to be employed twelve months at the same rate. Steam coals have been more inquired after. The shipments from the Tyne have been numerous. Recent prices are well upheld. The official price of coke will be reduced on the 1st of June; the figure for best sorts will then be about 15s. per ton. The local demand for manufacturing coals is steady. Prices are very well supported.

Gas, water, and sanitary pipes were shipped to the Continent last week; but none of the parcels which were exported were large. The iron foundries are short of orders in some instances. The manufactured iron trade of the North has hardly come up to expectations. The only branches of the iron business which can be called busy, are the iron shipbuilding and the marine engine trades, and they undoubtedly are very active. The business which is doing in fire-clay goods is very well sustained. Shipments continue to be general. The value of lead is unchanged. The timber business is quiet. The trade does not improve very rapidly. Prices remain unchanged.

The freight paid sailing vessels to load gas coals for Sligo is 7s. per ton; to Weymouth, 5s. 6d.; Plymouth, £5 5s. and £5 10s. per keel; Poole, 5s. 9d. per ton; Cork, 5s. 3d.; Rotterdam, £6 per keel; Dover, 4s. 3d.; Teignmouth, 6s. and 6s. 1½d.; Totnes, 7s. 3d.; London, for steamers, 3s. 10½d. per ton. Small sailing ships are taking low freights to load bricks and other general cargoes for the Thames.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At a meeting of the Finance Committee of the Dundee Gas Commissioners, held last Thursday, the annual accounts were submitted and examined, and it was found that there was a surplus of upwards of £1000 for the year just ended. Notwithstanding the increase in the price of coal, the Committee did not find it necessary to increase the price of gas, and

the present charge will remain in force during the current financial year. That charge, it may be remembered, is 3s. 8d. per 1000 cubic feet, subject to an abatement of 5 per cent. when payment is made within 28 days.

The Directors of the Buckie Gas Company have resolved to reduce the price of gas from 10s. to 9s. 2d. per 1000 cubic feet, and to allow the usual discount of 5 per cent. for prompt payment.

A special meeting of the Forfar Gas Corporation was held last Friday week, for the purpose of receiving the recommendation of the Committee as to the extent of the additional borrowing powers that should be asked of Parliament in the Provisional Order. This recommendation was that the sum asked for should be £5000; and in supporting it Baillie Laird, the Convener, urged that the Commissioners were already £3000 in debt, and that when the present extension was made, it would be a permanent debt, being money sunk in the shape of permanent plant. He had looked closely into the bank account, and had found that it had been regularly overdrawn every year to a considerable sum. His private opinion was that they ought to ask a much larger amount, but he hoped that they would not at all events go below £5000. If they did, he predicted that in less than three years they would see their mistake. His motion to approve of the recommendation was not seconded, and it consequently fell. Provost Lowson moved that the sum be restricted to £4000, and after some discussion this motion was agreed to—Mr. Craik dissenting, on the ground that the money was unnecessary, and Baillie Laird, because he thought the sum was inadequate. Mr. Grant, in the course of the discussion, said he had watched the management of the gas-works very closely ever since the transfer, and his opinion was that they had been most admirably managed; but in reference to the financial part of the business he had a widely different opinion. If they had kept to the letter of their Act, in respect of the contingent and sinking funds, they would not have needed to borrow money at the present time; and if they had kept up the price of the gas, as they ought to have done, they would have been in a position which would have enabled them to lower it by this time.

On Friday week three shares of the Montrose Gaslight Company were put up for sale by public auction at £53 10s. per share, and were purchased for £53 15s. each. The stock consisted originally of £20 shares, and the last dividend was £3 per share. The ordinary market price on the following day was £51 10s.

Glasgow Corporation 9 per Cent. Gas Annuities were sold last Friday at £218 10s; Edinburgh Gas Company's Stock was sold on Tuesday at £45 10s. per share, and on the previous day at £45 15s.; and on Tuesday the stock of the Edinburgh and Leith Gas Company changed hands at £30 10s. per share.

Loud complaints are being made of a somewhat extraordinary line of policy which is being carried out by the Police Commissioners of the burgh of Falkirk. A few weeks ago they resolved that there should be no street-lamps lighted at night, and that not even the town clock should be illuminated, and at a meeting which they held last Thursday they agreed to cut off the water supply from the town during the night.

A considerable amount of energy is being displayed by Messrs. Scott and Best, the contractors for the new water-works which are in progress for the town of Forfar. The collecting-ground and the principal reservoir, in the Den of Ogil, are about 10 miles from the town, and about 600 feet above sea level; and the service reservoir, about 2¼ miles from the town, is 500 feet above the sea level, and 100 feet above the highest house in the town which has to be supplied. The works are being constructed at present for a supply of 30 gallons per day to a population of 20,000, and the estimated cost is set down at £38,000.

There is still much public alarm in Perth in regard to the widespread epidemic of diarrhœa which has prevailed in that city during the last few weeks, and to the great fatality to which it has led. In the opinion of the leading medical men of the city there is now no doubt as to the disease having been spread through the medium of sewage-contaminated water, as was very pointedly stated at a special meeting of the Police Commissioners held on Monday last week for the purpose of receiving a deputation of the doctors in regard to the matter.

Last week's Glasgow pig iron warrant market was very steady, and a fair amount of business was done daily. The highest price was 45s. 7d. cash (paid on Monday), and the lowest was 45s. 0½d. At the close on Friday afternoon there were sellers at 45s. 4d. cash, and buyers at 45s. 3d. Makers prices have again been reduced, but there does not seem to be any accession of business in consequence.

No change for the better can be reported in the coal trade. There is a keen competition for any good orders that are going, and wages are being reduced all round.

SALE OF GAS AND WATER COMPANIES SHARES AT NEWCASTLE.—There have recently been sold by auction, at Newcastle, a number of shares in some of the local gas and water companies, and very good prices realized in all cases. The following are the particulars of the sales:—

Hartlepool Gas and Water Company—

A shares, £5 paid, sold for	£6 17s. to £7 0s. 6d. each.
B " " " "	£6 3s. 6d. each.
C " " " "	£6 7s. 6d. each.
£10 " " " "	£12 12s. to £12 16s. each.

Newcastle and Gateshead Water Company—

Ordinary £100 stock sold at	£123 2s. 6d. each.
£5 guaranteed preference shares sold at	£5 17s. each.
£5 preference, 1876, shares, £3 10s. paid, sold at	£4 8s. each.

Sunderland Gas Company—

Ordinary £100 stock sold for	£191.
£5 preference shares, bearing 5 per cent. dividend, sold at	£9 14s. 6d. and £9 15s. each.

PADIHAM CORPORATION GAS SUPPLY.—The working statement for the year ending March 25 last furnished to the Padiham Corporation by the Manager of their Gas-Works (Mr. J. R. Smith) contains the following particulars:—

Gas made	18,736,100 cubic feet.
" sold	16,675,650 "
" for public lighting	848,085 "
" used on works	191,000 "
" unaccounted for	1,021,365 "
Capital employed	£25,065 6 10
" per ton of coal carbonized	12 14 2
" per 1000 feet of gas sold	1 8 7
Illuminating power required by Act of Parliament	14 candles.
" supplied	16
Gas made per ton of coal	9510 cubic feet.
" accounted for per ton of coal	8983
Cost of coal per ton, in works	11s. 5d. "
Coke, tar, and liquor realized per ton of coal	5s. 0½d.
Net cost of coal per ton	6s. 5d.

For the year ending March 25, 1879, there were 1985 tons of coal carbonized, in respect of which 16,700,200 cubic feet of gas were accounted for, while last year 1972 tons were carbonized, and 17,714,735 cubic feet of gas were accounted for.

SALE OF STOCK AND SHARES IN THE TUNBRIDGE WELLS GAS COMPANY.
—On Friday, the 21st ult., some exceptionally good prices were realized at a sale by auction of stock and shares in the Tunbridge Wells Gas Company, the property of a gentleman deceased. Four lots of £100 consolidated ordinary 10 per cent. stock sold three at £200 and one at £201. Five lots of consolidated B stock, with a 7½ per cent. dividend, sold for £149, £149 10s., £150, £150 10s., and £151 respectively; while £140 of similar stock sold for £211. Two lots of ten £10 shares, fully paid, entitled to 7 per cent. dividend, sold at £145 10s. and £147. At the same sale ten £5 shares, fully paid up, in the Southborough Gaslight and Coke Company, Limited, were disposed of for £82.

Register of Patents.

APPLICATIONS FOR LETTERS PATENT.

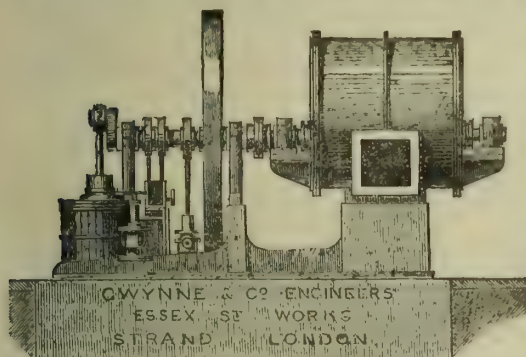
- 2065.—SUGG, W. T., Westminster, "Improvements in railway-carriage lamps, and in the means of supplying illuminating gas thereto." May 21, 1880.
2135.—LIVESEY, J., Westminster, "Improvements in apparatus for enriching gas by admixture of hydrocarbon vapour." Partly a communication. May 25, 1880.

- PATENTS WHICH HAVE PASSED THE GREAT SEAL.**
4901.—HEARSON, C. E., Southwark Street, London, "Improvements in gas governors or regulators." Nov. 29, 1879.
5197.—HADDAN, H. J., Westminster, "Improvements in the mode of purifying gas." A communication. Dec. 19, 1879.
619.—KROMSCHRÖDER, J. F. G., Prince of Wales Road, London, "Improvements in the manufacture of coal gas for lighting purposes." Feb. 12, 1880.
1162.—WILSON, W., Oakland, U.S.A., "An improved collapsible tube-valve, to be placed in pipes and passages for admitting a flow of water, steam, air, or gas in one direction, and preventing a back-flow in the opposite direction." March 18, 1880.

PATENTS WHICH HAVE BECOME VOID
BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

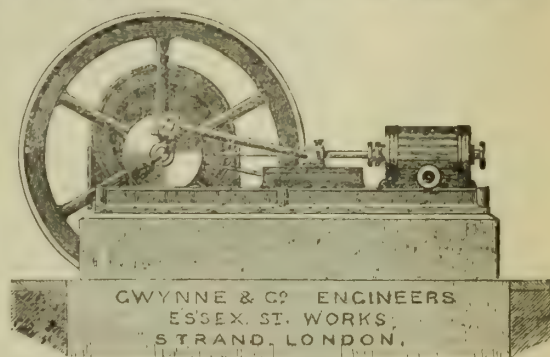
- 1579.—DAVIES, P. J., "Improvements in apparatus for controlling, regulating, measuring, and arresting the flow or discharge of fluids or liquids, and preventing waste thereof." May 2, 1873.
1637.—CASTRO, D. DE, and BURTON, R., "Improvements in gas-meters." May 6, 1873.
1799.—CAFFALL, R. M., "Improved means of and appliances for automatically preventing the back-rush of gas from gasometers, for purifying the gas, and for improving the brilliancy of the lights or flames of gas." May 17, 1873.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS. GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship."

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce machinery of the very highest quality, and most approved design and workmanship. The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

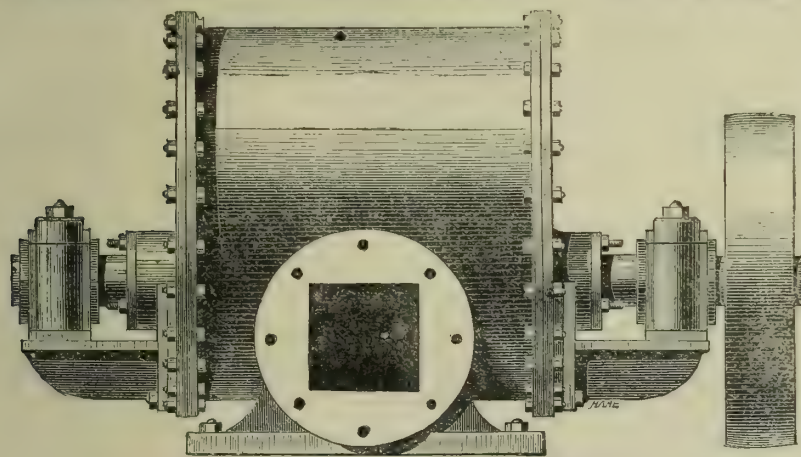
PLEASE ADDRESS IN FULL, **GWYNNE & CO.,** Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

BEALE'S IMPROVED PATENT GAS EXHAUSTERS,

WITH OR WITHOUT

WROUGHT-IRON SPINDLES AND
ENGINES COMBINED.



G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

PHENIX ENGINEERING WORKS:

HOLLAND STREET, SOUTHWARK, S.E.

Now Ready, Price One Guinea,

**PRECEDENTS IN PRIVATE BILL LEGISLATION
AFFECTING GAS AND WATER UNDERTAKINGS.**

COMPILED BY MR. G. W. STEVENSON, C.E., F.G.S.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, Readers of the NEW Edition,
"Cooking & Heating by Gas;" on Burners, &c.
Copies, by post, Threepence, direct from the Author,
MAGNUS OHREN, Assoc. M.I.C.E., Gas-Works, SYDENHAM.

WANTED, a Situation as Foreman of
Chemical Works. Understands Tar Distilling and
Treatment of Products; also Liquor and Sulphate of
Ammonia Making.
Address No. 662, care of Mr. King, 11, Bolt Court,
FLEET STREET, E.C.

A GENTLEMAN, nearly four years
Assistant Engineer on Gas-Works producing over
200 millions, desires a similar engagement, or the Manage-
ment of a Works.
Address G. D., 1, St. George's Villas, Beckenham,
KENT.

YOUNG MAN (aged 25) is desirous of
obtaining, at Home or Abroad, the Management of a
small Gas-Works, or Assistant in a larger Works. Has
had several years experience as Manager and Secretary.
Unexceptionable references and testimonials, and satisfac-
tory reasons for change.
Address, in first instance, No. 663, care of Mr. King,
11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Lytham Improve-
ment Commissioners, a steady, sober man as
STOKER at their Gas-Works. Wages 28s. per week
(throughout the year).
Apply to Mr. BOWER, Gas Offices, LYTTHAM.

RIPON CITY GAS-WORKS.

WANTED at once, for the above
Works, a steady, competent Man as FITTER and
METER INSPECTOR. Wages 30s. per week. One with
a knowledge of Water Meters preferred.
Apply, stating age, with references, to
JNO. S. INEON, Manager.

GAS-FITTER.

WANTED, a good Workman in Iron
and Compo. Pipe, who can Lay Mains and Services,
is capable of doing Smithing, and also understands the
routine of a Gas-Works. To a steady man the situation
would be a permanent one.
Appl., with testimonials, stating wages required, to
T. W. R. WHITE, Gas-Works, SHERBORNE.

WANTED immediately, for a Gas and
Water Works, a good FITTER, competent to Lay
Mains and Services in iron and lead pipe. Fix Meters, and
capable of making Plumber's Wiped Joints. Preference
will be given to one having a knowledge of the general
routine of a Gas-Works. Wages 23s. per week.
Apply by letter only, with references, to Mr. F. RUSSELL,
40, Fore Street, ILFRACOMBE.

TAR.—Wanted, to Purchase a few thou-
sand gallons. State price filled into casks on Works,
or delivered on rail.
Address No. 664, care of Mr. King, 11, Bolt Court,
FLEET STREET, E.C.

FOR SALE—A Second-hand Square
STATION-METER, to pass 40,000 cubic feet per
hour. Erected about 12 years. Made by Messrs. J. and
J. Braddock, Oldham. Now in use at the Plymouth Gas-
Works. To be removed to make place for a larger sized
Meter. To be sold a bargain.
For price and particulars apply to W. W. ANDREWS, 238,
Kingsland Road, LONDON.

A BARGAIN.

FOR IMMEDIATE SALE—A Round
STATION-METER, capable of passing 2500 cubic
feet per hour (clock in centre), three 4-in. Bends, and one
5-in. Four-way Valve, which have been taken down to
make room for a larger one.
Apply to Mr. W. C. DAWSON, Gas-Works, ARUNDEL.

EXHAUSTER FOR SALE.

THE Malton Gas Company have for
Disposal an EXHAUSTER and ENGINE, erected
by Messrs. Dempster in 1873, capable of passing 7000 cubic
feet per hour.
It may be seen in operation, and further particulars
obtained on application to the undersigned.
HENRY TORRY, Secretary.

THE Gloucester Gas Company, ceasing
to manufacture gas at their old works, will have the
undermentioned APPARATUS for Sale about the beginning
of August, viz.:—

About 150 feet of D-shape Wrought-Iron Hydraulic
Main, size 19 in. by 19 in. Also about 38 ft. of D-shaped
Wrought-Iron Hydraulic Main, size 20 in. by 20 in. An-
nular Condenser, consisting of six Vertical Pipes, 24 in.
diameter, 19 ft. high, with three 12-in. Slide-Valves and
12-in. Connections.

Scrubber (round), 5 ft. by 20 ft., with three 12-in. Slide-
Valves, and 12-in. Connections.

Exhauster (Jones) to pass about 15,000 feet per hour.
Exhauster (Beales) to pass about 25,000 feet per hour.

Two Vertical Steam-Engines, each about 6-horse power,
with Pulleys, and Shafting used for driving the above.

Boiler 14 ft. 6 in. by 3 ft. 6 in., with Centre Tube, and
four Galloway Patent Tubes.

4-horse power Horizontal Steam-Engine.

Three 4-in. Pumps, with cranked Shafting and a pair of
Mitre Wheels.

Two Purifiers, 16 ft. by 8 ft., with six 12-in. Slide-Valves
and 12-in. Connections.

Gasholder, Double Lift, with Cast-Iron Tank, capacity
37,000 feet.

Gasholder, Double Lift, capacity 100,000 feet.

Gasholder, Double Lift, capacity 240,000 feet.

One 12-in. Governor, by Wright, London, with 12-in.
Valves, Bye-Pass, and Connections.

Two 12-in. four-way faced Valves, by Cockey.
For further information, &c., apply to the undersigned.
R. MORLAND, Engineer.

CAMBRIDGE UNIVERSITY AND TOWN GASLIGHT COMPANY.

TO MANUFACTURING CHEMISTS AND OTHERS.

THE Directors of the above-named Com-
pany have for Sale about 190 tons of Spent OXIDE
OF IRON.

The same may be seen and samples taken upon applica-
tion to

JAMES WEEKS, Manager.

Gas-Works, Cambridge, May 21, 1880.

CAMBRIDGE UNIVERSITY AND TOWN GASLIGHT COMPANY.

THE Directors of this company have
for Sale the undermentioned PLAN:—

18 Lengths of Hydraulic Main, each 9 ft. long, 18 in. by
15 in. diameter.

Three Lengths of Hydraulic Main, each 10 ft. long, 19 in.
by 17 in. diameter.

126 Mouthpieces, with Ascension-Pipes, complete.

One Condenser, formed of 52 9-in. Pipes.

One Scrubber, 20 ft. high, 5 ft. diameter.

One Purifier, 11 ft. 6 in. square.

One Travelling Crane for the above.

One Meter to pass 15,000 cubic feet per hour.

One Governor to pass 30,000 " "

Two 9-in. and eight 12-in. Valves.

Four Wrought Girders, each 44 ft. long by 17 in. by 6½ in.

Two Cast Columns, each 21 ft. long by 13 in. by 10 in.

Two " " " 14 " " 10 " 8 "

Two " " " 11 " " 9 " 7 "

One " " " 10 " " 12 " 10 "

The above may be seen and further particulars obtained of
JAMES WEEKS, Manager.

Gas-Works, Cambridge, May 21, 1880.

GAS PLANT FOR SALE.

THE Coventry Gas Company have for
SALE—

SCRUBBERS.—One 5 ft. 6 in. diameter, 15 ft. high. One
5 ft. diameter, 20 ft. high; with or without 8-in. Connec-
tions and Valves.

STEAM-JET VENTILATOR.—One No. 2 Körting's
Patent Jet Ventilator, with Chest. One No. 3½ Körting's
Patent Jet Blower.

VALVE.—One 12-in. Cathels's Four-way Valve.

The above are being replaced by larger apparatus, and can
be removed at once. Also a 100-light Gas Apparatus
(Porter's make); this includes a Gasholder, 14 ft. diameter
and 10 ft. high, which could be sold separately.

For particulars and prices apply to
W. L. ROBINSON, Manager.

Gas-Works, Coventry, April 17, 1880.

THE Sheffield United Gaslight Company
OFFER for SALE the following lots of Retort-
House FITTINGS, which they are now taking down at
two of their Stations:—

54 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft.
6 in. by 18 in. by 18 in.

16 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft.
6 in. by 18 in. by 15 in.

4 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft.
6 in. by 16 in. by 15 in.

320 Cast-Iron Mouthpieces, D-shaped, 21 in. by 15 in.

160 Lengths 4-in. Cast-Iron Ascension-Pipes, straight,
7 ft. 6 in. long.

215 Lengths 4-in. Cast-Iron Ascension-Pipes, straight,
5 ft. 6 in. long.

50 Lengths 4-in. Cast-Iron Ascension-Pipes, curved,
5 ft. 6 in. long.

60 Lengths 4-in. Cast-Iron Ascension-Pipes, curved,
2 ft. 8 in.

37 Lengths 4-in. Cast-Iron Ascension-Pipes, curved,
10 ft. 2 in.

40 Lengths 4-in. Cast-Iron Ascension-Pipes, straight,
5 ft. 10 in.

17 Lengths 4-in. Cast-Iron Ascension-Pipes, straight,
5 ft. 5 in.

481 Lengths 4-in. Cast-Iron H-Pipes.

506 Lengths 4-in. Cast-Iron Dip-Pipes.

The above apparatus has been in use up to a recent date,
and is adapted for re-erection.

The Company will be prepared to receive an offer for
the whole or any portion of the above. Price £4 per ton,
loaded into trucks at Sheffield.

Applications to be addressed to the undersigned.

THOS. ROBERTS, Manager.

Gas Office, Sheffield, March 25, 1880.

GAS PLANT FOR SALE.

THE Maidstone Gas Company having
enlarged their Works, offer the following Apparatus
for Sale in good condition:—

SCRUBBERS.—One Tower Scrubber 30 ft. high by 10 ft.
diameter, with Distributor, and partly fitted with Livesey's
boards.

CONDENSERS.—One Set of Annular Condensers, con-
sisting of 9 Pipes 17 ft. high, outer diameter 2 ft. 6 in.,
fitted with 12-in. Valves complete.

ENGINES.—Two 12-Horse Power Horizontal Engines
in very good condition.

STATION-METER.—By Milne and Son, in first-class
condition, of monumental case, with Valves and Bye-pass
complete; to pass 20,000 cubic feet per hour.

HYDRAULIC MAIN.—Six 8 ft. by 18 in. Hydraulic
Main D wrought iron; 24 8 ft. 9 in. by 18 in. Hydraulic
Main D wrought iron. Nearly new.

BRIDGE AND ASCENSION PIPES.—90 6 in. by 4 in.
Bridge-Pipes, and a quantity of 6-in. Ascension-Pipes and
Bends.

RETORTS.—31 Rods, 15 in. diameter and 9½ ft. long,
in two pieces. 2 Ovals, 21 in. by 15 in. and 9 ft. long,
in one piece. All of Stourbridge Fire-Clay, and in good
condition.

For further particulars and price apply to
JOHN WEST, Engineer and Manager.

Gas Works, Maidstone, April 21, 1880.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Coventry Gas Com-
pany are ready to receive TENDERS for the
Purchase of the Surplus TAR produced at their Works.

Tenders to state price per ton of 20 cwt. delivered into
boats at Coventry for One, Two, or Three years from July
1, 1880. Weight to be taken over the Gas Companies
weigh-bridge at the Gas-Works.

Present annual quantity, 800 tons.

Tenders to be delivered not later than the 14th of June,
addressed to the CHAIRMAN.

TO GASHOLDER MAKERS.

THE Directors of the Kirkham (Lan-
cashire) Gas Company are prepared to receive
TENDERS for the Erection of a GASHOLDER, 50 ft.
diameter by 18 ft. deep.

Plans and specifications may be seen on application to
Mr. Green, Gas Engineer, Preston.

Sealed tenders, addressed to the Chairman of the Com-
pany, and endorsed "Tender for Gasholder," must be
delivered on or before Monday, the 21st of June next.

The Directors do not bind themselves to accept the
lowest or any tender.

BENJAMIN STUTTARD, Secretary.

EXETER GASLIGHT AND COKE COMPANY.

THE Directors of the Exeter Gaslight
and Coke Company are prepared to receive TENDERS
for the Replating, &c., of a Double GASHOLDER at their
Works.

Particulars may be obtained on application to the
Engineer, at the Basin gas-works, and sealed tenders, en-
dorsed "Tender for Repairs to Gasholder," to be sent to
me, the undersigned, on or before Monday, June 14.

The Directors do not bind themselves to accept the
lowest or any tender, nor will they pay for estimates.

By order,

W. A. PADFIELD, Secretary.

Gas Offices, Exeter, May 20, 1880.

CITY OF CARLISLE.

TENDERS FOR COAL AND CANNEL.

THE Carlisle Gas Committee are pre-
pared to receive TENDERS for the Supply of about
10,000 Tons of Screened or Unscreened GAS COAL, and
about 2000 Tons of CANNEL, to be delivered in Carlisle
in such quantities as may be directed, from July, 1880, to
June, 1881.

Tenders, specifying the description of the Coal or Cannel,
the pits at which they are raised, and the terms for net
monthly payment, are to be sent to me on or before June 2,
1880, endorsed "Tender for Coal."

J. HERWORTH, Engineer and Manager.

Gas-Works, Carlisle, May 20, 1880.

BOROUGH OF NEATH, GLAMORGANSHIRE.

THE Town Council of this Borough
are prepared to receive APPLICATIONS for the
Managership of the Corporation Gas-Works in this
Borough. The Manager will be required to discharge all
the duties incident to the management and conduct of the
Gas-Works, and the keeping of the accounts thereof (with
the assistance of one person to act as Clerk and Collector),
and to devote the whole of his time to the discharge of
such duties in connection with the Works as shall be
directed by the Corporation or its Gas Committee. Salary
£200 per annum, payable quarterly, with an allowance of
coal and gas for private consumption at own residence.

Applications and testimonials (such applications to state
when the applicant would be at liberty to enter upon the
duties of his office) to be sent, addressed to the Town
Council, and endorsed "Application for Gas-Works
Managership," under cover to me, on or before the 12th of
June, 1880.

By order,

ALFRED CURTIS, Town Clerk.

Neath, May 24, 1880.

THE SHREWSBURY GASLIGHT COMPANY.

AMMONIACAL LIQUOR.

THE Directors of the above Company
are desirous of receiving TENDERS for the Pur-
chase of the Surplus AMMONIACAL LIQUOR made at
their Works during the Three years commencing July 1,
1880.

The estimated quantity for disposal is about 1200 tons
per annum, delivered into tanks on the London and North-
Western Railway, or into boats on S.U. Canal (the latter
preferred) at Shrewsbury.

Payments to be made monthly, net.

Tenders to state a separate price per Ton for Liquor of
5°, 6°, and 7° Twaddell, and to be sent in to the undersigned
not later than June 7, 1880.

The Directors do not bind themselves to accept the
highest or any tender.

By order,

WM. BELTON, Secretary and Manager.

Gas-Works, Shrewsbury, May 10, 1880.

MANCHESTER CORPORATION GAS-WORKS.

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee are prepared to
receive TENDERS for the Purchase of the whole or
a portion of the GAS TAR to be produced at their Gay-
thorn and Rochdale Road Works during a period of Three
or more years, commencing on the 1st day of March,
1881.

Sealed tenders, addressed to the Chairman of the Gas
Committee, Town Hall, Manchester, and endorsed "Tender
for Gas Tar," must be delivered here on or before
Wednesday, the 16th day of June next.

The Committee do not bind themselves to accept the
highest or any tender.

Further particulars and forms of tender may be ob-
tained on application to Mr. Geo. B. Jackson, at the Gas
Office.

By order,

JOS. HERON, Town Clerk.

Town Hall, Manchester, May 15, 1880.

SALFORD CORPORATION GAS-WORKS.

THE Corporation of Salford invite
TENDERS for the Supply of CANNEL and COAL
required at the various Gas Stations in Salford for One,
Two, Three, or more years, commencing on 1st September
next.

Forms of tender (upon which only tenders will be re-
ceived) and all particulars may be obtained on application
to the Engineer, Mr. Samuel Hunter, Gas-Works, Lamb
Lane, Salford.

Tenders, endorsed "Cannel and Coal Contract," to be
delivered to me on or before the 22nd of June next.

The Corporation do not bind themselves to accept the
lowest or any tender.

By order,

CHAS. MOORHOUSE, Town Clerk.

Town Hall, Salford, May 14, 1880.

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TO CORRESPONDENTS.

L. M.—Thanks for information and good wishes. Shall probably soon have an opportunity of referring to the facts to which you call attention.
T. A.—The proceedings are rather wide of the mark as far as our readers are concerned.
CUM MULTIS ALIIS.—Crowded out this week.
No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 8, 1880.

Circular to Gas Companies.

THE Seventeenth Annual Meeting of the British Association of Gas Managers will have commenced its proceedings before this JOURNAL reaches our subscribers. The programme, which we published last week, contains material which promises to the large number of members who will doubtless attend, both interest and profit, and our expectation goes with our hope that the meeting of 1880 will prove in the truest sense a great success.

Our regret at the absence from the chair of the President for the year, Mr. John Douglas, will be generally shared. It will be remembered that when, last year, the choice fell upon Mr. Douglas, he was away on the Continent in search of health; his absence now will be the more deplored, because it seems to say that the search was unsuccessful. We hope that for the sake of the Association, of which he has been a useful and valued member, as well as for his own, he may soon be again the strong man we have known him. Under such circumstances, the Association is fortunate in having been able to fill, and that so satisfactorily, the gap created. Mr. Hunt has tried his "prentice hand" as President of the Midland District Association, and the very able and practical character of the addresses he has delivered before the members of that Society, as also of the papers he has contributed to the Association itself, make us look with even special interest for the Inaugural Address this year. It is worthy of remark that this year, as last, the presidential chair of the parent Association is filled by one who has held like office in one of the district offshoots. There has been much speculation in our columns and elsewhere, in recent years, as to the effect likely to be produced by the formation of these district societies now established all over the country. Would they be an added strength or a source of weakness? would they prove

tributaries or the contrary? It is difficult to say, so far, what, if any, has been the influence exerted. The proceedings at the meetings held have been generally of a distinctly valuable character to those who have attended or taken part in them, and anything which tends to benefit and improve the information of individual members should, and no doubt does, produce a beneficial effect upon the Association as a whole. We think, however, that it is eminently desirable that some more positive gain should result to the central and representative body from such machinery as these district associations afford. The training of presidents is doubtless a high function; but there is a higher one—that of contributing as largely as possible to maintaining and increasing the high character of the Association; thus securing that the office of President will continue to be looked up to as one of distinguished honour by all members of the profession. In his address in 1878, the President of that year made a suggestion which, though well received at the time, does not appear to have borne fruit; it was that each of the district societies should charge itself with the responsibility of contributing from among its members one paper to the annual meeting. Last year Mr. Warner amplified this idea by proposing that the Association should depute certain subjects for investigation to the branches, and receive their reports at the annual meeting. How useful might be the results of such a practice may be inferred, not only from the illustrations which Mr. Warner gave, but also from the excellent work which has been done by the Manchester District Association, in obtaining and tabulating information upon practical subjects from among its members. That the district associations should be in effect branches of the parent one, that the work in which they have been engaged during the year should produce some result, and find some record in the proceedings of the annual meeting, is clearly most desirable; and we shall rejoice if the proposals in this direction which have been repeatedly made should be referred to a representative Committee of the Association for consideration before the next annual meeting. With such a connection cordially accepted, the whole would enjoy the advantages and the strength of union; without it, the painful position might arise of the parent's pride in the growth of its offspring being dashed by fear of unnatural rivalry, and by anxious reflections upon the fate of the divided house.

Another question which has occupied much of the time and attention of the members at several of their too short meetings is that of the restrictions upon membership imposed by the present constitution. A letter which appeared in our columns last week, signed "An Assistant," stated the case very clearly from the point of view of those at present excluded. We observe that notice is given in the programme of an intention to amend the rules, and it is possible that the Committee may purpose submitting some proposition on this subject.

The formation of a class of Associates has much to recommend it, and we confess our inability to see what tangible objections can be set against them. That the class, if formed, would embrace many men of greater information and culture, and of much higher social and professional position than some of those who by right are members of the one with the more dignified name, there can be no doubt; but such is the case in many other societies, and the feeling of no sensible man would be hurt by what is simply an inevitable necessity. From the numerous body of assistants in and outside gas-works, leading draughtsmen, chemists, and others, there could be formed a class of earnest and intelligent men—the subalterns of to-day, the leaders of to-morrow—who would not only themselves derive help on their way, but who would, we feel sure, contribute much to the useful character of the Association as a whole. Such a class would, it seems to us, partake, if formed, of the characteristics of two sections of the Institution in whose house the meeting this year will be held—the Associate and the Student. There would be the same power in the hands of the Committee first, and of the general body of Members after, to determine the suitability of candidates, and under Rule 3, as amended a few years ago, there would remain to the Committee the right to nominate as members those whom the old rule excluded, and the proposed new one would relegate to the class of Associates. Radical changes in any constitution should never be made lightly; but, on the other hand, neither should they be resisted when their expediency is clearly apparent. Especially is this the case if investigation has failed to discover evil likely to result from them as a set-off against the anticipated good. Burning questions are apt to become nuisances if their consideration is over-long delayed.

We are glad to observe that the number of papers on the

programme for this year is smaller than usual. We are of opinion that the record of the annual proceedings will be at least as valuable a volume if it contains the report of full and exhaustive discussions on a comparatively limited number of subjects, as it is now, when enriched by a number of papers which the courtesy of their writers permits to be printed, though time did not admit of their being read. It is also very desirable that members taking part in discussions should be relieved as much as possible of the discomfort of feeling that their observations must be governed, not by the importance of the subject, or their own information upon it, but by the mere question of time. And this leads us to ask, has not the time arrived when the duration of this annual congress may be fairly and properly extended? The material available being amply sufficient to fill up twice the time allotted to its consideration, might not at least another day be given to the work? Members who leave their business to attend the meetings would find little more difficulty in arranging for four days absence than for three, and the advantage reaped would be proportionately greater. Last year the official programme did extend over four days, and we believe that by far the greater number of those who attended the Newcastle meeting remained to the end, and would even have spared a fifth day, could it have been as well bestowed as either of the official four. This is, however, hardly the precedent we care to use. We are most anxious not to appear to take upon ourselves the office of censor or mentor to the Association; but we would certainly, advocate the devoting of an extra day, if it can be arranged to the practical work of reading and discussing the papers presented—though in the hot days of June it may involve some weariness and a little discomfort—rather than to an extension of the festivities of the occasion, however delightful they may be. We do not by any means disparage the importance to the Association of the day usually devoted to an excursion; nor the pleasure and advantage which members derive from the free and cordial intercourse which is then in vogue. We think, however, that it is well, where possible, to combine in that excursion, instruction with enjoyment (a combination usually effected), and we know of no greater danger which could beset the future of the Association than that its holiday aspect, its hospitalities, and mere sociality should assume an excessive importance in the estimation of the members. By all means let every effort be used to make this section of the programme as thoroughly enjoyable as possible, at the same time bearing in mind that it is essentially a secondary and not a principal one.

The British Association of Gas Managers is a society of which its members have reason to be proud, and the growth of which may well cause astonishment to its promoters. It has been productive of much good, and that in several directions, in the past; and its published proceedings are among the most valuable literature at the command of the profession, containing as they do the result of a vast amount of observation, experience, and research. We may well congratulate the Association upon the circumstances under which it now meets; we may also congratulate it upon the career which plainly lies before it of still increasing honour and usefulness.

Gas-works, and the general business of gas making and supply, are usually supposed to present a tolerably promising field for the occurrence of accidents. Gas Companies and their officers are consequently not uninterested in the Bill now being promoted by the Government for defining and increasing the liability of employers to compensate such of their servants as may be injured in the performance of their duties. The Bill, as printed, and read a second time in the House of Commons on Thursday last, has received a remarkably unanimous condemnation from the accredited representatives of the employers in most of the important trades and manufactures of the kingdom. It consists practically of only one clause, and is designed to make the employer responsible, not only for acts done or orders issued by him personally, but by any agent, however far removed, who may hold an insignificant share of deputed authority; the words being, "Any person 'in the service of the employer who has superintendence 'entrusted to him.'" Hitherto it has been held, if injury or death has resulted to a workman from the negligence or fault of another workman engaged in the same employ, that the master was not responsible, and this principle of "common employment" has doubtless barred the way otherwise open to many claims of a more or less vexatious character. It is doubtless a terrible hardship upon the widow and children of a man killed by an accident of an easily preventable character that they have not only to deplore the loss

of their chief support, but that the law affords them no help or compensation for the great injury. On the other hand, the hardship upon the employer would be even more apparent, if, in such a case, from the neglect or stupidity of one workman, the grave charge and responsibility were put upon his, the employer's, shoulders, of providing for the family of the killed or injured man. In most cases of accidents involving injury or death to the man employed, there is also a destruction of property, which is, in itself, a heavy charge upon the employer. In the course of the debate in the House of Commons, an illustration was used which sets out the case very clearly:—A man is engaged as a bricklayer on a building; he has to work upon a high scaffold, in the erection of which he has had no hand; the scaffold fails to support the weight upon it, falls, and he is killed. As the scaffold was built for him, and he had no choice but to use it, should his family not have a claim upon the employer because of its failure? But the scaffold was correctly designed, the materials were good, and it was put together by men supposed to be specially expert at this particular work. A cord carelessly fastened, a tie left out, and the failure results. The master has no remedy for the injury to his property; is it right that he shall be fined further in the way now suggested? The employers who waited upon Mr. Gladstone to request a reconsideration of the measure appeared not unwilling to accept responsibility for recognized agents or managers, and this, it appears to us, is all that can reasonably be asked of them. At the same time, recognizing, as all classes do, the necessity for some less precarious provision than public charity to meet the cases of those who, to the number of many thousands annually, are exposed to the risk of bitter privation from accidents arising in the performance of duties necessary to the community, some better settlement of the legal position is necessary.

The request of the employers seems to be conceded that the Bill be referred to a Select Committee, which will have power to inquire whether a system of mutual assurance may not be devised to meet the acknowledged difficulty. If such a proposal can be brought into practical form—and there is surely no insuperable difficulty about the task—it will be a most happy issue out of what is at present a perplexing, and threatens to become an angry controversy. Mr. Baxter, speaking for the coalowners, strongly urged this course upon Mr. Gladstone, and undertook that the employers he represented would contribute pound for pound with the men to form such a fund. Mr. John Aird, in a letter which appeared in *The Times* yesterday, suggests that the Government should charge itself with the custody of such fund, and appoint the agents by whom it could be dispensed. Such an arrangement would have this advantage among others, that there would be means sufficient to meet those great calamities which occasionally happen, and overtax the resources of any one local fund. Any such concerted action on the part of masters and men would have the effect of promoting a better feeling between the two classes, while the bringing of actions at law would drive them farther apart, and increase the unfortunate opposition and distrust at present existing. In most gas-works there are sick and accident funds subscribed to by the men, and, in some cases we know of, contributed to by the Directors. Such is the case also in most large works. These form a nucleus which might, we think, be readily developed, and experience proves that a very small sum regularly and universally contributed would suffice to meet, not only claims for accidents, but also the heavier charges due to ordinary sickness and death from natural causes. We believe that the net result from the "voluntary offering" proposed by the employers would exceed that likely to be wrung from them under the provisions of the proposed Bill. The money would, however, be more equitably and uniformly collected, and the participation of the men in the fund would give them an added interest in preventing accidents; further, the latter would be saved from the very possible contingency of a great accident involving a vast number of sufferers whose legal claim, though fully proved, is of no value, because the parties sued, having been themselves ruined by the calamity, have no means to meet the awards. We would urge our subscribers to take such steps as they can to secure that this proposal of mutual assurance shall be fairly considered by the Committee to be appointed.

There is a growing tension, if we may borrow the term from the language of diplomacy, observable in the relations of the Gas Committee and the other members of the Manchester City Council. Frequent squabbles, arising out of this feeling, enliven the meetings of the Council, and there are not wanting other signs to show that a general engagement

is certain in the near future. There is a strong party of the members of the Gas Committee who are dissatisfied with the bondage in which the property for which they are primarily responsible is held by the Improvement Committee, with the sanction of a present majority in the Council. The Improvement Committee, by virtue of the provisions of an antiquated Act of Parliament, claim an annual tribute of ten per cent. on the capital of the gas undertaking, and this heavy charge, increasing, of course, as the scale of operations enlarges from year to year, has been duly paid. But now the Gas Committee find themselves in the exceedingly awkward predicament of having a large amount of capital expended in unproductive works, for which they have to provide the interest, and which the Improvement Committee persist in including with the ordinary capital of the concern, and claim their title of the whole. The Gas Committee naturally object to work altogether for the benefit of another department, and, in doing so, to incur the unpopularity of maintaining high prices in order that the spending Committee above mentioned may be kept from direct reliance on the ratepayers for their income. On the other side, it is not to be expected that the Improvement Committee will give way, and submit without a struggle to deprivation of their snug dividend. Consequently, we observe, while the Gas Committee are labouring to put themselves in a position from which they will be able to successfully assault the Improvement Committee, the latter and the friends of the established order of things—including all those members of the Council who cannot see that making gas consumers help to pay rates for non-consumers is a device for raising money by indirect means—lose no opportunity for attempting to bring discredit on the Gas Committee; and this was at least one of the causes of a discussion and division which took place at the meeting of the Council on Wednesday last, when the proceedings of the Gas Committee were brought forward for confirmation. The appointment of Mr. West as Gas Engineer was the ostensible bone of contention, not, we are pleased to observe, from any real dissatisfaction with the selection of the Committee, but on the ground that in some undefined way the prerogatives of the Council had been infringed by the assumption on the part of the Committee of functions respecting the installation of Mr. West, which should have been first submitted to the superior body. This merely technical objection was made a peg whereon a perfectly irrelevant discussion respecting the internal administration of the gas-works at Rochdale Road was hung, and it was not until almost everything which various councillors happened to know about gas manufacture and distribution had been paraded before their impatient brethren that a vote was taken on the ostensible question at issue, resulting in the confirmation of the appointment by thirty-eight votes to six. After this, an attempt to force the attention of the meeting to the distribution of the gas profits was frustrated by a count out, the Gas Committee evidently feeling that the time for the solution of that difficulty had not come, for reasons of which the previous incident afforded indirect illustration.

We need make no excuse for reverting this week to the Leeds Corporation Gas Supply, quoting now from remarks of Mr. A. W. Morant, C.E., made in the course of his address as President of the Association of Municipal and Sanitary Engineers and Surveyors, at the annual conference of that body recently held at Leeds. Since 1876 the price of gas in this favoured town has been lowered from 3s. 9d. to 2s. 2d. per thousand feet, the illuminating power averaging 18½ candles. An illustration, if such were needed, of the principle that lowering the price tends to increased consumption, is to be found in the fact that the increase recorded for the past year was one hundred million feet—equal to the largest increase in any one year at Manchester, which, considering the difference between the two places, is instructive. What would have been the comparative results if Manchester had followed the example of Leeds, or if Leeds had made a milch cow of the gas undertaking, as Manchester does? There are yet extant heretics who fail to see that market principles apply to gas as to other commodities. It would perhaps be instructive, and certainly entertaining, if we could get one of these financiers to give an opinion on the case of Leeds. We say that the facts are explicable only on the grounds so recently stated by Mr. H. Woodall. If any other reason exists to their discredit, we should be glad to be informed of it.

The affairs of the Rotherham Corporation Gas-Works and the manner in which the profits of that undertaking for the past year have been applied, have excited more than local interest, for mention of them has been made by the London press. It appears that the profit realized on the past twelve months working was exactly £3300, of which no less than £2750 was handed over to the Finance Committee to be

applied in aid of the rates. Unanimity respecting this proceeding did not, however, prevail in the Town Council several of the members endeavouring, unsuccessfully as it proved, to secure some consideration for the claims of the gas consumers to a particular share of this respectable surplus. The difference between those who contributed to the gas profit, and those whom its application in the manner agreed on would benefit, was strikingly exemplified in the course of the discussion. It was stated that four of the principal firms of the town were collectively rated at £5200, and by the proposed arrangement would have their rates lightened by about £120 a year; for, making their own gas, they had contributed nothing whatever to the gas revenue. The argument that, as ratepayers, these and similar firms were really responsible for the gas-works, and should therefore participate in benefits derivable from them, may be allowed to pass for what it is worth. We presume that if coal were to rise in price, or for any other reason the expenses of manufacture were to increase, the price of gas would be raised to correspond—the ratepayers would not be called upon for a rate in aid. We wish to commend to all who may be disposed to follow the bad example of Rotherham in this regard, but upon whom the case of these great ratepayers and non-consumers may have some deterrent effect, just one consideration. If all gas profits are applied in the direction of reduction in price, all, or nearly all ratepayers will become gas consumers, and the two interests will become identical; on the other hand, if rates are lightened at the expense of the gas, the heaviest ratepayers (the manufacturers, millowners, and others) will find an increasing advantage in making their own gas, the development of the public gas undertaking will be slow, and the separation of the interests of the ratepayers and gas consumers will be painfully accentuated, with all the attendant evils which unrighteous financing never fails to bring in its train.

A case tried recently before Mr. Paget calls for the serious attention of Gas Companies, or of such a body as the Gas and Water Companies Association representing them. The Wimbledon and Mitcham Gas Company summoned a consumer for the non-payment of his gas-rate. The contention was that the quantity charged was excessive. The Company proved that the meter had been taken down by the official examiner, tested, and found correct. The certificate was handed in, and its validity not disputed. The consumer, on the other hand, stated that while the old meter registered a consumption of 500 feet per night, the new one then in use recorded only 200 feet. On the strength of this statement, the Magistrate expressed himself as having "no doubt" that there was an error in the registration of the meter, and dismissed the summons. If the Wimbledon Company do not appeal against this judgment—and we have not seen an intimation of their intention to do so—a most inconvenient and a very objectionable precedent indeed will have been set up. Such cases, if allowed to pass unchallenged, are acted upon in subsequent disputes, become registered as precedents, and go to make up that great volume of "case law" so frequently consulted. In this instance the facts are all in favour of the Company, and the law clearly requires that the decision shall be according to the facts; but upon the mere statement of the consumer that his consumption has been reduced considerably at a time when he was giving special attention to economy, both law and facts are disregarded, and the rightful claims of the Company disallowed. We repeat that such cases need the attention of Gas Companies generally, and that they should be most jealously watched. Once more we would express the wish that the Gas and Water Companies Association was so generally supported, especially by Gas Companies, as that they might have the right to look to it in such matters. They could not be in better hands.

The sale of gas "to be consumed off the premises," in lighting tramcars, railway carriages, and other moveable structures, is being established as an ordinary branch of the business of the Alliance and Dublin Consumers Gas Company. The Company's energetic Secretary and Manager, Mr. W. F. Cotton, is very sanguine of the ultimate development of this application of ordinary coal gas, from the complete success which has attended his preliminary experiments. Dublin gas with Mr. Sugg's apparatus was tried on one of the Irish railways a short time since, and was entirely successful; but for some reason the Railway Companies did not see their way to its adoption at that time, but preferred a petroleum lamp, which it appears has not met with unqualified approval by the general public. The Gas Company meanwhile were so convinced of the practicability of using gas for such purposes, that they took powers in their last Act of

Parliament for carrying out any systems of portable gas lighting which might prove commercially successful, either with a specially made rich gas, or for the common gas supplied by them in the ordinary course of their business. We hope that the quantity required for this purpose will be such as to repay the Company for their enterprise in taking the matter up so earnestly, and shall await with much interest Mr. Cotton's experiences, which he will doubtless make public on an early date.

Water and Sanitary Notes.

As proposed by the Home Secretary, the House of Commons has agreed to the appointment of a Select Committee to inquire and report as to the expediency of acquiring, on behalf of the inhabitants of London, the undertakings of the existing Water Companies within the metropolitan area, and also to examine and report whether the agreements for the purchase of the Companies, provisionally entered into by the late Government, or any of those agreements, would furnish a satisfactory basis for such an acquisition. The Committee are further to inquire and report as to the nature and extent of the powers of the Water Companies to levy water rates and rents, and how far it may be desirable to modify the same. On the motion for the appointment of this Committee, the House engaged in a prolonged and important discussion; but, owing to the circumstance that the debate took place something like two hours after midnight, the daily papers were utterly unable to do justice to it. By the aid of the telephone, *The Times* succeeded in giving a fuller account than any other paper, but even in that case the report amounted only to the barest possible outline. On reference to another part of our pages, where the debate is given *in extenso*, occupying several columns, it will be seen that it is one which will repay careful perusal on the part of all who take an interest in this subject.

One of the salient points in the debate just referred to was the emphatic manner in which the Home Secretary declared that, unless the reference to the Committee were allowed to stand as he had framed it, he must "wash his hands" of the whole question. "I cannot undertake any responsibility in 'the matter of this Committee,'" said Sir William Harcourt, "unless I am allowed to keep it as an open question whether 'the supply of the existing Water Companies is or is not one 'that is worth buying.' The point thus contended for by Sir W. Harcourt is one to which we have drawn attention before, and is of especial significance. Speaking of the existing works, Sir William told the House, 'It may be the fact that you may buy these things on reasonable terms, 'but they may not be worth buying at all.' 'It may be,' continued the Home Secretary, 'for this Committee to consider whether the undertakings are worth buying at any 'price.' Sir William was resolved that this should remain an open question, although it was pointed out that its investigation involved a variety of considerations, calculated to prolong the inquiry far beyond the limits of the present session. The Home Secretary signified that he was doubtful whether or not London should be supplied from the Thames at all. It would be, he said, for the Committee to consider 'whether for twenty millions you can have a 'better and more abundant supply of water than you can 'get for thirty millions from the Companies.' Mr. W. H. Smith discreetly observed in reference to the sweeping proposals of the Home Secretary, 'You must always bear in 'mind that the powers possessed by the Water Companies 'have been given to them by Acts of Parliament, and all experience is against the withdrawal of powers which have 'been given by Parliament to public companies.' Sir Richard Cross, who made a speech pregnant with information and practical good sense, pointed out that if the Committee were to make an accurate report according to the terms of the reference, there would necessarily be a long and costly inquiry. Mr. Brand and Sir H. Holland feared a similar result. Mr. Ritchie remarked that had the Committee been limited to an investigation of the agreements, their labours might speedily end; but it was now proposed that they should go into 'the enormous question' of whether or not it might be better policy to bring in a fresh supply of water altogether. This, Mr. Ritchie predicted, would involve immense labour and serious delay. Nevertheless, despite all argument, the Home Secretary kept to his text, and the resolution was passed in the form for which he stipulated. The responsibility thus incurred cannot be ignored.

There is one serious aspect of the present agitation on the Water Question to which even Sir William Harcourt cannot

shut his eyes. A deputation from fourteen Vestries and District Boards, which waited on the Home Secretary last week, said "it is anticipated that a claim for increased rates 'under the increased valuation will be made, and it is 'desirable that this should, if possible, be prevented.' To this proposal Sir W. Harcourt replied by saying that one of the principal subjects to be inquired into by the Select Committee would be the power which the Companies possessed of raising their rates, and the manner in which they exercised those powers. Such an inquiry, he thought, would be more just than attempting to deal with the matter at once. "Parliament," said the Home Secretary, "will see that no 'crying injustice is done to the inhabitants of the Metropolitan." "We must see," added Sir William, "if we 'cannot accomplish the object of the deputation without 'alarming people as to the security of property." A declaration which goes home to the heart of the present controversy was finally made by Sir W. Harcourt, and we trust it will not be lost sight of. Sir William said: "I do not know 'anything more unsafe in this country than to make people 'suppose the securities given to persons in their properties 'by Act of Parliament are not safe, and are liable to be 'invaded."

The Times, which recently described the Water-Works Purchase Bill as in a state of "suspended animation," now speaks of it as "dead and buried;" and yet the most important part of the Bill is still alive, for the provisional agreements relative to so many millions of capital cannot be considered a mere spectral illusion. *The Times* echoes the words of the present Home Secretary, that "the Water Companies have 'no monopoly in the supply of London." Still "they are 'in possession," and this, we suppose, constitutes nine points of the law. They are not to be dispossessed, we presume, without strong and irrefragable reasons. Yet it is evident the proposal for a competing supply is virtually an attempt to drive the Companies from that position which the law has given them. The argument held by Sir W. Harcourt, that even "reasonable terms" should be rejected if a new and independent supply offers a temptation to adopt such a course, is one of a most mischievous nature. Probably it would not be politic, but it would be in one sense justifiable, if the Companies were to intimate, in the face of this announcement, that at the close of the present month they will have nothing to do with any more agreements or negotiations, but will fall back solely on arbitration. A different course will probably be the wiser, but some degree of irritation is natural when a Home Secretary counsels the rejection of "reasonable terms," and indulges in lofty talk about a competing supply, or rather a supply which is altogether to supersede that which now exists, supposing such a project to be practicable.

Probably some of the extreme notions of Sir W. Harcourt will be softened down or overborne by the general sense of the Select Committee which is to inquire into the question of the London Water Supply. As proposed by himself, that Committee will consist of Sir W. Harcourt and sixteen other members, among whom are Sir Richard Cross, Mr. Chamberlain, Sir James M'Garel Hogg, Mr. Slater-Booth, Mr. Brand, and Mr. Parnell. On the whole, it is a powerful Committee. Its nomination was to be moved for last night. The Corporation, we should observe, have also appointed a Committee, with power to take such part as they may think expedient in relation to the forthcoming inquiry in Parliament.

The speech of the Earl of Camperdown in the House of Lords on Friday last was very much in accordance with the demand made by the Vestry delegates, and the answer given by the Earl of Fife was even more explicit than that of Sir W. Harcourt, as to the unwisdom of an arbitrary interference with statutory rights. "Such an interference," said the representative of the Government, "would sap the springs of 'commercial enterprise, and would strike a blow at the very 'foundations on which repose our commercial undertakings." The unwillingness of the Government to interfere suddenly with the question of annual value is readily to be accounted for, not only on the broad grounds of general policy, but by a shrewd foreboding that this same annual value must be the basis of future charge, whether the water supply be in the hands of the Companies or a Public Authority. A lessened charge may be practicable, but a water-rate, no less than a drainage-rate, must bear some relation to the value of the property which has to bear the charge. As we pointed out some time ago, business premises which consume little water likewise make small use of the drainage works; yet the occupiers have to pay sewer-rates in proportion to their rental. The water supply is not a mere question of individual consump-

tion, but is itself a general sanitary provision, of value to the community at large.

Mr. Thomas Horsey, of Billiter Square, writes to the *Daily News* to complain that he is charged as high as twenty-two shillings per thousand cubic feet for water, and contrasts this with the price of gas. But this gentleman forgets to say that he might consume a much larger quantity of water without paying any more for it, whereas any increase in his consumption of gas is accompanied by an increased demand on his pocket by the Gas Company. Mr. Horsey also fails to perceive that in all probability he will have to pay for his water on the basis of his rental, even when the Companies are superseded by the coming "Authority."

RIVER WATER.

BOTH in spirit and substance, in argument and fact, Dr. Meymott Tidy's recent lecture, delivered before the Chemical Society, on the subject of "River Water," is an admirable answer to those far-stretched objections against the Metropolitan Water Supply which have done much to disturb the public mind. Dr. Tidy's paper, or lecture, has a wider scope than the Water Supply of the Metropolis, but nowhere else does it meet with so important an application. Concerning the tenor of his remarks, good sense and scientific acumen characterize all that Dr. Tidy has advanced, and, as a foundation for his assertions and contentions, there is a solid substratum of fact and experiment. The paper is long, but none too long for the matter it contains. In an early part of his address, referring to different methods of water analysis, Dr. Tidy speaks of the value both of the oxygen process and the combustion process, but expresses regret "that conclusions of grave importance sanitarily, and involving serious interests monetarily, should ever be based on determinations of the so-called albuminoid ammonia, which determinations are as incapable of arrangement or of interpretation as they are outside the sphere of scientific accuracy."

Dr. Tidy's researches include the water of the Thames, the Lea, the Severn, the Shannon, the Egyptian Nile, and incidentally some other rivers. He properly observes that the use of the term "total solid impurity" to signify the "total solid matter" in water is scarcely expressive of the facts, and, although chemically accurate, may lead to some misapprehension. In a chemical sense, we presume nothing short of distilled water can be considered pure. Yet the public would never tolerate distilled water as a beverage. The facts observable in the case of the Nile are specially interesting as showing in the highest degree the extent to which the quality of river water is affected by the action of floods. The Severn affords a singular instance of having a varying proportion of chlorine as exhibited by samples taken at the same time only a quarter of a mile apart. The chlorine in one sample will sometimes be double that in the other, although there may be no possible source of sewage contamination whereby to account for the difference. Professor Ansted—whose decease we now deplore, and who was associated with Dr. Tidy in one of the inspections which yielded these strange results—considered that the existence of bottom springs, rising through new red sandstone (itself a salt-bearing stratum) is the explanation of this unusual occurrence. Professor Ansted informed Dr. Tidy that salt springs are known to rise in the bed of the Trent, and affect the quality of the river water in a very sensible degree. The possibility of such a disturbing cause being in operation is assuredly not to be lost sight of in river investigations.

Floods necessarily affect the purity of rivers. The first result of a flood is to raise the impurity of the stream to its maximum; but this is followed by a condition of things which brings the river to a state of maximum purity. The turbidity, in the first instance, is occasioned by the washing of the drainage area, and this area being thus made clean, the water becomes the better for it. Certain other deductions are worked out from a careful observation of floods, and one general conclusion from the facts is this—that "if river water be used as a supply, a river subject to frequent floods is not necessarily a disadvantage." In advising as to what water should be taken into the reservoir, and what rejected, in order to avoid the bad and not lose the good, the chemist can immensely assist the engineer. The average period of primary flood water should be accurately studied, and the general law should be borne in mind, that the last day of low water is worse than the first, and the first day of high water worse than the last. The use of primary flood water should be avoided as far as possible, and on this account due provision must be made in the shape of storage reservoirs. The

difference between the primary flood water and the secondary, in reference to the amount of solid matter and organic impurity, is very marked. It is also observed that in summer the longer the interval between two floods the better the water is, so far as organic purity is concerned; but in winter the longer the interval the worse the water is when the flood comes.

In treating of peat waters, Dr. Tidy mentions a very striking illustration which came under his own notice, as to the oxidation which goes on in running water freely exposed to the air. At a Water Company's works in the North of England, where the supply is of a peaty character, a large distributory reservoir near the town is filled from a storage reservoir 6820 yards distant. The water is delivered into the distributory reservoir by two channels, one being a closed iron pipe and the other an open brick conduit, the fall between the two reservoirs being 401 feet. Both channels leave the upper reservoir by the same pipe, the pipe dividing soon after leaving the reservoir. When the lower reservoir is reached, the water taken from the closed pipe exhibits a well-marked peaty tint, but water taken from the open conduit is nearly colourless. On analysis, the water from the upper reservoir gave 0.461 part of organic carbon per 100,000, and the water at the lower end of the closed pipe gave practically the same result. But the water from the open conduit contained only 0.23 part of organic carbon per 100,000. Thus there was apparently complete proof of the oxidation of peat. The result appears the more important when we consider that the oxidation of vegetable matter is, as Dr. Tidy shows, incomparably less rapid than the oxidation of animal matter. We should observe that Dr. Tidy is careful to show the distinction between the mere bleaching of peat and its actual oxidation, by which he means its entire destruction, or burning up. A colourless water may still contain a considerable quantity of dissolved peat.

A curious phenomenon with regard to peaty rivers is that they are capable of being benefited by the introduction of water rendered turbid by mineral matter. Dr. Tidy was consulted by the Limerick Water Company as to whether they should remove their intake on the Shannon to a point above that where the River Mulcaire enters the main stream. The water of the Mulcaire, although otherwise good, is singularly turbid, owing to the presence of red sandstone drift mixed with more or less road mud. At first, having apparently in mind the case of the River Mole, on the Thames, Dr. Tidy was inclined to recommend the removal of the intake. But on making a close investigation of the circumstances, he found that where the muddy Mulcaire joined the Shannon, the admixture of the apparently impure water was the means of effecting purity, the mineral matter causing the deposition of the peat, both going down together. Neither was it a mere ocular phenomenon. A quarter of a mile below the junction of the Mulcaire the organic carbon fell from 0.914 to 0.61 part per 100,000, and the oxygen required from 0.37 to 0.27 grain per gallon. Some laboratory experiments further proved beyond question that a turbid feeder may be an advantage to a river, and serve as a means of purification. Accordingly, Dr. Tidy advised the Limerick Company not to move their intake.

The pollution of river water by sewage comes "last but not least." Dr. Tidy agrees with Dr. Frankland in considering this "a subject of vital importance." Dr. Tidy does not seek to evade the issue by drawing a distinction between healthy and unhealthy sewage. He regards all sewage—and contends that it should be so regarded—as unhealthy, and absolutely objectionable when existing in water used for drinking purposes. But Dr. Tidy contends that "if sewage be discharged into running water, the organic impurities will, after a flow of a few miles, be entirely destroyed or got rid of, the water once again assuming its normal condition of purity." This power of self-purification is said to depend on three things—namely, on the subsidence of the suspended impurities brought down by the sewage; on the presence of animal life in the river; and, lastly, on the oxidation of the organic matter. The question is asked: Are we never to drink water which has once been contaminated with sewage? In reply, it is said that we might as well object to breathe an air which has once been polluted by the scales of a person suffering from scarlet fever, or the infected breath of one attacked by measles. If oxidation purifies in the one case, may not the same power be expected *a fortiori* to act in the other? "dissolved oxygen," to quote Dr. Frankland's own words, "being well known to be chemically much more active than the gaseous oxygen of the air."

Three kinds of evidence are adduced in proof of the oxidation of sewage in running water. There is, first, the evidence

obtained by the unassisted eye. The sewage at an outfall is probably offensive, very turbid, and more or less brown. Tracing the sewage stream down the river, it will be seen to assume a black appearance, from the formation of sulphide of iron. A little farther on the blackness perceptibly decreases, and continues to do so almost yard by yard, until at last the river water exhibits no signs of colour, turbidity, or smell. Another test is that afforded by the sewage fungus, the presence of which is almost an absolute indication that sewage in considerable proportion is mingled with the water. Where this is the case, all signs of vegetable life, except perhaps a few straggling weeds, disappear; and no fish, or only fish of a certain kind, are to be seen. The banks and river-bed become black, and branches of any trees that by chance dip into the water will be seen covered with a black flocculent deposit. But a short distance below the outfall the sewage fungus cannot be found, vegetation becomes clean and luxuriant, fish are abundant, and the banks and river-bed, seen through the now clear water, show no signs whatever of that black deposit observed higher up the stream. In proof that these are no fancy sketches, Dr. Tidy states that he has seen the River Soar at Leicester black with sewage, no river vegetation being visible. The day following he has seen the river at Loughborough, thirteen miles below Leicester, perfectly clear, the banks clean, and fish abundant. At Manchester he has seen the Irwell polluted with every form of filth, personal and manufacturing; whereas at Warrington, after a flow of nine miles, the stream was perfectly free from everything offensive. Other instances are given, and Dr. Tidy says he could cite still more. He contends that the change which is thus apparent, whereby a foul, offensive river becomes to all appearances pure and fresh, must be due to some power of self-purification.

The next step conducts us to a more refined test—namely, that of analysis. As far down as Lechlade the water of the Thames is as nearly as possible of a normal character, practically no sewage having found its way into the river. Between Lechlade and Hampton (speaking of the state of affairs a few years ago) the river received the sewage of nearly a million people. One mile below Reading, Dr. Tidy has found the proportion of organic matter in the river to be at least double that indicated at Lechlade. But four miles farther on the water was again found to have become normal; while the organic carbon and nitrogen at Hampton, notwithstanding the sewage of the foregoing million of people, was rather less than at Lechlade. The question follows—What has become of the sewage of this million of people, if it has not been oxidized during the flow of the river? Near the spot where the sewage of Worcester is discharged into the Severn, the organic carbon is 0.842 part per 100,000. A mile below the sewer outfall the proportion is 0.510. Two miles and a quarter below Worcester (the River Teme having meanwhile joined the main stream) the proportion of organic carbon is only 0.101. From Bishop Auckland to Durham, the River Wear receives the sewage of about 100,000 people, including that of the former place. The rocky bottom of this river constitutes a series of natural weirs, and the mechanical action on the water is so great that at Durham, a distance of only thirteen miles from Bishop Auckland, the river shows a far greater degree of purity than it does above the sewer outfall at Bishop Auckland. It is singular that Dr. Tidy is able to quote the Sixth Report of the Rivers Pollution Commissioners in support of his argument. So satisfactory is the analysis of the water of the River Wear at Durham, that although it contains the sewage of 100,000 people, and the Commissioners feel bound to make some protest against the use of a sewage-contaminated river as the source of a drinking supply, yet the report describes the liquid as “a good water.” The analyses of the water of the Wear are remarkable as showing not only that the organic matter becomes oxidized, but that the water at Durham is absolutely free from nitrates. No doubt they are formed, says Dr. Tidy, but they do not reach Durham. The excess of chlorine also disappears, being probably taken up by vegetation.

Having proceeded thus far with Dr. Tidy’s paper, we shall complete our notice of it next week, at the same time advertising to the discussion which ultimately took place in reference to a portion of its contents. Necessarily Dr. Frankland objected to much which had been advanced by Dr. Tidy, though on some points he expressed a cordial agreement. Dr. Frankland also brought to his help a letter which he had received from Professor Tyndall, opposing the views of Dr. Tidy on the existence of germs. Professor Huxley likewise did battle for the bacteria, and contended that chemical analysis might declare a water to be pure which was as deadly as prussic acid.

Communicated Article.

THE ACTION OF THE BLOWPIPE
CONSIDERED WITH REFERENCE TO THE PRINCIPLES
OF GAS ILLUMINATION.

By Mr. R. H. PATTERSON, F.S.S.

CONCLUSION.

One thing certain is that a mixture of air with coal gas before ignition greatly reduces, and if increased wholly destroys the illuminating power of gas-flames. The effects of this commingling of air with gas are stated thus:—

Per Cent. of Air.	Loss of Light.	Per Cent. of Air.	Loss of Light.
1	6	8	58
2	11	9	64
3	18	10	67
4	26	15	80
5	33	20	93
6	44	30	98
7	53	40	(no light) 100

I may remark that when only a small quantity of air—say 1 per cent.—is mixed with the gas, the effect upon the illuminating power of the flame would vary very much according to the kind of burner employed. The combustion is produced by means of the external atmosphere, *plus* the air contained in the gas; so that the effect of the mixture of air will be increased or diminished according to the great or less external air supply, or draught, upon the flame. Accordingly, in the supposable case of the external air supply being deficient, a small admixture of air in the gas would actually increase the illuminating power. On the other hand, when an Argand of the old kind is employed—viz., one from which the gas (owing to the smallness of the orifices and other causes) issues under considerable pressure, thereby producing a greater draught upon the flame—the mixture of air will cause a greater loss of light than if the gas were consumed in one of the new and pressureless burners. Nevertheless, when the mixture of air rises beyond 2 or 3 per cent., the kind of burner will cease to make any perceptible difference. So that so far as the burner affects the question, it may be safely assumed that, as shown in the above figures, when the admixture of air amounts to 50 per cent. (*i.e.*, when the mixture is half air and half gas) the illuminating power becomes wholly destroyed.

Still, it seems strange that 10 per cent. of air should reduce the light by 67 per cent., while another 10 per cent. only reduces it 26 per cent. more; while a third 10 per cent. should only reduce the light 5 per cent., and a fourth 10 per cent. (*viz.*, when the air is increased from 30 to 40 per cent.) only impairs the light to the extent of 2 per cent. These are curious facts, if correct, and I do not know upon whose authority the above table rests; it is quoted by Dr. Letheby, but he does not say that he made the experiments and ascertained the facts for himself. I should be much inclined to question the accuracy of the table; but it is all we have to go by at present; and although the *gradation* of the figures may suggest a doubt, the ultimate result, that light is destroyed when the gas contains 40 per cent. of air, does not appear at all improbable, and is always accepted as an ascertained fact.

Another fact of much significance in this inquiry is the effect of a gradually increased supply of air to an Argand by means of a quickened draught upon the flame. The flame becomes smaller, but more brilliant. In a series of experiments of this kind which I made in 1870, while noting the changes both in the height and illuminating power, I also observed the changes in the *intensity* of the flame, by placing in front of the flame a metal plate with a horizontal aperture about half an inch in depth, which was raised or lowered in each experiment so as always to be on a level with the brightest part of the flame, the rest of the flame being hidden by the metal plate. The following were the results obtained, the highest illuminating power of the entire flame, and likewise of the narrow band of flame, being each taken as 100:—

Sugg’s “London” Argand, No. 1, consuming 5 Feet per Hour of 16-Candle Gas.

Experiments.	Size of Chimney.	Height of Flame.	Illuminating Power of the Entire Flame.	Varying Intensity of the Narrow Band of Flame.
No. 1.	Without chimney.	8 inches.	66.0	29.3
2.	6 in. × 1½ in.	Smoked.	98.0	82.0
3.	6 in. × 2 in.	Smoked slightly.	98.2	82.6
4.	6½ in. × 2 in.	4.0 inches.	98.7	83.7
5.	7 in. × 2 in.	3.6 "	100.0	90.0
6.	7½ in. × 2 in.	3.25 "	99.2	92.9
7.	8 in. × 2 in.	3.0 "	96.7	94.7
8.	9 in. × 2 in.	2.75 "	92.1	97.1
9.	10 in. × 2 in.	2.6 "	87.9	98.9
10.	11 in. × 2 in.	2.5 "	84.57	100.0

A mere reduction in the size of the flame, although in the above instance it amounts to nearly one-half, does not necessarily involve a diminution of light; because the same quantity of illuminating substance is consumed, and, as is shown in the electric light, even a light which in size is little more than a speck or spark may give a vast amount of illuminating power. Also, as above shown, the gas-flame constantly increased in brightness or intensity as its size was reduced. The question is, Why should the increased intensity of the gas-flame, beyond a certain point, fail to compensate for its reduction in size or volume?

In connection with this question, I may mention an opinion strongly held by Mr. Sugg, and which is more or less in accord with

some of the chemical phenomena of a gas-flame already stated. Mr. Sugg holds that the great advantage of gas being consumed without pressure is, that, when so consumed, only the oxygen of the air really impinges upon, and combines with the surface of the burning gas. We have seen that the heat of the flame produces "dissociation" within the flame (among the constituents of the gas itself); and Mr. Sugg believes that the heat of the burning gas likewise produces dissociation in the immediately surrounding portion of the air; the oxygen being disunited from the nitrogen, and being drawn in by itself to feed the flame. So far as there is a difference between this and the common opinion, it amounts to this—that the nitrogen does not really touch (and cool) the surface of the flame, but that the flame, if perfectly consumed for illuminating purposes, simply attracts and draws in upon itself the oxygen from the atmosphere. On the other hand, if the gas be consumed under pressure, there is not room for this dissociation to take place; the air is too short a time in proximity to the flame to become heated up to the point where the oxygen becomes dissociated from the nitrogen; the air as a whole, or in its ordinary state, being driven in upon the flame, whereby the surface of the burning gas is somewhat cooled by contact with the incombustible nitrogen; or, which comes to the same thing, the flame does not rise to the high temperature which it acquires when it is able (as it were) to select the oxygen from the atmosphere. Now, it is possible—I do not say more—that this fact (?) may explain how it is that beyond a certain point the quickening of the draught upon the Argand flame produces a diminution of light. More oxygen is driven in upon the flame, but it is accompanied, more or less, by the nitrogen; and in proportion as the process of dissociation in the feeding air ceases, the greater is the drawback which ensues upon the increased supply of oxygen.

Looking at the facts just passed in review—viz., the experiments with the Argand, compared with the effects of a mixture of air with the gas as manifested in the flame of the Bunsen burner and the blowpipe—it is manifest that there is a vast difference between quickening (however greatly) the draught upon a flame and mixing air with it. In the Bunsen burner and the blowpipe, where air is intermixed with the gas or its flame, the illuminating power becomes destroyed; whereas, so long as the air plays only upon the surface, the flame, although diminishing in size, increases in brilliancy.

The two explanations of the action of air in reducing or destroying the illuminating power of gas are entirely conflicting. One of these, and the received opinion, is that the carbon particles of the gas are too quickly consumed to allow of their emitting or developing light; the other opinion, partially held, is that the air impairs or destroys the luminosity of the gas by cooling the flame. Now, as quickened consumption of the gas implies a higher temperature of combustion, it is obvious that, in the first of the two explanations, the luminosity is destroyed by the gas being burnt at too high a temperature; while, by the second explanation, the light is destroyed by the gas being burnt at too low a temperature. Which of these explanations is the right one? or perhaps we should say, *how far* is either of them right?

The second is the more readily intelligible. Every one will acknowledge that cooling a flame reduces its luminosity; and the sole object of heating the air and gas is to raise the temperature of combustion, and thereby obtain more light. On the other hand, the former and received explanation more fully accounts for the very various phenomena.

In favour of the cooling hypothesis, it is certain that when the air supply increases to a certain (or, rather, very uncertain) degree, a flame is extinguished altogether. It is blown out. The mass of air thrown upon the flame entirely destroys combustion. And in this case there cannot be a doubt that the flame is extinguished by being cooled. Again, a sudden draught or gust of wind (as Dr. Letheby once pointed out) will make a flame smoke. In this case the air is not enough to extinguish the flame, but it so cools it as to leave part of the carbon unconsumed. These are indubitable proofs of the cooling action of air upon flames, in reducing their illuminating power.

Next, as to *doubtful* proofs of the same thing. As shown in the Argand experiments, when the draught increases beyond a certain degree, the illuminating power is somewhat impaired; and also when air is mingled with the gas before ignition, the decrease of luminosity is very marked; but whether are these effects produced by cooling the gas, or by "over-combustion," which means an increased temperature of combustion? We can readily understand the first hypothesis, but the second conflicts with the well-known and universally received maxim that the higher the temperature of an illuminating substance, the greater its luminosity. Hence, if ready inference were to settle the question, one would say that in all these cases (as indubitably in the two first mentioned) the decrease or destruction of light was owing to the "excess" of air *cooling* the flame.

But how can we believe that the gas-flame is cooled by an intermixture of air, if the Bunsen burner and the blowpipe give hotter flames than the ordinary ones? As already stated, my experiments (not decisive) indicated that the Bunsen flame is not so hot as that of an ordinary gas-burner; as I have also shown that, despite its greater results (owing to a more powerful *application* of the heat), it is not *certain* that the blowpipe has any superiority in heat of flame or temperature of combustion.

It is certain that air may be thrown on a flame in such quantity as to extinguish it; and that this is owing to the large proportion of incombustible nitrogen contained in the air. But is it not conceivable (and theoretically certain) that even an excess of oxygen would do the same; for every particle of it which is in excess—i.e., which cannot combine with the combustible gas—is just as incombustible as nitrogen itself.

There must be a certain quantity of air supply which is best for developing the illuminating power of gas; and too much or too little must be adverse to the illuminating power. Everybody knows this. And also every one knows how *too little* air impairs the light, whether by the total combustion being sluggish, at a low temperature, or by part of the gas not being consumed. But how does the *excess* of air operate? In great quantity, I repeat, air wholly extinguishes a flame, by cooling it; but, short of this quantity, is there an excess of air which actually raises the temperature of the flame, yet destroys its illuminating power? This is what the received opinion maintains. Is it correct?

Manifestly, I think, the effects upon the illuminating power of mixing air with the gas *before ignition* (as shown in the experiments quoted from Dr. Letheby); of mixing the air with the gas *partially* before igniting, as in the Bunsen burner; and of mixing the air with the burning gas (or with the gas-flame), as in the blowpipe, are ascribable to the same cause, whatever it be. The effects of quickening the draught or air supply upon the *surface* of a gas-flame (as shown in the experiments with the Argand) may belong to a different cause; nevertheless, it is probable that they are produced by the same cause, but operating in a gentler fashion. Therefore we come to the ultimate question—Is the decrease and eventual destruction of the illuminating power of gas exhibited in the Bunsen burner and the blowpipe, occasioned by the excessively quickened combustion of the gas, at an increased temperature (called "over-combustion"), which is the received doctrine; and, if so, how are we to explain this phenomenon in the face of another received opinion, that the higher the temperature of combustion the higher the illuminating power? Or is it a mistake that the Bunsen burner and the blowpipe consume the gas at a higher temperature; and are the whole phenomena of loss of light from an excessive air supply due to the *cooling* of the flame?

P.S.—It seems impossible to ascertain the temperature of combustion of the gas-flame from a blowpipe in a manner applicable to the present question—namely, to determine the absolute temperature at which the gas burns, irrespective of the high *applied* heat produced by a concentration of the flame. But it is an easier matter to test the heat of a Bunsen flame compared with that of an ordinary burner; and if, despite the somewhat smaller volume in which the gas burns in the Bunsen apparatus, the ordinary gas-flame shows the higher temperature (as appeared in my confessedly inadequate experiments), then the general belief as to the superior temperature of the Bunsen burner must be abandoned. Will some of your readers make such experiments for themselves, and thereby take one step towards finding a conclusion to the case, the very various parts of which I have now set forth?

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

MR. NIVEN'S PAPER ON CORRECTIONS FOR TEMPERATURE AND PRESSURE.

SIR,—In the last number of the JOURNAL a report is given of Mr. D. C. Niven's paper, with a rather lengthy title, on the methods of correcting gaseous volumes for temperature and pressure. Some of the expressions in that paper are so strange (and I say this without the slightest intention to be offensive), that, if the author's name had not been given, I should be fairly puzzled to determine whether the paper was the production of a person who was fully instructed on the subject, or of some one who had just applied himself to its study. I am convinced, however, that Mr. Niven understands the subject well; but his enthusiasm in the cause of "simplification" has led him to attach an undue importance to differences which are of little moment in a practical point of view.

Mr. Niven says: "The factor 480 can now hold no place in the volume and temperature of gas;" by which expression he means, I presume, that the factor 480 as a coefficient of expansion can now hold no place in any formula for correcting the volume of gas for temperature.

Perfectly correct; but when Mr. Wright calculated his tables of volumes, 480, as determined by Gay Lussac, was the accepted coefficient, and continued to be accepted until Regnault finally fixed it at 491.2 Fahr., or, as he gave it, .0036666 C. That differences in the tabular numbers, as given by different authorities, should exist, ought to be no cause for surprise to a mathematician; the coefficient of expansion of air and gases lying between 491 and 492, some persons will elect the one and some the other, this making a difference, although a small one. Again, the tables are limited to four figures, and this limitation involves errors, some of the numbers being a little too small, and others a little too large—which numbers may be in excess and which in deficit depending to a certain extent upon the election of the calculator. Thus, taking the first page of Table C in the Appendix to the "Gas Analyst's Manual," and following the first line vertically, it will be found that the progression in difference is by 4 and 3—thus, 4, 4, 3, 3, 4, 4, 3, 4, 3, 4, 3; while horizontally it is 5, 4, 5, 4, 5, 4, and so on. If the figures be traced angularly from 998 on the top of the first column to 981 in the right-hand column, the progression is 1, 1, 1, 2, 1, 1, 1, 2, 1, 2, 1. Even if the numbers were extended to seven or eight figures, similar but smaller differences would still arise. The table just mentioned only contains a few figures of my own, it being otherwise a copy of that issued by the Metropolitan Gas Referees, and the figures differ from the older tables because, first, aqueous tension is taken into account, and the coefficient 492 is taken for temperature. Taking extremes, 28 inches and 31 inches Bar., and 32° and 84° Ther., the numbers in Mr. Wright's table are 988 and 987; while in the new table they are 998 and 967, showing in each case a difference of a little over 1 per cent., but in contrary directions. As, however, the difference would only operate one and not both ways at a time, we see that, in

correcting for volume, where illuminating power is concerned, the new table should, at 32° Fahr. and 28 inches Bar., show the gas to be 1 per cent. less in power than the old table, and at 84° Fahr. and 31 inches Bar. 1 per cent. greater. Thus:

Illuminating power	17.5
Multiply by	1000

Table No., old table, 32° and 28 in. 998)17500

Result 17.71

As before 17.5
1000

Table No., new table, 32° and 28 in. 998)17500

Result 17.53

The difference in candles is 0.18—surely no great and serious matter.

Mr. Niven says the rule given for the correction of volumes of gas to true bulk (i.e., bulk which such volume would occupy at 60° Fahr. and 30 inches Bar.) "seems to convey the idea that the table can be used for corrections for temperature and pressure." I am very glad that the words do so seem to convey such an idea, for they were absolutely intended to do so; "and yet, if that be so, there are at least apparent mistakes." In what? If in the numbers, the cause has already been explained, and the little importance of such differences indicated. The table shows us to what extent 1000 volumes at various pressures and temperatures would be in excess or deficit, if subject to what is still called standard temperature and pressure. Hence the performance of the operation indicated by the rule gives the true bulk, not only as nearly as any practical man can require, but sufficiently so in most cases for the wants of the scientist.

Mr. Niven has been good enough to say that I am in general a clear writer; I can only hope that what I have now written will be sufficiently clear to show him that it is scarcely worth while to strain at the gnats of small errors while the camels of graver ones remain to be swallowed. I admire the ingenuity of Mr. Niven's formula, but am afraid I am now a little too fixed in the old mode to take kindly to the new.

55, Millbank Street, London, June 2, 1880.

F. W. HARTLEY.

THE USE OF GASEOUS FUEL.

SIR,—In reference to your remarks in the "Circular" of the 25th ult., concerning the duty of gas fuel in water heating, as given in my lecture before the Society of Arts, I may state that the results were obtained, not with a test meter, but with a jet which had been tested at the Warrington Gas-Works, and verified afterwards at the Birmingham Gas-Works. Both experimenters said that the jet passed, at 10-10ths pressure, 24 cubic feet of gas per hour. The apparatus I used for the experiment has been sold, and therefore I cannot repeat it under precisely the same conditions. The gas was burned perfectly in one solid flame, with precisely the right proportion of air for complete combustion, and the products of combustion were cooled down by the feed water, leaving the apparatus at a temperature not exceeding 70° Fahr.

To prove that there was no glaring error such as you imagine, I have repeated the experiment with one of my ordinary pattern water heaters, having fifty coils of very thin copper tube. In this there is a decided loss of heat by radiation from the outer casing, and the products of combustion leave the apparatus at 115° Fahr. In this I find that the available duty, working with a tested jet passing, at 10-10ths pressure, 20 cubic feet of gas per hour, is equivalent to 6½ pints or 135 fluid ounces of water heated from 52° to 212° Fahr. with 1½ cubic feet of gas. The difference between this result, which I have obtained three times on three different days, can, I think, be fully accounted for by the comparative imperfection of the apparatus used in the last experiment.

I have no test meter to absolutely verify the results, but I have a complete set of jets tested under different pressures by Mr. James Paterson, of the Warrington Gas-Works, and verified by Mr. Wood, of the Birmingham Gas-Works, and these jets (not copies of them) were used in my experiments. As I worked without a meter, I was careful to state that it required about 1½ cubic feet of gas to boil one gallon of water, leaving by my wording a margin for possible errors which I could not check with my own apparatus.

I enclose a copy of the jet which was given to me as passing, at 10-10ths pressure, 20 cubic feet of gas per hour. With this jet and gas at the specified pressure I heat 6 pints of water in 1 minute from 52° to 92° Fahr., which is equivalent to 1½ pints to 212° Fahr. As the burner requires at 20 cubic feet per hour 4½ minutes to pass 1½ cubic feet of gas, it would appear that either your remarks are slightly incorrect, or the jet has been twice tested by good authorities with the result of a blunder exactly corresponding in both cases. That the latter is not the case I am certain, as, since writing the above, I have tested the jet I now send with the drum of my ordinary meter, and it is, if not absolutely correct, so near that I cannot detect any error. The gas used was the ordinary "stock pattern, warranted always good alike," as supplied by the Warrington Gas-Works, and the odd ½ cubic feet used for my first experiment were not manufactured specially for the occasion. If it was wonderful, it is a daily and nightly wonder all the year round. It is evident there is something wrong somewhere, as the available duty, even in a very imperfect apparatus, is greater than that stated as the maximum theoretical duty possible. I have been informed that the available duty, as obtained in the injector furnace, is also greater than the maximum theoretical duty of the fuel used, this information coming from a well-known chemist as the result of his own work and experiments with the furnace, and not from my statements or results.

Warrington, June 2, 1880.

THOMAS FLETCHER.

[The basis upon which the comments referred to by Mr. Fletcher were made, is an analysis of common coal gas made by Dr. Letheby, and quoted by Dr. Wallace in our issue of Dec. 9, 1879, p. 902. In this the calculated thermal power of 1 foot of 12-candle gas is stated as 621 units. We allowed for slightly better gas in giving 1050 units as the heating power of 1½ cubic feet. A gallon of water weighs 10 lbs., and

there are 162 degrees between 50° and 212°, hence 1620 units of heat are required to raise it through this range of temperature when 1050 only are available. If Mr. Fletcher is right, it follows that Dr. Letheby is wrong; but the onus of proof certainly lies with the former gentleman. We do not pretend to say where the mistake has been made, but that there is a discrepancy Mr. Fletcher admits.—Ed. J. G. L.]

PUMPING GAS AT BECKTON AND LIVERPOOL.

SIR,—In this week's JOURNAL the pumping machinery as made by Messrs. Gwynne and Co. for Liverpool is illustrated, and for some weeks past you have kept us amused in your correspondence columns by the claims of that firm to be the first to make such an arrangement, which they state they patented in December, 1871.

I think Mr. Trewby is quite right in saying they merely added to Her Majesty's Exchequer by so doing, for in the summer of 1870 I erected at the Great Brunswick Street works of the Dublin Consumers Gas Company two larger exhausters, coupled direct to the shaft, one on each side of a 16-horse power horizontal high-pressure engine, the slides of exhausters set at right angles to reduce oscillation, and of which your illustration this week is a copy.

I have no doubt the members of the British Association of Gas Managers will remember seeing them in action, on their visit to Dublin in June, 1871, and as I did not patent it, any engineer was at liberty to adopt the same arrangement.

It is an example of the old proverb that "necessity is the mother of invention," for there was not room in the engine-house to put down two separate engines and exhausters, so I designed that arrangement for the sake of economy in space and money. The engine was made by Messrs. J. and J. Ellis, of Salford, and the whole apparatus worked admirably.

I had no intention of intruding myself upon your notice, but when Messrs. Gwynne and Co. so repeatedly and boastfully lay claim to *their being the first to see the necessity for such an arrangement*, I think they had better be reminded that they were not the first to erect and use what, after all, is but a trifling matter, and which any engineer would do under similar circumstances.

South Metropolitan Gas Company,

JOHN SOMERVILLE.

589, Old Kent Road, S.E., June 5, 1880.

EMPLOYERS LIABILITY BILL.

SIR,—There are three Bills under the above title now pending in Parliament—one in the House of Lords, and two in the House of Commons. Of those in the Commons, one is promoted by Her Majesty's Government, and the other by the members who are supposed to represent the interests of the working classes. The main object of all three Bills is the same, although they differ in the mode of carrying it out. As, however, the Government Bill is the only one likely to be proceeded with, it is unnecessary to do more now than state what the provisions of this Bill are, and these may briefly be described as follows:—

"The workman, his wife, children, or legal representatives, shall have the same right of compensation and remedies against the employer as if he had not been a workman of, or in the service of the employer, nor engaged in his work: Provided always that the workman injured did not materially contribute by his own negligence to the cause of his injury."

In the early part of last week this Bill was placed on the list for second reading on Thursday, the 3rd inst. As this was rather sharp practice, the railway companies, coal and iron masters, dock companies, and others, asked the Prime Minister to receive a deputation from them before the second reading, and he appointed Wednesday, the 2nd inst., for the purpose. Thereupon a general meeting of all parties interested was convened for the Tuesday preceding, to consider and determine what course should be pursued at the interview with the Prime Minister; and all large employers of working men—gas companies among the others—were invited to send representatives to the meeting, and the gas companies did so. The meeting was well attended, and after some discussion it was resolved unanimously to urge the Prime Minister to refer the Bill to a Select Committee, to consider the expediency of establishing a mutual insurance between employers and employed, each paying equal contributions, instead of the provisions then in the Bill.

The Committee of the Gas and Water Companies Association then held a meeting to consider this proposal, but with only the information then before them they did not feel authorized in saying that the Association would either accept or reject it, and therefore decided to accompany the deputation, but not make any special reference to the gas companies case.

At the interview with the Prime Minister all the persons who addressed him strongly recommended the adoption of the course proposed in the resolution passed at the preliminary meeting. In reply, he thanked the deputation for having so clearly expounded their views, and said that they should receive his careful consideration, but that he could not at that time pledge himself to any particular course, or say whether Her Majesty's Government would or would not consent to the Bill being referred to a Select Committee. Since then the Bill has been read a second time, and passed through a Committee of the whole House (*pro forma*), with alterations. It is, therefore, now in the hands of the Government, to be altered as they think fit. When they have decided in what shape they will proceed with it, it will be reprinted and brought forward again, and then if the opponents are dissatisfied, they can move that it be referred to a Select Committee; but at present the Government decline to say whether they will adopt that course or not.

Much might be said against the Bill, both as to the principle and detail; but as it may, and doubtless will be very considerably altered when brought forward again, it would be but a waste of time to go into the objections now. When the Bill is reprinted a copy will be sent to all the members of the Association, and the Committee will hold a meeting to consider what course it may be desirable to recommend the companies to adopt.

W. LIVESKY.

Gas and Water Companies Association, 6, Victoria Street,
Westminster Abbey, S.W., June 7, 1880.

Parliamentary Intelligence.

PRIVATE BILLS RELATING TO GAS, WATER, &c.

SESSION 1880.

PROGRESS MADE TO SATURDAY, JUNE 5.

Title of Bill.	Parliamentary Bill.	Bill Read the First Time.	Bill Read the Second Time.	Bill Reported.	Bill Read the Third Time.	Bill Received Royal Assent.
Ackworth, Featherstone, Purston, and Sharlston Gas Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Birkenhead Borough Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
British Gaslight Company, Limited (Staffordshire Potteries), Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Burton-upon-Trent Corporation Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Cardiff Water Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Chester Gas Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Cork Gas Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Cork Improvement Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Dagenham and District Electric Light and Power Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Dartford Gas Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Dearno Valley Water Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Deuton and Haughton Gas Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Doncaster Corporation Water Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Eastbourne Gas Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Edinburgh and District Water Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Exmouth and District Water Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Gaslight and Coke, Commercial Gas, and South Metropolitan Gaslight and Coke Companies Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Great Yarmouth Water Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Hinckley Local Board Gas Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Huddersfield Tramways and Improvement Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Hull Lighting Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Hyde Gas Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
King's Lynn Corporation Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Lancashire County Justices (Water, &c.) Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Lancaster Corporation Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Lincoln Gas Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Liverpool Corporation Water Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Liverpool United Gas Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
London Gaslight Company Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Maidstone Gas Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Malton Gas Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Oldham Improvement Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Phoenix Gaslight and Coke Company Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Portmadoc Water Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Prescot Gas Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Preston Improvement Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Rathmines and Rathgar Township (Vartry Water Supply) Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Rathmines and Rathgar Township Water Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Reading Gas Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Rochester Corporation Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Sea Water Supply to London Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Sligo Borough Water Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
South Metropolitan Gas Company Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Southwark and Vauxhall Water Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Stafford Borough Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Wakefield Corporation Water Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Wandsworth and Putney Gas Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Wigan Improvement Bill	Commons	Feb. 9	Feb. 10	March 5	..	..
Wrexham Water Bill	Lords	Feb. 9	Feb. 10	March 5	..	..
Yeadon and Guiseley Gas Bill	Commons	Feb. 9	Feb. 10	March 5	..	..

HOUSE OF LORDS.

MONDAY, MAY 31.

The Select Committee on the Sligo Borough Water Bill reported that they had not proceeded with the consideration of the Bill, no parties having appeared in opposition to it.

THURSDAY, JUNE 3.

The Chairman of Committees informed the House that the opposition to the Chester Gas Bill was withdrawn.

FRIDAY, JUNE 4.

A petition against the Prescott Gas Bill was presented from London and North-Western Railway Company.

LONDON WATER SUPPLY.

The Earl of CAMPERDOWN: My lords, the question of the Metropolitan Water Supply appeared last session in the shape of a Bill, which met with an untimely fate, and it now appears in the new Parliament in a different shape. I am not now going to make to your lordships a speech on the subject generally, but I simply wish to call your attention to one point in respect to this question, which, if not properly attended to at the present time, will in a short period naturally entail considerable additional outlay on the ratepayers of the Metropolis. I find that this question, which is now under the consideration of the present Government, has been taken up in a different shape, and last night a Select Committee of the House of Commons was appointed, and the question was referred to them in very wide terms. Now the first remark I have to make upon the terms of the reference to the Committee is this: They are to inquire into two or three subjects and have discussions upon them, which, if they progress with that want of rapidity that is usual with Parliamentary Committees, will make it highly improbable, and almost impossible, that the report should be received from them during the present session of Parliament; and even if the report should be made to Parliament this session, it will be next to impossible to introduce a Bill to enforce the existing agreements, or any modification of those agreements which may be found satisfactory; and, of course, if this inquiry takes place, and the agreements are not found to be satisfactory, the whole matter would be thrown over, and legislation deferred. In what state will the ratepayers then find themselves? I have submitted this question to your lordships because, after all, the case of the ratepayers is only at present half brought before you, and that part which is brought before you is the less important half. The more important matter to the ratepayers of London at the present time is, how are we to prevent new powers of rating at a far higher rate accruing to the Water Companies hereafter? My lords, I would point out to your lordships that the existing agreements—what I may term the inchoate arrangements—of the Water Companies will expire at the end of the present month, and if nothing should be done before that time, and supposing that the agreements are dead and are not to be renewed on the 1st of July next, the assessment that would come into force on that day will furnish new evidence of the value of the houses that are rated to the water-rates. So far as my experience goes, from what we have known to take place in former years, the ratepayers of the Metropolis will become liable to pay a still higher charge for their water supply, it being remembered that they will be supplied with exactly the same article; and the consequence will be that the ratepayers will find themselves landed in considerable difficulty. Under these circumstances, what we naturally look to is for the Legislature to protect us from such a state of things, which is certainly not the state of things that ever was contemplated at the time the Water Companies came into existence, and when the original undertakings were first begun. Next comes a question which we are bound to consider, and it is that wherever there is an increase of value, and a new assessment is made, the ratepayers would naturally be subjected to an increase in the amount of the rates. In my view it is the proper function of a municipal body to have the charge of this question; but, unfortunately, we are obliged to accept things as they are, and, as a matter of fact, there is no municipal body in London to take them up. No one who has the slightest experience could say that the ratepayers should be left unprotected; therefore there must be some power or some body of the Executive Government who should *primâ facie* have power to protect the London ratepayers. At present it does not appear to be the duty of any one to do so, and if, unfortunately, no notice should be taken of this matter, and no measure be passed during the present session of Parliament for the purpose of concluding such an agreement, the ratepayers will consider that, looking to the fact that this matter has been introduced at least two or three times to your lordships attention, their interests have been neglected, or at all events not been attended to, and they will feel some indignation, and not without reason. Therefore I wish to ask whether it is the intention of Her Majesty's Government to take any steps to protect the ratepayers of the Metropolis from arbitrary augmentations of assessment by the Water Companies, in the event of no fresh bargain being concluded with them during the present session of Parliament, or whether the Government propose to refer the whole Water Question, including the means of protecting the ratepayers, to a Select Committee of the House of Commons.

The Earl of FIFE: My lords, I am sure my noble friend will believe me when I say that Her Majesty's Government are as fully alive as he is to the necessity of consulting the interests of the ratepayers in this respect. It is certainly a most important subject, and I am fully aware of the great attention which my noble friend has given to it. I am sure he will bear me out when I say the question is one of great magnitude, as well as one involving many varied interests, both from a financial point of view, and in its sanitary character; and, therefore, it is no wonder that its settlement is attended with such great difficulty, and cannot be attempted without much care and deliberation. At this stage I cannot help thinking that I should be serving no useful purpose if, while the whole matter is in the crucible, I were to allow myself to be drawn into any general argument on the incidence of the water-rates of London. In regard to one point, however, I will venture to refer your lordships to the well-known case, bearing upon this question, of the *New River Company v. Mathers*. This case shows that whenever a ratepayer considers himself aggrieved in the matter of the annual valuation which a water company may arbitrarily fix, he is at liberty to have the annual value assessed by two justices. If this be so, then, I think, such a proceeding would prove a remedy for such an excessive demand as my noble friend seems to anticipate. I think also that we may gather from the remarks made last evening by the Home Secretary, in the House of Commons, that he is not prepared to see the water-rates in the Metropolis raised out of all proportion with the rest of the country, neither does he desire to close the door against any other more economical scheme of water supply being brought forward; and, if these objects can be attained for, say, 20 millions instead of 30 millions, I think that no one will regret the discussion which has taken place upon the subject. My noble friend seems to expect that people should step forward and deal with this question in a practical manner; but he does not seem to be aware that the Government are taking such practical steps. If the Government were to attempt to abrogate the

present parliamentary rights of the Water Companies, it would be taking away from them a statutory right of property which they now have, and this I am sure your lordships will think would not be consistent with principles of justice, and would be a course of Government interference with lawful remuneration in cases of commercial enterprise. It is not by interfering with private rights that exorbitant charges can be met. That a remedy can and will be found I am quite certain; but it seems to me that it would be against all ordinary rules of justice to take away the rights possessed by these Companies. We know perfectly well that the City authorities have power to obtain a fresh water supply for London if they like, and therefore I think it will be better to abstain from any extreme measures. With regard to referring the matter to a Select Committee, I must remind my noble friend that the Committee to which it has been referred represents the whole of the ratepayers of London, and they are entirely in favour of the Metropolitan Board acting with the City Corporation and the Vestries for this purpose. Many of the recommendations which have been sent to the Home Office have been embodied in the recommendations to the Committee, and all I can say is that if, after the Committee have thoroughly investigated the question, and made their report to the Government, my noble friend is not satisfied with the report, he will stand alone in his opinion.

HOUSE OF COMMONS.

MONDAY, MAY 31.

A petition against the Liverpool Corporation Water Bill, and to dispense with the Standing Orders in respect to it, was presented from the Corporation of Oswestry.

The petitions were withdrawn, of North-Eastern Railway Company against the Malton Gas Bill; and of (1) Chester Water Company, (2) Brymbo Water Company, (3) Ruabon Water Company against the Wrexham Water Bill.

THE GOVERNMENT AND THE METROPOLITAN WATER QUESTION.

Mr. BRAND asked the Secretary of State for the Home Department whether the Government intended to introduce a Metropolis Water-Works Purchase Bill, with a view to refer the terms of purchase under the Water Purchase Bill in the last Parliament to a Select Committee; and if not, whether the Government would take any steps to maintain the basis of valuation upon which the Water Purchase Bill was framed, or to prevent the Water Companies from augmenting the nominal value of their property by charging extra rates upon any increase in the assessment of property by the new valuation now in progress under the Act of 1869, or by their own assessment other than new houses coming under supply.

Sir W. V. HARCOURT: As the question of my honourable friend involves large pecuniary interests, which might be prejudiced by a postponed or imperfect statement of the intention of the Government, I shall ask the indulgence of the House if what I have to say extends somewhat beyond the ordinary limits of an answer at this table. It may possibly be deemed convenient that I should take this opportunity of stating with precision the course which the Government intend to pursue with reference to the measure called the Metropolis Water Purchase Bill. It is within the knowledge of the House that a Bill was introduced in the last Parliament to give effect to certain agreements which had been negotiated with the Water Companies with a view to their purchase. That Bill came to an end at the dissolution, if not before. Most gentlemen present are probably acquainted with the circumstances which have cast grave doubts on these agreements, in regard to their prudence and the advantages to be derived by the public in carrying them into effect. It seems to Her Majesty's Government quite impossible to take any steps to give validity to these agreements without a public and searching inquiry into the real character of the documents, and their actual relation to the value of the property to be acquired under them. The Corporation of London and the Metropolitan Board of Works, the two most important representative bodies of the Metropolis, have addressed to me memorials desiring such an investigation, and have undertaken to render the requisite assistance in conducting it. In my opinion this is a most wise and reasonable request. Nothing short of such an investigation will satisfy the public mind as to the true character of these agreements, and of the property with which they deal. The Government will, therefore, ask the House to appoint a Select Committee to carry out this inquiry. The exact terms of the order of reference are matters of some difficulty. It is obviously not expedient to give the inquiry too large a scope, so as to hang up this urgent question indefinitely. The inquiry into the agreements can be brought into a moderate compass, so as to be disposed of in the present session. An investigation of the whole question of water supply would evidently extend to far wider limits; at the same time it would not be possible or desirable to exclude from the mind of a Committee appointed to examine the proposed terms of purchase, the consideration of the question whether the purchase of the undertakings of the existing Water Companies is in itself the only or the best possible alternative, and whether it might not be more desirable to obtain from other sources a better supply at a cheaper rate. There is another question the Corporation in their memorial point to as a subject for inquiry, namely, the basis of the charge for water—*i.e.*, the basis on which the powers of the Companies are founded, and which enables them to raise their water-rents, without limit, in proportion to the growth in the value of houses, without themselves expending any further moneys or rendering any additional services. That likewise seems a matter deserving of inquiry and redress. In conclusion, I only wish to say one word as to the attitude of the Government towards this question. As respects the agreements, they accept no responsibility in regard to them. As they are to form the subject of a public inquiry, it is not desirable that I should even express at this moment the opinion I entertain of them. The Government will lay them impartially before the Committee, neither as attacking nor as supporting the agreements, but prepared to deal with them as may seem best, after their true value has been ascertained. I presume they will be explained to the Committee by the gentleman who negotiated them, and who will not be the witness of the Government. They will be criticized, tested, and sifted by the representatives of the Corporation and the Board of Works. What course the Water Companies may think fit to take with regard to them I cannot at this moment say, as I have not received any communication from them. But, of course, every facility they may desire will be placed at their disposal in order to state their case as they may think fit; and by this means the Committee will be enabled to form a sound judgment on the matter of the agreements. With reference to the whole question of the Water Supply of the Metropolis, I would observe to the House that it is not *primâ facie* an Imperial question which belongs strictly to the province of the Executive Government. It is, and ought to be, if the proper machinery were available, a question of local metropolitan administration. On this, as on many other subjects, we have to deplore the want of a central metropolitan authority for the general government of London. That is a great and urgent question, and I hope that this Parliament will not close without making an earnest attempt at its solution. But in the meanwhile it is the duty, as it is the wish of the Government to assist the inhabitants of London in supplying the defects of their local organization. I have thought that the best avail-

able means in the present instance was to invite the co-operation of the Corporation and the Metropolitan Board to aid the Government in a solution of the difficult matter we have to deal with. I am happy to say that this appeal has been cordially responded to. Both these great bodies, representing the inhabitants of London, have expressed their willingness to co-operate with the Government and with one another before the Committee. This seems to me a good augury for the future, and it is in such a combination that I see the best hopes for dealing hereafter, in an adequate manner, with a matter which so deeply concerns the health and wealth of this great Metropolis.

TUESDAY, JUNE 1.

The King's Lynn Corporation Bill, the Rochester Corporation Bill, the Maidstone Gas Bill, and the Great Yarmouth Water Bill were referred to a Select Committee, consisting of Mr. Dodds (Chairman), Mr. Schreiber, Mr. Justin McCarthy, Mr. Northcote, and Sir John Duckworth (Referee); to meet on Tuesday, June 8.

The Hull Lighting Bill, the Wigan Improvement Bill, the Hyde Gas Bill, and the Ackworth, Featherstone, Purston, and Sharlston Gas Bill were referred to a Select Committee, consisting of Lord Eustace Cecil (Chairman), Mr. W. O. Cartwright, Mr. Brodrick, and Mr. Grafton; to meet on Wednesday, June 9.

The Cork Gas Bill and the Wrexham Water Bill were referred to a Select Committee, consisting of Mr. Abel Smith (Chairman), Mr. Samuelson, Lord Moreton, Baron de Worms, and Mr. Bonham-Carter (Referee); to meet on Wednesday, June 9.

The Huddersfield Tramways and Improvement Bill, the Preston Improvement Bill, and the Oldham Improvement Bill were referred to a Select Committee, consisting of Colonel Loyd-Lindsay (Chairman), Mr. Tillet, Mr. A. Grey, and Sir William Palliser; to meet on Thursday, June 10.

LOCAL GOVERNMENT (GAS) PROVISIONAL ORDER BILL.—This Bill was read a second time, and committed.

LIVERPOOL CORPORATION WATER BILL.—This Bill was specially committed to a Select Committee of nine members, five to be nominated by the House, and four by the Committee of Selection.

THE WATER SUPPLY AT LONDON FIRES.

Mr. S. BALFOUR asked the Secretary of State for the Home Department if his attention had been directed to the proceedings, as reported in the *Standard* newspaper of the 27th of May, at the inquest held on the death of two men by fire at North Woolwich, when all the witnesses complained of the lack of water; several of the jury said that the water service, which was nominally constant, had been practically no supply at all for a fortnight; and the Coroner remarked that he had just seen children begging for water at the railway station. And if he would direct inquiries to be made on the subject, and take such steps as might be necessary to compel the Metropolitan Water Companies to fulfil their statutory obligations to provide a sufficient supply of water for the extinction of fires.

Sir W. V. HARCOURT said, with respect to the first part of the question, that he had received a letter from the Coroner, dated the 31st of May, and stating that according to the accounts of various persons who attended the inquest in regard to the death of the two men who lost their lives by the fire referred to, the report in the *Standard* was perfectly correct, that it was clear no water was to be had on the occasion, and that the supply of water at Silvertown was most insufficient, while sometimes there was no supply at all. With respect to the second part of the question, he (Sir W. V. Harcourt) was sorry to say that the statutory power alluded to did not exist. From the report of the Fire Brigade Committee it appeared that the Companies were controlled in common by certain general enactments; but, subject to these, were governed by their own special Acts, having a separate system of pipes, and peculiar regulations suitable to their own circumstances; that none of the Companies were under obligation to provide water sufficient for the extinction of fires, all that was required of them by the general enactments being that they should allow the gratuitous use of their water for that purpose, and grant certain special facilities; that under the special Acts they were treated as mere purveyors of water for ordinary consumption, considering solely the convenience of their customers and the profit of their Shareholders; and that therefore what was needed for the extinction of fires was an immediate and ample supply of water at high pressure. This, he believed, was a true statement of the existing law on the subject, and he thought it was one of the most unsatisfactory features of the present Water Supply of the Metropolis.

WEDNESDAY, JUNE 2.

The *locus standi* of (1) Roger A. Rashbotham and (2) C. F. O. Davis (for himself and Eliza Flint) and William Johnson, as petitioners against the Wrexham Water Bill, was disallowed.

GAS AND WATER ORDERS CONFIRMATION BILL.—This Bill was read a second time, and committed.

THURSDAY, JUNE 3.

LIVERPOOL CORPORATION WATER BILL.—On the motion of Mr. Dodson, the Committee on this Bill were nominated—viz., Mr. Stevenson, Mr. Joseph Pease, Mr. McLagan, Sir Gabriel Goldney, and Mr. Knowles.

LONDON WATER SUPPLY.

Sir W. V. HARCOURT, pursuant to notice, moved—"That a Select Committee be appointed to inquire and report as to the expediency of acquiring, on behalf of the inhabitants of London, the undertakings of the existing Metropolitan Water Companies; and also to examine and report whether certain agreements, or any of them, already entered into provisionally for the purchase of these Companies would furnish a satisfactory basis for such an acquisition; and further to inquire and report as to the nature and extent of the powers of the Water Companies to levy water rates and rents, and how far it may be desirable to modify the same."

Sir R. A. CROSS: I am glad to find that the right honourable gentleman has come to an understanding with us. The first point is that he has apparently come to the conclusion that this matter is one of considerable difficulty, that there are a number of points which require most careful consideration, that it is not a question to be dealt with at hap-hazard by any manner of means, but that it does require great care, and is a very difficult question to deal with, especially considering the fact of the number of Water Companies which supply water to the Metropolis, and also the fact that in the Metropolis there is no body to undertake the whole supply of water. I am also glad to find that the right honourable gentleman has not the slightest idea of treating this matter as a party question. I have always, throughout all the negotiations, endeavoured, so far as was possible, to divest it of all party aspects of every sort or description. The right honourable gentleman must know that the first person to whom I applied for assistance in case the Bill of the late Government should be read a second time was the present Foreign Secretary, in order to obtain his assistance in nominating the Committee. I did that for the purpose of showing my anxious desire that no party bias should be displayed in forming the Committee, and therefore I can assure the

right honourable gentleman at the present moment that all my friends on this side of the House will be perfectly willing and ready to give him all the assistance possible in order to bring this matter to a satisfactory conclusion for the benefit of the Metropolis. I observed in the somewhat elaborate statement the right honourable gentleman made to the House the other day, in answer to a question, certain remarks to which I wish to make allusion. I observed that the right honourable gentleman very properly congratulated himself, and put it to the House as a matter for congratulation, that he had secured the co-operation of the Corporation of the City of London and the Metropolitan Board of Works in the undertaking. But the way in which this was put, and the suggestion that it was a good augury for the future, seemed to me to imply that the right honourable gentleman thought that this was the first time those promises had been made. I can only say, in justice to myself and to the Corporation of the City of London, and also to the Metropolitan Board of Works, that this was very far from being the case. I myself took them into communication, and I found them most ready to offer every facility for the passage of the Bill. I should be wrong if I did not at the present moment state that I have always received from the Corporation of London the greatest possible assistance in many ways, and my honourable friend who presides over the Metropolitan Board of Works I have always found, as well as the Board, most ready and willing to give the Secretary of State every possible assistance in any matter which interests the Metropolis. I only wanted to guard against the supposition that to consult the Corporation of the City of London and the Metropolitan Board of Works was a new idea. Now there are two classes of persons who, it appears to me, were conspicuous by their absence from the statement of the right honourable gentleman. One of these classes of persons I will call the outsiders. The right honourable gentleman must be perfectly aware that there are a very large number of persons who live outside their areas, but who are within the metropolitan water area, and I am surprised that in the statement of the right honourable gentleman there is no reference to consumers of water outside the areas of the City and of the Metropolitan Board of Works. I was also more surprised that the right honourable gentleman appeared to take it as a matter of satisfaction to himself that he had had no communication with the Water Companies. I am glad it was a satisfaction to him, but I was surprised at the absence from his statement of those persons outside the metropolitan water area, and also the Water Companies themselves. The right honourable gentleman then said that there were two questions to be considered. One was whether the present supply of water was the best that could be obtained, and if not, whether, as an alternative, a better supply could be secured elsewhere at a cheaper rate. Now I think the right honourable gentleman must have forgotten for a moment the deliberations of the Select Committee upon that very question. He must have forgotten that the Committee of 1877, of which my right honourable friend the member for Westminster was Chairman, came to the conclusion that it was to the interest of the Water Companies to take action themselves. No doubt the right honourable gentleman is perfectly well aware that I did not at all say that such a plan was not possible, or that it was not justifiable to undertake such a work. Still, there are very great practical difficulties in the way of it; and while you have these Companies still existing, I do not think the language of the right honourable gentleman would lead persons very readily to embark in a Company which has this object in view. I also think it would be unfair to the ratepayers and to the water consumers to have, in addition to the existing water supply, another scheme, at an expense of 11 or 12 or perhaps 20 millions, for bringing water from elsewhere; at all events, it would not cheapen the supply of water to incur this expense. And I must say also that there are some practical difficulties in the way of laying the mains through the streets. I rather gather from the statement of the right honourable gentleman that it has occurred to him that this was entirely a new proposition, whereas I may say that it has been considered for a long time. With every wish to give all possible assistance to the right honourable gentleman, I should like to make one or two observations as to his propositions. And, first, as to the proposal that a Select Committee should be appointed to inquire into the expediency of acquiring the existing undertakings of the Water Companies within the present area. I presume this means whether it is expedient to buy them, or to get somebody else to buy them. I understood that it was not expedient to give the inquiry too large a scope, or to hang up this urgent question for too long a time. The more years you allow the Water Companies to remain in their present position, the more you must be prepared to see an increase in the value of their property—an increase amounting probably to about a million a year. For example, some time ago the Companies laid out a large sum of money to enable them to provide for supplying the large number of additional houses now being erected every year in the Metropolis. Within the last year or two I believe that not less than 60 miles of new streets have been made, and there is no doubt that the increase in the income of each of these Companies is such as to raise the value of their property very much year by year. If it is not expedient to make this inquiry too large, what are the Committee to do? Are they simply to go in a perfunctory manner through all the materials which are already at hand? or are they to go into the question whether water can be brought from anywhere, and if so, at what cost? If they are to undertake this, I think it will be a very long and a very expensive inquiry; and I do not see what the right honourable gentleman means when he states that it is not expedient to give the inquiry too large a scope, and yet says, almost in the same breath, that this is a question which they must consider. I should have thought that this was a matter which the Government could have settled amongst themselves without a Committee; but, of course, it may be that they do not wish to take any responsibility on themselves. If the Committee are to make an accurate report, I venture to say that it will be a long, a careful, and an expensive inquiry, if the report is to be of any value whatever beyond the reports which we have already; because we had the matter most carefully discussed before a Committee only two years ago, and that Committee inquired into all the plans. If these are to be re-discussed at any considerable length, it will be a very tedious inquiry. Now, the reference says, "to examine and report whether certain agreements, or any of them, already entered into provisionally for the purchase of these Companies would furnish a satisfactory basis for such an acquisition." If it is expedient to purchase at all, of course there are only two ways in which you can do it—namely, by agreement, or by compulsion subject to arbitration. If you are to purchase by agreement, there must be two parties to the agreement. If you are to purchase by compulsion, you go to the arbitrator, and are left entirely in his hands. If you are to do it by agreement, both parties must be agreed, and it is of no use for a Committee to say that they think the value is any particular sum if the Companies say they will not sell their undertakings for this sum. If you are not agreed, you cannot buy except by compulsion; and if you have compulsion, you cannot buy at your own price, but you must go to an arbitrator. It is therefore difficult to see what is to be the advantage of the Committee saying what in their opinion is the actual value of the Water Companies property, when you have no power to enforce the Committee's report. This really was the sole principle of the Bill of the late Government;

that is to say, it was agreement and nothing more. The whole spirit of the Bill was that you should purchase the Water Companies property by agreement—that you should be free to purchase it by agreement in the first instance, if satisfactory terms could be arranged between the water consumers and the Companies. I quite agree that the Government are in an awkward position in taking up this matter, because they do not like to take upon themselves to buy for the water consumers when the ratepayers are not parties to the bargain; and if the late Government had brought in a Bill to enforce with all their strength any such bargain that had been made, I think they would have been justly open to a great many remarks which are now unjustly made against them. But that was not their course at all. Their course was to see how low they could get the Companies to fix the price, in order to talk the matter over in a committee-room with the water consumers, the Metropolitan Board, and the City of London. These agreements were understood perfectly well, and were entered into with the distinct understanding that they were to be subject to the most rigid scrutiny by a Select Committee, and if the Committee had reported that they thought the price too high, the House would no doubt have rejected them. If, on the other hand, the Committee thought the terms were such as could properly be accepted, they would have asked the House to pass the Bill. Or there was a third course—that when the Companies had explained their case before the Committee, and when the Metropolitan Board and the water consumers had explained theirs, if the Government had thought that any lower terms might be had in any of the cases, and the Companies had consented to agree to them, then the terms might be accepted and become law. But the Bill was not to be withdrawn except at the request, not of one, but of a majority of the Companies concerned. I regret very much that the Companies and the consumers did not have the opportunity of talking the matter over before a Committee of the House of Commons, for it is no very easy matter to bring a company on the floor of the House, and it was with the greatest possible difficulty that the Water Companies were brought here. I only make these remarks for the purpose of stating that the Committee will enter upon this inquiry with the disadvantage that they will not have the Companies before them willingly—I mean, they will not have them there as willingly as they would have come with their agreements ready to prove their case.

Sir W. V. HARCOURT: If the right honourable gentleman will excuse me for a moment, I should like to know what his view is upon this point. As I understand, these agreements are binding on the Companies till the end of the session, and if the conclusion of the Committee were that the agreements were good agreements, and the Government were willing to introduce a Bill to carry them into effect, the agreements would still be binding on the Companies.

Sir R. A. CROSS: The right honourable gentleman does not quite understand what I mean. The arrangement originally was that a Bill should be brought in to give effect to these agreements, and that the Bill should be referred to a Select Committee. I am not at all clear that the Companies, if they chose, might not say to you, "There are our agreements, and we have nothing more to say." I still hope, however, the Companies will come before the Committee, and if so that some arrangement may be arrived at. The last part of the reference is to "inquire and report as to the nature and extent of the powers of the Water Companies to levy water rates and rents, and how far it may be desirable to modify the same." I was very glad to see that if the right honourable gentleman is correctly reported, he himself has given an answer on this subject, almost exactly in the same terms as one I gave in the last session of Parliament. When I gave that answer it was considerably cavilled at by many members of the House. I am glad to find that, having looked into this point, the right honourable gentleman is of the same opinion that I was—namely, that you must use great caution in invading rights conferred by Act of Parliament. I am not at all saying that the Acts of the Companies are Acts such as they ought to have had. Parliament, in its wisdom at that time, granted to many of them rather extraordinary powers; but it is not the question whether Parliament would grant those powers now. We have to deal with them as they are. Power was given to the Companies to charge upon the actual value of the houses supplied. As I read the right honourable gentleman's remarks, I think he said it was a mistake to think that an alteration of the assessment altered the legal right of the Companies, and it was also a mistake to think that Mr. Goschen's Act at all affected this question. The question is, what is the annual value at which the Companies charge? and that is a question which has to be decided on appeal before certain justices appointed for the purpose, and it is a question of evidence what the annual value of a house may be. The right honourable gentlemen went on to say—and I agree with him—that although he would do all in his power, as I would do all in my power, to prevent any injustice being done, or any undue advantage being taken of an Act of Parliament, he did not know anything more unsafe in this country than to make people suppose that the securities given to persons in their properties by Act of Parliament were not safe, and were liable to invasion. I think I have quoted his words correctly. It gave me great pleasure to read that he made that statement. It is the only statement I should have expected from such an accomplished lawyer as he is, and from one so thoroughly cognizant as he is of matters of this kind; and I hope it will be a very long time before this House invades the rights of people in that way. Having pointed out what I think the difficulties of the Committee will be in this matter, I can only repeat that I most sincerely hope its object will be accomplished. I believe the wisest course will be that the property of the Water Companies should be purchased. I hope that the Companies will come before the Select Committee and argue the matter out, and that the question may be settled before the close of the session. I will give every assistance in carrying out so desirable an object; but as to the first part of the reference I cannot help pressing upon my right honourable friend that I think it would be wise to limit the words in some shape, because I think if the Committee once enter on this large and interesting question, they will not reach their report for a very long time. There is one part of the subject that the right honourable gentleman has not alluded to, and that is the constitution of the body which would have to administer these water properties if bought on behalf of the Metropolis. The right honourable gentleman has entirely absolved himself from any responsibility in this matter, and it is quite clear the Government have not the slightest desire to take any; but I am surprised that silence has been kept on this point. In the Bill laid before the House by the late Government an elaborate Water Trust was proposed; but there was one principle then for the first time enunciated, and I hope that, in the formation of any body for the purpose of carrying out arrangements for a water supply, this principle will be kept in view. We laid it down that we ought, on such a Trust, to have a direct representation of the Metropolis. That is the only principle that will work with satisfaction. So far as the elective members are concerned, there should be direct and not indirect representation. I think it always one of the great faults in the constitution of the Metropolitan Board of Works that its election is indirect, and I should be sorry to see any other body of that description set up without a recognition of the principle of direct election. I do not wish to detain the House any longer.

I can promise my right honourable friend that he will have every possible assistance from me in his endeavours to arrive at a proper conclusion.

Mr. RITCHIE thought the course taken by the Government in this matter was somewhat instructive. The House would remember that there was nothing on which speakers upon Liberal platforms throughout the country spoke with more scathing denunciation than the so-called utter inability of the late Government to manage any kind of domestic legislation, and the mode in which they dealt with the water supply. The late Government were said to have been drowned with water. Water was made to account for the Dissolution; and naturally, when all these denunciations came from the Opposition, those who were interested in the Metropolitan Water Supply expected that the first thing the new Government would do would be to introduce a comprehensive scheme, dealing with this question in an entirely different manner from that in which it had been treated by the late Government. But when the new Ministry came in, the right honourable gentleman the Home Secretary, from the way in which he received deputations, seemed by no means to have made up his mind as to the right plan to pursue, and appeared to be fishing all round for advice as to the proper mode of dealing with this question; and now the Government had practically brought forward a proposition which was identical with that for which the last Government were so roundly denounced. He did not object to the reference of these agreements to a Select Committee, for that was probably the best course that could be taken, but he did object to the reference to the Committee being laden with other matter which, in his opinion, could only have the effect of hanging up the water question for an indefinite period. Had the Committee been limited to an investigation of the agreements, their labours might have been brought to a speedy conclusion; but the right honourable gentleman proposed to ask the Committee to go into the enormous question of whether or not it might not be better policy to bring in a fresh supply of water altogether. This would necessarily involve immense investigation and a vast expenditure of time, and the result would be that nothing could be done this session, and probably nothing in the next. If the Committee simply reported on the question whether the agreements were good agreements or not, there would be plenty of time after that to draw attention to the question whether something might be done to obtain water elsewhere. Instead of waiting for a report on the possibility of modifying the existing agreements, the right honourable gentleman had seen fit to overload the reference to the Committee, so that delay was unavoidable. As a representative of the Metropolis, which had been for years crying out for the Government to take steps in this matter, he must protest against anything that would lead to further delay in the settlement of this important question; and even now he hoped the right honourable gentleman would see his way to making some amendment in the terms of the reference, so that the question of whether or not the agreements were proper agreements, or whether they could be modified, should be alone placed before the Committee. The longer this matter was hung up, the more the Metropolis would certainly have to pay. He understood that at any moment the Water Companies might, under their Acts, put up their rates. They had not even to wait for the re-valuation of the Metropolis. That re-valuation would take place, as a matter of course, next year, and the Companies would only be acting strictly within their rights if they raised their rates when the valuation was increased. All these considerations ought to influence the Government in making the reference as simple as possible, so that some settlement might be arrived at, and so that they might see whether any reasonable bargain could be made with the Companies. Then, if it were found that no satisfactory bargain could be concluded, he still thought there would be ample time to take other steps to provide the Metropolis with a fresh supply of water. This should only be done if the Water Companies would not listen to reason; but the question should first of all be referred to the Committee, whether a satisfactory bargain could not be struck.

Mr. BRAND said that the objection which had been mentioned by the right honourable gentleman opposite, and by the honourable member for the Tower Hamlets, had also struck him very forcibly—namely, that the terms of the reference to the Committee seemed to open a very wide and exhaustive field of inquiry. He should have thought that the question contained in the first paragraph of the motion was a foregone conclusion; that was, whether the Water Companies were prepared to accept such terms as the House would offer. There was another point—viz., that in the reference it seemed to be open to the Committee to inquire as to the character of the existing source of supply. This was a question which had been decided, or at any rate inquired into, by the Commission of 1869. That Commission issued a very exhaustive report, and he thought they had all the facts before them on which to form a conclusion on the point. He therefore wished to ask his right honourable friend the Home Secretary whether it would not be possible to narrow the inquiry by simply referring to the Select Committee the report of the Royal Commission of 1869, so that they might have cognizance of the opinion which was expressed at that time. With reference to the raising of the rates by the Water Companies, it would be in the recollection of the House that he put a question to his right honourable friend on this point the other day, and he quite admitted with the right honourable gentleman opposite, and with his right honourable friend, that there might be some questions which should be asked privately by private members, and which it was not in the interests of the public directly to answer. Nevertheless the putting of those questions sometimes had the desired effect, and he thought at any rate it was clear that the Water Companies would understand that Parliament would look with great disfavour on any attempt to raise their rates after that discussion.

Sir H. HOLLAND said he heartily joined in the request that the Home Secretary would, if possible, reconsider the terms of the reference to the Committee. He certainly understood the right honourable gentleman to deprecate any extended inquiry, and he understood that he was extremely anxious to come at once to terms with the Water Companies. It was quite clear, however, that the Committee could not help, under this reference, considering any plan which might be brought before them. He (Sir W. Holland), as a Director of a Water Company, naturally felt much interested in the question of expense, because they knew what the expense of the Royal Commission of 1869 had been. It was something enormous, and if the Committee were now to go into all the matters that were brought before the Royal Commission, and settled by that Commission, they would naturally feel very anxious about the expense to which not only the Water Companies, but also the ratepayers, would be put. He earnestly hoped the right honourable gentleman would alter the terms of the reference, and confine it to the question of whether the agreements before the House should be acted upon, or whether other terms could be made with the Water Companies, and if so, what terms. He believed himself that the Companies would meet the House in a fair and open spirit, and at the same time he thought that if the Committee were to go into the general question of the supply of London with water, they would never come to the end of it—at any rate, not this session. It was very important to the Companies as well as to the ratepayers, because at the present moment the Companies were stopped from making any contracts because of the indefinite and uncomfortable position in which they were placed. He could not at all agree in finding fault with the Home Secretary for not

SUPPLEMENT TO THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XXXV.

LONDON, JUNE 8, 1880.

No. 891.

BRITISH ASSOCIATION OF GAS MANAGERS. SEVENTEENTH ANNUAL MEETING.

INAUGURAL ADDRESS OF THE ACTING PRESIDENT, CHARLES HUNT, Esq., OF BIRMINGHAM,

DELIVERED TUESDAY, JUNE 8, 1880.

Gentlemen,—The circumstances under which I have to ask for more than the usual measure of that indulgence and support which have been so freely accorded to every former occupier of this chair, are fully known to you. It has unfortunately happened that the President of your choice has been compelled by persistent ill-health, in the midst of his term of office, to return into your hands the dignity conferred upon him. Our regret at the necessity for such a step remains profound; and I am sure that you will wish me to convey thus publicly to Mr. Douglas the assurance of your sympathy, and of your earnest wishes for his speedy and complete recovery and future prosperity.

As you are, doubtless, also aware, our esteemed Secretary, Mr. Bennett, has during the last few months been laid prostrate by a serious illness, from which he is happily to a considerable extent restored. While congratulating him upon his recovery thus far, we have it in our power to testify, in the most practical manner possible, to our regard for one to whose exertions the Association is so greatly indebted, by assisting in the work of this meeting when assistance would be of service, and by the exercise of as much forbearance as possible during the continuance of it.

During the past year we, as an Association, have lost, through death, five of our number. These are—Mr. George Berry, formerly and for many years Manager of the Ashford Gas-Works, in Kent; Mr. A. F. Livesay, formerly part Proprietor of, and otherwise officially connected with the Ventnor Gas-Works, Isle of Wight; Mr. F. W. Brothers, late Manager of the Chorley Gas-Works; Mr. H. S. Pierson, formerly Inspector of Mains in the service of the Chartered Gas Company; and Mr. Claudio Gil, of the Gas-Works, Barcelona; all of them most worthy representatives of the profession to which they belonged. It is fitting here to record also the death of one who, although not a member of the Association, yet took a warm interest in its welfare, as in everything connected with the gas industry. It was only last year that we had to lament the loss of the familiar reporter of our proceedings; and now the keen, yet kindly critic is gone from amongst us. Mr. W. T. Fewtrell, F.C.S., whose death we now deplore, took for several years an active part in the management of the JOURNAL OF GAS LIGHTING, succeeding, in a great measure, the late Mr. T. G. Barlow. His intimate knowledge of chemistry rendered his criticisms upon the subject of gas manufacture of especial value; although his name will probably be held in remembrance chiefly as co-Editor with Mr. Newbigging of "King's Treatise on Coal Gas," the most valuable and comprehensive work of the kind yet attempted.

If the present total number of members be compared with that for the year 1870, when it was 314, it will be seen that the Association has considerably more than doubled during the past ten years, proving it to be possessed of an amount of vitality greatly in excess even of that with which the manufacture of gas is ordinarily credited. Nor will it be found upon examination that its augmented usefulness suffers in comparison with this great accession of numbers. Year after year fresh fields for investigation have been opened up, new problems have been presented for solution, until there is

hardly a detail, intimate or remote, of the complex art of gas manufacture that has not been made the subject of free, exhaustive, and instructive criticism. Our discussions have made of individual knowledge one common stock; our published Transactions will be found to be a faithful reflex of, almost without exception, the most advanced opinions upon all technical matters relating to gas. These annual gatherings afford to the gas manager more and more favourable opportunities for throwing off that crust of isolation by which he is apt to be enveloped, and for freeing himself of crudities that are so often engendered by a life of comparative self-dependence. It is not necessary that his voice should have been heard at these meetings; he may have been a mute participator in our proceedings; yet, if he has not returned to his work improved by contact with his professional brethren, quickened in his desire to do the best that he can both in and for his calling, he will have proved himself to be insensible to one of the most powerful appeals that could be addressed to him. Such, in brief, has been the work of the Association, and such may it long continue to be.

My object, however, in thus referring to it is not one of laudation merely; there is, as may be readily imagined, a reverse side to this pleasing picture, which I conceive it to be equally my duty to place before you. Some there are amongst us who do not feel entire satisfaction at the past career of the Association, and who desire to mould its future more in accordance with their views of an enlarged sphere of usefulness. With these it is impossible not to feel a certain amount of sympathy. There can be but few who, looking back along the road they have travelled, have not to recall some opportunities disregarded, some aspirations unfulfilled. As with the individual, so it may also be with the Association. It is objected that its aims have been metropolitan rather than cosmopolitan; its actions mechanical rather than progressive. Towards the satisfying of a growing desire on the part of members for more frequent opportunities of discussing matters of immediate importance, it has made no effort; and hence the formation of District Associations; of sections, bound to it indeed by the strongest ties of sympathy, but owing to it no other allegiance than that which is secured to it by the force of superior numbers, position, and influence. In the conduct of its affairs it has adhered, without sensible variation, to its original programme; our annual volume, while increasing in bulk and, let me add, in value also, remaining what it was at the commencement—a report solely of the proceedings of two, or at most three days in every year. There seems to be no good reason why, except perhaps on the ground of expense, this should not be made of still greater value to us all. Following the example of similar Associations, it might, through the instrumentality of a Committee of Publication, be constituted a complete record of the progress of gas manufacture in all parts of the world. This would be accomplished by the selection, and translation where necessary, of such extracts from both British and foreign journals as might, in the opinion of the Committee, possess a permanent interest in relation to gas. In this way we should be kept informed semi-annually, or oftener if found desirable, of the advances made in connection with gas lighting abroad, and

at the same time be building up for ourselves an epitome, for reference, of the most valuable and comprehensive kind. In another direction also it seems possible that we might with advantage imitate the practice of kindred societies—namely, in the encouragement and prosecution of original research. I am not unmindful of the fact that the Association has in its gift at least one medal, besides premiums at will, and that in the bestowal of these it is unlikely that the claims of the meritorious investigator could be overlooked; yet do we not fail somewhat in our aims by not giving, to a certain extent at least, point and direction to the labours of the latter, and by abstaining, in our collective capacity, from all attempts at elucidating some of the apparent mysteries of gas manufacture? Such, at any rate, are among the suggestions that occur for extending the usefulness of the Association; and I venture to hope they may not be deemed unworthy of your consideration.

Whatever of truth there may be in the saying that "London is not England," certain it is that its gas polity is reflected far and wide, possessing an interest extending beyond even the limits of the realm. Here was first made conspicuously apparent the failure of active competition when applied to gas undertakings; and here also, following within the space of a few brief years the rejection of this principle, was first accepted, in its most comprehensive sense, the very opposite one of amalgamation. It is not necessary to justify the combinations that have taken place, and of which we cannot yet have witnessed the last, by pointing to reductions of price that have followed, or are expected to follow; their advantage has been made apparent enough during the past few years by the disappearance from crowded neighbourhoods of works that could not but be inconveniently and uneconomically conducted. The growing requirements of an overflowing population had, in fact, rendered amalgamation a necessity altogether apart from financial considerations; yet the concentration of manufacture in the most suitable localities thus made possible, must of itself, from its greater economy and the higher degree of skill that it admits of, have eventually secured great and lasting benefits to the consumers, had they only possessed what has been called the "magic of patience" to await its fruition. Gas legislation, however, like Parliament itself, seems destined, every few years, to undergo a more or less complete revision; and in the fulness of time, albeit precipitated by events that need not now be recalled, it was considered desirable to stimulate the action of the Companies towards further reductions in the price of their gas. The introduction of the sliding scale of dividend is recognized as having been mainly the work of one of our Past-Presidents, and now an Honorary Member—Mr. George Livesey; and it is an achievement of which he may justly feel proud. Without of necessity endorsing every argument that was advanced in support of so great a change, it may be accepted, at this distance of time, as the first, as it remains the only attempt to apply to what, in the hands of companies, are essentially commercial undertakings, sound commercial principles; and for this reason, if for no other, any endeavour to disturb it would be a matter for regret. Nevertheless it is to be apprehended that the public will regard with increasing jealousy augmentations of dividend for which only a bare justification can be shown to exist. The permanence of the sliding scale as an institution depends, it may be said, upon its good behaviour. It may be expected to continue in favour so long as it operates, or is believed to operate, more for the benefit of the consumer than the legislation that it superseded; but it might quickly fall into disrepute upon the production of evidence of the superiority of the latter, or, in other words, if it could be shown to have retarded rather than have accelerated what may be called the natural progress of reduction. Whether, in such an event, the acquisition of the gas undertakings, in trust for the public, would be further promoted by parliamentary action, it is perhaps, notwithstanding the recent correspondence upon the subject, premature to consider.

Public attention has now for a lengthened period been directed to the claims of the electric light to be considered, under its most recent aspects, as a rival to gas for the general purposes of illumination. Ever since the discovery, almost contemporaneously with the invention of gas lighting, of the conversion, under certain conditions, of electric energy into light, this possible means of illumination has attracted to itself the very highest scientific intelligence. For nearly the best part of a century the names of many of our most eminent men of science have been identified with efforts for its development; and it is, therefore, not at all surprising that

its advocates to-day are men upon whom we are proud to say have fallen the mantles of Faraday and of Davy. But what, it may be asked, is the position which has been secured for it, and what are the prospects with which it has been endowed? Have we any greater reason to fear in it a rival now than at any past period of our history? Are we entitled still to term it the *ignis fatuus* of modern philosophers? or has it, in the words of one of the most distinguished of these, after having been in dreamland for sixty years, now come into the world of realities? These are questions that concern our future; and although we may reasonably believe that in the main they are in course of practical settlement in favour of gas, yet a brief consideration of them may not seem altogether undesirable.

It is evident, then, that the electric lamp, for ordinary indoor purposes, has yet to be invented. Notwithstanding the sensational announcements that have from time to time been sent to us from across the Atlantic, no advance whatever has been made towards the adaptation of the light to domestic requirements. It is not, however, to be inferred from this, or from the many failures that have occurred, that therefore, in the present state of the science, the lighting up of moderately large interiors is impracticable. On the contrary, evidences of its practicability are of no recent date. As an example, I may recall to your remembrance the illumination, some time ago, of the Hippodrome, in Paris, than which anything of the kind more charming in its general effect it is difficult to imagine. The impression left upon my mind by that enormous building, flooded with light in every part, by that sea of faces, every lineament of which was, so to speak, distinctly visible, will not soon be effaced, and has reconciled me to much of the enthusiasm which the new light invoked. The Paris *Salon*, also, has this season, and for the second time, been lighted up upon the Jablochhoff system, in a manner that has called forth a large measure of approbation. Many efforts in the same direction have likewise been made in this country—efforts, it is true, for the most part of brief duration; yet becoming more persistent and continuous; and, so far, illustrating the possibility of successful illumination. There is no need to inquire too closely into the causes that in so many instances have led to the abandonment of experiments auspiciously commenced. These may have been various; but one that has been patent to all is the intolerable flickering and unsteadiness inherent in almost every lamp that has yet been introduced. As an instance of the extent to which this interferes with the efficiency of electric lighting, I may mention the results of some observations made not long ago, at my instigation, of the effect of a Jablochhoff "candle" in full combustion, placed within a clear glass lantern. These disclosed a rapid variation in the light afforded; the difference in the areas of illumination, many times repeated within the space of only two or three minutes, being represented by the proportions of about 9 to 4; that is to say, that while the observer was able, at one time, to see to read at a distance of 203 feet from the lantern, almost immediately afterwards the light became so contracted that he could only see to read the same print at a distance of 132 feet. This experiment was continued for some little time, and by three different observers, with practically the same results, although, as was to be expected, the distances arrived at by each were by no means the same. Within doors this defect has usually been overcome in a great measure by placing the lamps sufficiently close together to allow their circles of illumination to completely overlap; but so expensive a remedy is of itself an efficient barrier to the employment of any system depending upon it. Much attention, however, continues to be given to a matter of such vital importance; and not long ago there was exhibited, among others, in this hall* an improved form of lamp, the invention of a Mr. Crompton, which is said to combine steadiness with simplicity of action. This lamp, it is understood, is already in use in Glasgow and other places; while the improvements that have been made in the Werdermann incandescent burner has secured for it a place among the competitors in the interesting trial that is about to be conducted at the Opera House in Paris. The Brush system also has been introduced into this country from America, where, according to report, it has met with considerable success, and has been applied, amongst other uses, to the lighting of underground workings. It is not easy for us to conceive of the adaptation of any system of electric lighting to such a purpose; but I need hardly say that we, of all sections of the community, are interested in the highest degree in all that concerns the safety and comfort of the miner, and are prepared to welcome with satisfaction and thankfulness any means by which they may be rendered

* Institution of Civil Engineers.

more secure. So far, therefore, from grudging to electricity this field of usefulness, we would say to it in all sincerity, "Go on, and prosper."

The cost of production of the electric light per candle is, according to the most reliable evidence, so absolutely governed by the magnitude of the light evolved, and the ultimate value of the latter is so entirely dependent upon the use that can be made of it, that it seems impossible to arrive at any fixed notion with regard to it in comparison with that of gas. All that we know with any degree of distinctness is, that its superior economy has never yet, unless for very special purposes, been demonstrated, either in this country or, I will venture to say, out of it. It is true, we have heard much, and are probably destined to hear more, of the cheapness of its production on a large scale, say in a 6000-candle lamp; but then it is apparent that such cheapness may be bought too dear, and that in the application of such a powerful light all, and more than all of the advantages of economical production may readily disappear. This, in practice, is found to be the case, and hence it is that systems producing lights of lesser magnitude continue to be preferred, although costing very much more, in consequence of, to use the words of Mr. Preece, the "terrific waste" of subdivision. It has, however, been claimed for these that, in their adaptation to the requirements of factories and other similar buildings, they possess an advantage over gas in the matter of cost; but here again there is little or no reliable data; and it will be found that in the majority of cases other reasons than that of economy have determined their adoption. Such comparisons, too, as have been made, have invariably, and perhaps of necessity, been between the cost price of the one means of illumination and the selling price of the other; forgetful of the fact that in the same way might gas itself be proved to be cheaper than gas. It was only the other day, for instance, that I heard of a large manufacturer, having gas-works of his own, who is making gas mainly for the sake of the coke that he produces, which is valuable to him in his manufacture, and with which it is evident that he is by no means overstocked. It is clear that his gas is costing him very much less than it would do if he obtained his supply from the Local Authority or Company; and this, although probably in a much less marked degree, is doubtless the position of many who prefer to be their own producers. But such experience by no means suggests the advisability of every consumer following the example of these economists; this impracticable alternative being very far removed by the development of a system that has hitherto remained unsurpassed for convenience and adaptability to the requirements of the greatest number. What is really to be considered, then, is, not so much whether electric lighting is or is not going to supersede gas in this large building or in that, or whether, for certain purposes, it may not find extended employment; but rather the possibility or otherwise of its expansion into a system at all comparable with our own. In this view our interest in the efforts of electricians continues to be centred almost wholly in the experiments upon the Thames Embankment, where alone has there been any practical attempt at determining the problem of distribution. This being a matter upon which so much of the future of electric lighting depends, the engineers in charge are justly entitled to the credit of having scored a considerable success in proving, as has been done during the last few months, the practicability of the transmission of the electric energy, without appreciable loss, to nearly twice the distance originally contemplated; although to us, who are accustomed to send our gas through systems of mains of hundreds of miles in length, it seems a very small matter indeed to make an extension of a few hundred yards or so.

The bolder spirits amongst electricians, however, are at the present time meditating far loftier flights, calculated, in their opinion, to exalt electric lighting into the regions of economical science. Dr. C. W. Siemens, whose name has long been honourably associated with the progress of science and industry, both in this country and also abroad, has proposed the transmission of electric energy on a scale far exceeding anything that has yet been attempted. He has arrived at the conclusion that a copper conducting-rod, 2 inches in diameter, would suffice to convey 1000-horse power to a distance of 30 miles. We are not concerned as to the initial power that would be required to produce this effect, nor as to the means by which it would be obtained, whether by the agency of steam or by the subjugation of a waterfall. What interests us mostly is the indication the proposal affords of the possibility or otherwise of successful distribution in competition with coal gas. It is probable that such a conductor would not cost, in ordinary times, much less than

£100,000, or, let us say, about that of a 24-inch gas-main. There is, it is true, no precise parallel to such a length in gas distribution, the nearest approach to it being probably the case of the Beckton works, where it is understood the gas is transmitted to a distance of 15 miles before distribution; but our knowledge of the subject enables us to discuss such a project as one that is entirely within the bounds of practicability, and with regard to which a tolerably exact calculation can be made of the effect. Assuming, then, an initial pressure of, say, 6 inches, or that of most gas-holders of any size, it will be found that a 24-inch main is capable of delivering to a distance of 30 miles, and between two level points, a sufficient quantity of 17-candle gas for an effective illumination of about 220,000 candles, when consumed during one hour. On the other hand, the value of the 1000-horse power has to be variously estimated. If expended in conjunction with lamps of large power, which for ordinary purposes are simply impracticable, it may be said to represent an illumination of 1,200,000 candles; if applied to the more practicable Jabloch-koff system, we should expect to get an available illumination of about 230,000 candles, or much the same as in the case of the gas. This, however, it may be fairly assumed, is the maximum effect to be expected from the copper conductor, whereas we know perfectly well that the rate of delivery through the gas-main could, by means of common enough appliances, and at a very trifling cost, be enormously, if not indefinitely increased, to say nothing of the accidental assistance that might be afforded by rising ground. Regarded, therefore, merely as a question of transmission, and taking no account of the fact that the minimum delivery of the gas-main would represent, if converted into power by the gas-engine, more than three times the ultimate effect of the copper conductor, it is evident that gas lighting has nothing whatever to apprehend from the facility of conduction of electric energy as illustrated by the proposals of Dr. Siemens. So that, when we are threatened with a competition that is to be brought about by the utilization of waste water power, we may confront dream with dream; ours, not perhaps the least possible of realization, being of the time when the waste gases from innumerable coke ovens shall be collected, purified and stored for the use of the nearest towns; or, further yet into the future, when gas manufactories on a gigantic scale shall be established in the heart of our principal coal-fields, for the purpose of furnishing the means of light and heat to our great centres of population, in much the same way as the water supply is in course of being dealt with by the bold and sagacious projectors of the Thirlmere scheme.

While occupied in this way in observing the front of our position, a more potent, because a more insidious adversary claims attention in our rear. Considering all the advantages that gas lighting possesses and is able to offer, it may upon first thoughts appear to be a little absurd to describe the inconvenient oil lamp as a powerful competitor; and yet to this dignity must it be acknowledged that our apathy has too frequently raised it. Ever at hand to a very numerous class of consumers as a possible and cheap alternative, its manufacture has become an important, and continues to be an increasing industry, with an effect upon our own that cannot fail of being almost correspondingly opposite; so that, at a time when so much is being done to establish for gas new uses, it is important to inquire how far its primary use is restricted by the protective policy just now so much the fashion. The returns that have been most kindly furnished me, and which I take this opportunity of acknowledging, reveal the fact that there is, in most towns, a very wide field for the employment of gas for illuminating purposes, untouched, because for the most part avoided, by gas enterprise. They show that, in 40 large towns, having populations of not less than 40,000, in which what is known as "common" gas is supplied, the consumption per head of population varies from 2000 to 4600 cubic feet per annum, the average being 3197 cubic feet, while the proportion of consumers to tenements differs more widely still, being, in the 20 towns respecting which I have been able to obtain complete returns, from 28 to 91 per cent., with an average of 59.25. In only two instances is the percentage more than 76, and in only eleven is it over 60. It might be superficially assumed that these variations are the effect of population, price, or habits; but the returns make evident the existence of an influence more powerful than these. For example, there are two neighbouring towns, similarly constituted, but one more than twice the size of the other, price and quality being much about the same in both, in the smaller of which has been developed a consumption far exceeding per head of

population that of the other, with a percentage of consumers actually more than double. In this instance a less generous treatment of the consumer in the larger town stands plainly enough in the way of an augmentation of business of fully 60 per cent. Again, in one very small non-manufacturing town, not included, on account of its size, with those I have just referred to, there is a percentage of consumers of 70, and a consumption per head of population of 3500 cubic feet; in striking contrast with a manufacturing town more than twelve times its size, in which the percentage is only 34, and the consumption 2500. I do not know what may occur to you as a reasonable explanation of such an anomalous condition of things; but I believe that I am in possession of a sufficient, although by no means a satisfactory one. The fourth question in my circular was, "What is your rule with regard to deposits or guarantees?" and the answer to this from the smaller of these two towns is eminently simple and straightforward: "No deposit or guarantee." The other reply is to be interpreted as expressing considerable confidence in the principle of "money down," and a determination to uphold it; so that here are illustrated two distinct lines of policy, with their attendant results—the one founded upon ordinary business faith and business practice, the other upon suspicion and mistrust, probably without a parallel in the commercial world. There are, however, open to gas managers the famous "three courses." In addition to what may be called the repellent and the neutral, of which I have furnished examples, there is also the attracting. At the head of my list stands a large manufacturing town, having 91 per cent. of consumers, and a consumption of a little over 4600 cubic feet per head of population. What is the reply in this case to question No. 4? I will quote a portion of it: "Cottages supplied under agreement with the landlord, who becomes responsible for payment of gas consumed by his tenantry, and on the aggregate he obtains a discount varying with the amount," &c. I need not follow my correspondent in the table of discounts that he has been kind enough to send me; that is a matter of detail less interesting than the principle involved, and the lesson we may derive from its application. This lesson I take to be that gas undertakings are not exempted from the conditions that govern the success of all commercial enterprises, except in so far as a beneficent Legislature has shielded them from the ill effects of a mischievous policy; but that liberality, combined with caution and sagacity, is certain to meet with a full reward, not only in the shape of assured profits, but also in the approbation of the consumers; in short, that as we sow so may we expect to reap.

It cannot, however, be said that either the possible or the actual rivalry to which I have referred, however they may at times have disturbed the serenity of the prospect, have hitherto affected our material prosperity. With very few exceptions, the price of gas is at the present time lower than at any former period, while full dividends continue to be secured. Nor are there any indications of our being spoilt by success. On the contrary, there probably never was a time of greater activity for progress, if one is to judge from the number of what may be called "burning questions" that await solution. Prominent among the many subjects that are at the present moment engaging our attention may be enumerated the proper application of heat to the retorts, the principles that govern economical condensation, the substitution of machine for hand labour in the retort-house, and the desirability, not to say the necessity, of measures for extending and popularizing the uses of gas.

The question of economy in the consumption of fuel is one that has never by any means pressed heavily upon the English gas maker. Fortunately for him and for England, fuel has continued, with rare exceptions, to be both cheap and abundant; so that, in many localities, the enforced production of coke has from time to time proved a source of considerable embarrassment. Even in places not unfavourably situated for its disposal, the problem of how to get rid of it has been sadly debated, and various ingenious devices have been resorted to for the purpose of presenting it in a more attractive form to the consumer. Under these circumstances, it could hardly be surprising if economy were the exception rather than the rule, and that it is otherwise may be regarded as distinctly creditable to those who practise it. It is, however, quite conceivable that a striving after excellence in this particular may be carried too far; and that a liberal, but at the same time an effective expenditure of fuel may, after all, turn out to be the truest economy. So, at least, would seem to be the opinion of our Continental and American brethren, for their settings have for years been worked at a temperature exceed-

ing anything that has hitherto, except, perhaps, here and there, found favour in this country. They appear, in fact, to have made deliberate choice of increased production as against a low fuel account; their make per mouthpiece, with retorts of an ordinary size, being commonly from 7000 to 8000 cubic feet per diem, with an expenditure of fuel varying from 30 to 40 per cent. of the coke produced. If, then, as is to be reasonably inferred, this policy of high heats be successful with fuel at prices that we should consider excessive, what chance could it have of failure where fuel is a drug, seeing that it offers the double advantage of increased and profitable consumption and diminished production?

While, however, the principle itself is receiving but tardy recognition here, already the means by which its advantages have hitherto been secured are, in Germany at least, in a great measure superseded. The large combustion chamber, forming, as it were, the core of the German setting, is, in most modern constructions, giving place to the gas-producing furnaces of Oechelhäuser, Liegel, Grahn, and others. The idea of applying heat in a gaseous form to gas-retorts is by no means new. It is now many years since Dr. Siemens proposed the employment of his regenerative furnaces for this purpose, and they were so applied in at least two English works. It is perhaps unnecessary to recall the circumstances that led to their ultimate abandonment in both instances; suffice it to say that their fuel economy was satisfactorily demonstrated. A trial of them made almost simultaneously at the Paris Gas-Works proved more fortunate for their permanence; for there they have since, in a modified and improved form, been adopted in all extensions. Those of us who have visited these works—and many availed themselves of the opportunity afforded them two years ago—are able to testify to the admirable heats maintained by this system—obtained, it is stated, with an economy over the solid fuel system sufficient to cover the extra cost of construction in one year and a half of constant work. It is not, however, easy to become reconciled to the somewhat elaborate application of the regenerative principle, which forms so prominent a feature of the arrangement; and this, perhaps more than anything else, has hindered the general acceptance of this description of furnace. However desirable the utilization of waste heat may be under all circumstances, it has never come to be regarded amongst us as an object of the first importance, or as one to be pursued to the exclusion or sacrifice of other considerations. The Germans, although under a greater necessity for economy in this respect than ourselves, have practically adopted the same view, by seeking, in their gas-furnaces, to make the regenerative principle subservient to, or a useful adjunct, rather than an essential feature of their arrangements. Thus, the exhaust flue, which is frequently placed underneath their settings, instead of, as with us, upon the top, is to be found cased with an outer brick lining, between which and the flue the air supply to the furnace is drawn; and in this way much of the heat that would otherwise be lost by radiation is made use of in a simple and inexpensive manner. Some of the most successful of their furnaces will be found to bear a strong resemblance to the gas producer of M. Tessié du Motay, employed in America for the production of water gas, a description of which was given in *Engineering* of Dec. 12, 1879, and April 23, 1880. This, as will be recollected by those who have seen the description, is of a very simple construction, having, in lieu of grate-bars, channels at bottom formed of fire-brick, from which is to be inferred the absence of any serious amount of clinkers. Others, again, have much wider openings, and are furnished with grate-bars, after the manner of the Siemens furnace, both kinds being used either with or without an air or steam blast; and the object of all of them is to form a deep mass of incandescent fuel, so as to ensure the decomposition of as large a proportion as possible of the carbonic acid generated by combustion.

It is perfectly evident that the employment of these furnaces, either wholly or only partially detached from the bench of retorts, must involve a very considerable loss of heat through radiation; and their economy notwithstanding would seem to be a serious reflection upon the solid fuel system. That they are economical, however, there appears to be little room for doubting. The last report of the German Continental Gas Association, for instance, makes prominent mention of the fact that it has been decided to adopt them throughout the whole of their works. At Cologne, where entirely new works have, within the last five years, been erected by the Municipality, under the guidance of their Engineer, Herr Haganer, the whole of the retorts are heated by this method, the consumption of fuel being stated to be as low as 22 per cent. of the coke produced, with an

economy of labour, owing to the facilities for firing and comparative absence of clinker, of no less than 40 per cent. These works, I may observe, will well repay a visit by any of the members of the Association who may be passing their holidays abroad, for they combine some of the best features both of English and of continental practice. When I called there two summers ago, I was received with great kindness by Herr Haganer and his assistants, and the hour or two that I spent in their company tended, in no small degree, to dissipate any insular prejudices on the subject of gas-making that, up to that time, I may have entertained. Throughout the works are to be found evidences of a thoughtful appreciation of the most advanced appliances, with a general arrangement very superior to what is ordinarily to be met with at home. It is scarcely necessary to inquire whether the question of gaseous *versus* solid fuel was considered in connection with any extension in this country contemporaneous with that at Cologne, but now that our attention has been fully aroused to the importance of it, it is not too much to expect that something decisive will be speedily achieved. Meanwhile, the first fruits of real work will be made apparent to-day in the papers on the subject by Messrs. Frank Livesey and G. E. Stevenson, whose example it is to be hoped will find many imitators.

From the heating of the retorts to the disposal of the coal within them is a natural, if not in all respects an easy transition. High temperatures require to be followed up by well-ordered systems of charging and drawing. The sufficiency of hand labour, in point both of economy and of efficiency, has long been questioned; but it cannot be said that the principle of mechanical stoking has found by any means a ready and complete acceptance. Our attitude towards it hitherto may be described as one of cold neutrality. It is true, the desirability of employing machinery has been almost universally admitted; yet no sooner has the fertile brain of an inventor conceived of a way by which this might be accomplished, than the onus of proof has been cast upon him, almost without reserve, or a helping hand. The effect of this has undoubtedly been to retard progress; nevertheless, sufficient has been established to justify our regarding the subject as one within the range of practical gas politics. In particular, the past year has been distinguished by the advent of a new aspirant for honours, in the person of our ex-President, Mr. Warner, whose efforts and ingenuity we all hope may be crowned with success; while it has also been remarkable for the first competitive trial of distinct systems within the same works. Without entering into the respective merits of the various systems that are now offered for our acceptance, it may be observed generally that their success seems in a great measure to be proportioned, in the first place, to their departure from the ordinary method of treating the coal; and, in the next, to the observance of the conditions which experience has shown to be conducive to the best results in carbonizing. For example, in the earlier stages of its introduction, many fruitless attempts were made to improve the prospects of machinery by adapting the settings to its somewhat arbitrary requirements; whereas to-day we are witnesses of what may be called, without undue emphasis, a double triumph, in the combination of very simple machinery with a most admirable setting. Again, every endeavour to deal with the coal in the exact condition in which it is received into the works, or in which we have been accustomed to manipulate it, has resulted, more or less, in failure, for the sufficient reason, apparently, that the work of filling the scoop has seldom been attempted, and has never been satisfactorily accomplished. Now, however, this, the very pith and marrow of the difficulty, it is shown can be overcome by the simple expedient of breaking up the coal, so that it would seem as though we have only to satisfy ourselves that this may be done without injury to results, to ensure the removal of perhaps the only real obstacle in the way of the introduction of almost any form of mechanical appliances.

In the consideration of these important matters, the exercise of caution has been abundantly manifest; yet in another direction will be found evidences of mutability scarcely in harmony with its influence. It will appear that, in the opinion of the well informed, we have, during a series of years, and upon slender grounds, been pursuing, with reference to condensation, a course of procedure the very opposite of that which sound knowledge would dictate, or a regard for our own interests recommend, and that we are now invited to turn from the error of our ways, and retrace our steps. It is not so many years ago since the practice of conveying away the tar separately from the hydraulic main was general, not to say almost universal; but, in the course of time, and in

obedience to a necessity that arose for the prevention of naphthaline deposits, this came to be reversed, in many instances the plan being resorted to of carrying the entire products of condensation, for a considerable distance, measured by temperature, along with the gas. This was so far successful, not only in the fulfilment of its original purpose, but also, according to many, in the improvement that was apparent in the illuminating power of the gas, that the speedy and general acceptance of the principle of the horizontal condenser followed almost as a matter of course. It is true the enrichment of the gas by its means rested, and may be said still to rest, upon evidence of a somewhat indeterminate character; nevertheless, there is the fact that the stated results have not in any one instance been disproved. Whether the correct reason has been assigned for them is an entirely different matter. It is by no means either singular or impossible to be right in practice and yet wrong in theory. Success in the one is not incompatible with inaccuracy in the other. When, therefore, it is suggested, however faintly, that we should abandon that which experience has shown to be in some degree beneficial, for the reason, among others, that our theory is at fault, a little hesitation is not only excusable, but at the same time desirable also. It may be at once admitted that the opinion which has hitherto prevailed as to the beneficial effects of contact between gas and tar is, without qualification as to temperature, untenable. It was, in fact, discredited almost before it was conceived; and the more recent experiments of Mr. Young and others appear to have fully confirmed the earlier ones of the Rev. W. R. Bowditch, which first disclosed the almost opposite fact of the injurious effect of such contact except at certain high temperatures. How, then, are we to reconcile this with our practice? To me it seems that we have neither been altogether right in this matter, nor altogether wrong. Our perception of the truth at the beginning has simply failed us towards the end of the process of condensation; but in our operations we have been shielded from much of the harm that might otherwise have resulted from this by the adaptability of the horizontal condenser to the purpose for which it is required. It is impossible, when speaking upon condensation, not to refer to the admirable series of articles, by Mr. R. H. Patterson, that appeared in the JOURNAL OF GAS LIGHTING a few months ago. It is only scant justice to acknowledge the important service that has been rendered to gas manufacture by his clear and able elucidation of a somewhat abstruse and difficult subject. Mr. Patterson, it is needless to say, is agreed in condemning the principle of what may be called indiscriminate contact; but, what perhaps is equally interesting, he is by no means emphatic as to the efficiency of the means by which this is commonly sought to be promoted. He is, in fact, unable to discern any particular virtue in the horizontal condenser. On the contrary, it would seem to be the vertical form that possesses the best claims to be preferred. We are reminded by him of a circumstance that bears with some importance upon the determination of this question. Notwithstanding the great separation that takes place in the hydraulic main, there still remains with the gas, as everybody knows, throughout the whole of the subsequent process of condensation, and, in fact, until finally eliminated in the washers or scrubbers, a quantity of heavy tarry particles, that injure the gas by absorbing, or becoming dissolved by the light naphthas, and which it is consequently desirable should be got rid of as speedily as possible. Now, with regard to these, what is it reasonable to suppose takes place in the condensers? In the horizontal, on the one hand, the products of condensation may be expected to form a small stream along the bottom of each pipe, into which all tar, as it condenses, would naturally sink, and be covered over with the lighter oils and weak ammoniacal liquor. On the other hand, as pointed out by Mr. Patterson, the sides of a vertical pipe become coated, not alone with the lighter oils, but also with these objectionable tarry particles, which, in their course from the top to the bottom, present a continually changing surface to the gas, with a result that may be imagined. On this supposition the efficiency of the horizontal condenser not only does not depend upon the presence of the products of condensation throughout its entire length, but would really be increased by their removal as the temperature becomes diminished. As ordinarily employed, its effect may be described as beneficial at the higher temperatures (say above 80° or 90°), in so far as it permits of contact with the light naphthas, undisturbed, so to speak, by the presence of the heavy tar; and serviceable at the lower temperatures, in so far as it may be the means of avoiding contact with the products of condensation.

The proposals, however, that are now made to us possess a

wider significance than can attach to the somewhat vexed question of what is the best form of condenser. Whatever system be preferred, there inevitably remains with the tar much that would enhance the illuminating power of the gas, if only it could be practically applied to the purpose. This it is now proposed to do, either by the maintenance of a temperature, at or near the hydraulic main, sufficiently high to prevent the union of the light naphthas with the tar, or by re-heating the latter, so as to restore the naphtha to the gas. The advantage thus to be derived can, of course, be determined accurately only by experience. Against the permanent gain in illuminating power would have to be set the first cost of plant and of carrying out the process, besides the lessened value of the tar consequent upon the abstraction of some of its most valuable constituents; but that the financial results are not unsatisfactory may be inferred from the increasing favour with which the various apparatuses now under consideration have come to be regarded. In the St. John Carburetter and Purifier, as it is called, the invention of an American engineer, and which has been employed, not alone in America, but also in this country for several months past by Mr. T. O. Paterson, at the works of the Rochdale Corporation, we seem to be furnished with a direct proof of the actually beneficial effect of contact between the tar and gas at a temperature considerably below that of the outlet of the hydraulic main; while in the case of Messrs. Aitken and Young's Analyzer, the application of extraneous heat is said to be productive of a yet more complete economy. It is also to be inferred, from no mention being made of it, that the difficulty to be apprehended from having to deal with the tar in a much more viscid state than is usual, either has not arisen or has been overcome; so that, the question being before us in a fairly practical shape, it may be desirable to consider how far, at any rate, the essence of the proposition may be imported into our ordinary practice.

We learn, in the first place, that the heat which is usual in the hydraulic main, although, so far as it can be made use of, beneficial, is insufficient to maintain the complete separation of the lighter oils. Next, that the heat determined upon as adequate for such maintenance should be kept up, as nearly as possible, for a period long enough to admit of the deposition of all heavy tarry matter. Thirdly, that all liquid products should be drawn off before the temperature has been sensibly reduced. Lastly, that means should be taken to eliminate, while the temperature is still moderately high, those tarry particles that would otherwise be carried forward with, and do injury to the gas. These conditions observed, the subsequent process of cooling will probably be a matter of comparative unimportance, care being taken not to pursue it too far. Whether they are such as can be practically applied is a question that can only be decided by experiment. Mr. Patterson has suggested that the temperature in the hydraulic main might be raised to the required point, say about 190° , by the aid of steam; and he would avoid the formation of pitch, if this were to be apprehended, by employing a shallow, or the Livesey hydraulic. It is to be feared that he would find his preventive of no avail. Shallow hydraulics—at least so far as I have had experience of them—however useful they may be in preventing the accumulation of certain forms of carbonaceous matter, are powerless against a sufficiently high temperature for the formation of pitch, for they only choke up the sooner for being shallow. This, however, by the way. There is little reason for supposing that a moderate increase of temperature could not be maintained without inconvenience, but the necessity for any extraneous assistance may well be doubted. It ought not to be difficult to render available for this purpose the enormous reserve of heat within the retort-bench below, by regulating the amount of radiating surface between the mouthpiece and the hydraulic main; or, in other words, by adapting the retort fittings to our requirements. Another way would be by raising the heat of the retorts themselves, by which plan a double advantage would be secured. By either method, or by a combination of the two, it should be possible to attain to the desired temperature in a way at once simple, direct, and practicable; and this, coupled with a system of condensing-pipes, inclining towards the hydraulic main, yet leading from it, would apparently secure much, although perhaps not all of the advantage of supplementary appliances. It will, at all events, appear probable, upon careful consideration, that the practical limits of the application of what it may not be incorrect to describe as the strictly scientific method of condensation are within the reach of simple and admissible modifications of existing means.

In return for the permissive rights, neither excessive nor

extensive, without which the business of a gas undertaking could not be carried on, many restrictions have been imposed upon gas companies. It is hardly to be supposed, however, that these have been deliberately intended as fetters upon their industry; but that some of them have operated as such there is little room for doubting. In a significant article upon coal gas illumination, *The Times* newspaper has recently remarked upon the comparative apathy shown by English gas makers with regard to the employment of gas by the consumers. We may go further, and admit that there is little indeed to be found, on the part of our leading gas companies, of recognition of the principle of community of interests between manufacturer and consumer such as so freely obtains in the enlightened administration, say, of the Paris Gas Company. If it should be inquired why it is that in this country the consumer meets with so little encouragement in his desire to avail himself of the convenience and economy of gas, the answer will be that the law has set bounds to the operations of the companies which they cannot pass; the sanction of the Imperial Parliament—of Queen, Lords, and Commons—being necessary to render legal the sale or manufacture by them of even a single cooking-stove. It will be naturally and correctly inferred that, inasmuch as such sanction would cost both money and effort to obtain, success being at the same time by no means assured, and dividends tolerably secure without it, there is little inducement for enterprise in this direction. *The Times* has said truly that "they manage these things better in France," for, in the arrangements that are in force in the sister capital for promoting the intelligent use, not only of gas, but of gas products, it is impossible not to recognize the beneficial results of a policy having for its object the control of these industrial monopolies for the mutual benefit of all concerned. It is true, there has occurred a period when the perception of our rulers may be said to have been temporarily awakened to the desirability of establishing improved relations between the companies and the public, resulting in the adoption of the sliding scale. It is true, likewise, that the description I have given is by no means susceptible of general application. During the last few years a great change has taken place. In some few instances, under the authority of Parliament, in more numerous instances without such authority, or with authority ill defined, much is now being done for the spread of information amongst the consumers; and in the many exhibitions of gas heating and lighting apparatus that continue to be held in all parts of the kingdom, are to be recognized the gradual breaking down of a barrier created by jealousy on the one side, and by indifference on the other, and the re-uniting of interests that ought never to have been considered apart. May we not venture to hope that the liberality of the new Parliament will be exercised in acknowledging the efforts that are thus being made, and in cementing this most auspicious union, by the passing of a general Act, in the shape, it may be, of a further amendment to the Gas-Works Clauses Act, empowering all gas companies, and corporations possessing gas undertakings, not to manufacture, for this is neither necessary nor altogether desirable, but to sell or hire to their consumers, under reasonable limitations, any apparatus that it may be found convenient or economical to employ in connection with the consumption of gas. By adopting this course much unnecessary expense in the procuring of special Acts would be avoided; the position of gas manufacturers with regard to the subject would be clearly defined; while it could not but be acceptable to the makers of the apparatuses in question, from the prospect that would be held out to them of a widely extended market for their wares.

It is not, however, to be denied that very much may be done without any direct legislative enactment. The gas maker who waits to be made good, if I may be allowed the expression, by Act of Parliament, is in much the same position as the waggoner in the fable appealing to Hercules. There has never, in reality, been anything to hinder him from endeavouring to instruct his consumers in the economical uses of gas, nor from bringing under their notice the most modern and approved appliances, supposing him to have been so minded; nor are there at the present time any obstacles in the way of the fulfilment of this obligation, if such it may be termed. The way has been ever open to him to effect, by precept and by example, very much of the good that is expected to be achieved by projects of a more or less ambitious character; but the consequence, primarily, perhaps, of legislative restrictions, but mainly of the tacit acceptance by the companies of the position assigned to them, that of gas makers pure and simple, has been to divorce the science of the application of gas from that of its manufacture. The loss to the consumer from this unnatural

separation has been, without exaggeration, enormous. In the matter of light alone, it is almost a trite observation that very many have continued for years to pay 20, 30, and even as much as 50 per cent. more than they need have done had they been under the guidance of sound advice in the choice of burners. How useful to them would be a permanent exhibition of apparatus, after the model of those in Paris, or the services of a skilled official attached to each sufficiently large undertaking, specially qualified to advise them on all matters relating to the uses of gas; and what a valuable acquisition might not such an one prove to his employers, although not deriving his authority from any Act of Parliament.

Perhaps the most successful example on record of the direct application of heat as a mode of motion is furnished by the modern gas-engine. The recent development of this, after a succession of efforts, is one of the achievements of our time, and bids fair to secure for it a high place in the industrial annals of the century. Its progress has been watched with lively interest from two opposite standpoints. On the one side, gas makers have noted with satisfaction the promise of an additional source of future increase; while, on the other, the electrician has almost brought himself to regard it as a means through which the supremacy of coal gas as an illuminant may be vigorously disputed. It would be strange if the weapons furnished by ourselves should ever come to be effectually employed against us; yet this, in the opinion of some, is not beyond the limits of probability. In the minutes of evidence taken last year before the Select Committee of the House of Commons on Electric Lighting will be found abundant testimony in favour of the economy of the gas-engine, while at the same time the economy of the manufacture of the gas itself is sought to be discredited; so much so that, on reading them, one is almost tempted to imagine that henceforth the continuance of its manufacture is to be justified only for such purposes as that of furnishing motive power for the "light of the future;" or, at any rate, that this is to be its position when the electric light shall have been perfected and established. Even upon this supposition, however, consolation is left to us in the reflection that we shall remain the purveyors of a fuel which, in point of cheapness and convenience, it ought to be difficult, if not impossible, to surpass; and which, if ever the occasion should arise, might enable us to supply, without fear of competition, even the electric light itself. But there is little necessity for indulging in speculation of this kind. The time is obviously far distant, if it ever is to come, when coal gas shall be valued less for the light than for the heat that it affords. What chiefly concerns us in such a probability, remote though it be, is the refutation it furnishes of the plea so influentially urged against gas manufacture, that it is, comparatively speaking, an uneconomical science. It is scarcely to the purpose to be told that coal converted into electric energy can be made to produce much more light than it is possible to obtain from an equal weight when subjected to destructive distillation. It would be absolutely condemnatory of electric lighting if this were not so, seeing that in the one process the entire quantity of coal is reproduced, or is represented in the form of light; whereas, in the other, only a fractional part is converted into illuminating matter. This, however, does not of itself settle the question of comparative economy, the ultimate determination of which is influenced by a variety of considerations which it is unnecessary to discuss. It is somewhat more to the point to urge, as a reason why gas should be employed for the production of light, indirectly through its conversion into electric energy, rather than directly by means of the ordinary gas-burner, that only in this way can be utilized to its fullest extent the heat generated by combustion; but here, again, practical considerations prevail, and so long as it is found desirable to retain the present system of gas lighting, so long also may it be expected that the unavoidable expenditure of heat by which it is attended will be endured, even if it be not rendered more and more subservient to general requirements. Meanwhile we may wait with perfect equanimity the coming to the front of this question of heat or light, because already the economy of gas manufacture for the sake of heat alone has been amply vindicated. In the gas-engine we have means by which the gaseous products alone are able to exert an effect equal to that of the entire weight of the coal required for its production when expended upon an ordinarily well-constructed high-pressure non-condensing steam-engine. That is to say, taking 18 feet of gas to be the consumption per indicated horse power per hour of the gas-engine, which is a little in excess of what is found to be required in the largest of them, and 4 lbs. of coal as the consumption of the steam-engine, the

one would nearly enough represent the gaseous products of the other, while the actual weight of material consumed by the two engines would be in the proportion of about 1 to 6. Doubtless a much smaller consumption with the steam-engine than 4 lbs. per horse power is readily attainable; yet the greatest economy that has ever been secured by the aid of elaborate and costly contrivances still leaves the proportion, weight for weight, as about 1 to 3 in favour of the infant gas-engine—this child of great promise.

It is, of course, open to remark that the 18 feet of gas cost more than the 2 lbs., or even the 4 lbs. of coal; and so they do to the consumer, who willingly pays, in the shape of profit to the manufacturer, for the advantages he enjoys in the use of the gas-engine; but for our own requirements its superiority in all respects would seem to be beyond question, having regard to the almost nominal cost of gas in most cases. We do well to bear in mind also that, in according to it such a practical recognition, we are helping forward an agency that may be destined to exercise a powerful influence upon the fortunes of our industry.

Just now I hinted at the possibility of bringing more under control the heat generated during combustion when the gas is used for illuminating purposes. This heat, although a source of comfort rather than otherwise to the majority of consumers, stands very much in the way of the extended use of gas in confined spaces, and in houses of the better class, where also, it is needless to say, the products of combustion constitute a real objection. No doubt the proper remedy for this is efficient ventilation; but unfortunately the practice of this most necessary art is "more honoured in the breach than in the observance." Left to our own resources, however, the difficulty is not by any means a formidable one. What is known as the "Benham" system has long been applicable to the majority of cases, and Mr. Sugg has recently introduced what may be recognized as a modification of this, for use in connection with his large Argands. These latter have also rendered especially practicable the employment of a simple form of chandelier furnished with a central tube, by which the entire products of combustion may be carried off, and either disposed of in the nearest flue, after the manner of the "Benham" system, or they may be made use of for heating an upper room by means of a radiating stove or a simple coil of piping. There is probably nothing particularly novel in such an arrangement, but it satisfies, at a moderate cost, the conditions considered necessary to comfort by a numerous and influential class of gas consumers, while at the same time it opens up a way for the utilization of heat that would otherwise be worse than wasted.

Heating by gas having come to be regarded with increasing favour, improved appliances follow almost as a matter of course, although much remains to be done. Gas fires, for instance, are still for the most part but indifferent imitations of a cheerful coal fire, except in their inevitable waste by way of the chimney; and yet their use is rapidly extending. It may be inferred from this that their employment would become much more general if the resemblance could be rendered more complete; or, better still perhaps, that the heating agency of gas might speedily enjoy a fuller recognition, if the tastes of the public would admit of our dispensing altogether with the art of imitation, and relying solely upon the intrinsic merits of the fuel that we have to offer. The waste, even in the most approved forms of gas-fires, cannot amount to less than from 20 to 25 per cent., and ought to furnish a strong argument in favour of the substitution of stoves by means of which the whole of the heat generated might be applied to the purpose for which it is required. It is satisfactory to note that advances are being made in this direction, and amongst others of recent introduction may be mentioned the "Adams" and the "Ritchie" stoves, as, although proceeding on different lines, complying in a high degree with the conditions essential to the combination of economy with efficiency.

Although so much is being done for these subsidiary uses of gas, it is not to be supposed that the original, and what in all probability will, for a long time to come, be the main purpose of its manufacture, has in any degree been overlooked. Improved burners furnish one of the most satisfactory evidences of recent progress. The principle of controlling pressure at the point of ignition, as a means of obtaining higher and uniform results, is becoming widely acknowledged in the many excellent combinations of regulator and burner by which, without additional cost for the gas, increased comfort may be dispensed to every household; while the prospect of rivalry has stimulated into being, for

outdoor purposes mainly, burners of large power, that have fully maintained the superiority of coal gas over the electric light. To Mr. Bray our thanks are due for his development of the flat-flame burner into a lighting medium of a very high order, and for his vindication of its claims to practical consideration; although with Mr. Sugg remains the honour of being the most successful expositor of the illuminating power of coal gas. I have had occasion to refer to the theoretical disproportion between the heat of burning gas and the light evolved. Whether this heat may be regarded as the measure of the light that will ultimately be obtained, it is perhaps impossible to say; but certain it is that the limits of progress in this direction have not yet been reached. Every successive investigation reveals the possibility of further improvements, and the enlargement of the Argand by Mr. Sugg has furnished a development of light unequalled by any other form of burner. Some of the latest results show an improvement of fully 15 per cent. over anything previously attained, and upwards of 30 per cent. in advance of the Referees standard burner. It is not necessary to dwell upon the significance of this discovery. It may be tendered as one answer out of many to those who would assign to gas lighting, in the immediate future, a secondary position, as a science outstripped in the march of progress; it may be accepted by ourselves as an assurance, if such were needed, of the rich reward that continues to await the patient and intelligent investigator.

ROTHERHAM CORPORATION GAS SUPPLY.

THE APPROPRIATION OF GAS PROFITS.

At the Meeting of the Rotherham Town Council on Wednesday, the 2nd inst.—the Mayor (Alderman Harrison) in the chair—the Gas Committee reported that the profit realized on the gas undertaking during the past year, subject to audit, was £3300. The Committee agreed that, with the consent of the Council, the sum of £2750 should be placed at the disposal of the Finance Committee. This latter Committee, at their meeting on the 26th ult., decided to recommend the Council to appropriate the sum as follows:—General district rate account, £898 9s. 4d.; borough-fund account, £800; and markets account, £1051 10s. 8d.

Mr. TAFINDER asked the Chairman of the Committee if the decision to place £2750 at the disposal of the Finance Committee had been arrived at by the Gas Committee unanimously. He also said that it would have been more satisfactory, at all events to the gas consumers of the borough, if a portion at least of the sum had been appropriated to making a reduction in the price of gas.

Mr. WALKER also protested against the appropriation of the profits for the good of the rates, and said that it was unjust to the gas consumers, and, according to the ruling of the Lord Chief Justice, illegal; as this authority had ruled that corporations were not entitled to work any of their undertakings for profit, but must sell their commodities at the lowest prices. With regard to the injustice of the thing, he pointed out that in the outlying portions of the borough the ratepayers had the benefit of reductions in the rates, although they did not contribute to the profit made in the gas department. There were also four of the principal firms of the town who made their own gas; they were collectively rated at £5200, and if the proposed arrangement were carried out their rates would be saved to the extent of about £120 a year.

Mr. WRAGE thought if Mr. Walker's idea were acted upon, the large firms of the town would be driven out of the borough, and the Council would be killing the goose that laid the golden egg. He also pointed out that the Corporation at present supplied Greasborough and Rawmarsh with gas, and if a reduction in the price were made in the town, those districts would also ask for similar terms.

Alderman MORGAN said that when the gas-works were purchased the rates had to be mortgaged as security for payment, and as the ratepayers came forward to help the Council out of the difficulty, he considered they had a perfect right to let them participate in the profits. If the profits were not appropriated, the Council would have to levy a rate of 8d. in the pound, and the result would amount to nearly the same thing; at all events, the difference would be only about 3d. in the pound.

Mr. NEILL contended that it would be unfair to allow the gas consumers alone to participate in the profits of the gas department. It would be unfair to saddle the users of the town water with the deficit on the water-works, and the same would apply to the markets question; and they must take the three departments into consideration. It would only be the time to make reductions in the changes when they were possessed of a surplus which accrued from the management of all three undertakings.

The minutes were then adopted.

ROCHDALE CORPORATION GAS SUPPLY.

The report of the Gas Committee of the Rochdale Town Council, for the twelve months ending March 25 last, has just been issued. The Committee report an increase in the consumption of gas during the year, amounting to 3,800,000 cubic feet, against a decrease of 600,000 cubic feet the previous year. Owing to the low prices which ruled for house coal, the coke receipts were slightly under those of the previous year; but the surplus profits exceeded those of any previous year. They amounted to £8886 0s. 8d., after deducting £1922 for payment of the St. John purifying apparatus, concerning which the Committee say: "The increase in the profits this year is accounted for mainly by the introduction of a new apparatus known as the St. John Purifying Apparatus and Carburetter, and also to an increase in the consumption, and to a considerable saving in the general working expenses. The object of the St. John apparatus is to entirely free the gas of all particles of tar, naphthaline, and a considerable quantity of sulphuretted hydrogen and ammonia; but the principal object your Committee had in view when purchasing this apparatus was to be able to manufacture 18-candle gas with a smaller percentage of cannel than had hitherto been practicable. The report of your Engineer and Gas Examiner on experiments made with the apparatus previous to its being purchased, showed that it was capable of removing tar, naphthaline, a portion of sulphuretted hydrogen and ammonia, and of carburetting or enriching the gas to the extent of 1½-candles, and they estimated that in one year a profit of £772 would result. It is satisfactory

to find that in six months winter working a saving has resulted of £870, owing to the large reduction in the consumption of cannel rendered possible by the use of this carburetting machine, the standard of illuminating power having been maintained throughout. From the results obtained by this apparatus during the period of working, it may be fairly estimated that in one year the saving will not be less than £1000."

The report further states that the Committee are about to arrange for the fixing of governors to equalize the pressure in the higher parts of the district, and are having the services laid on the box system. The present number of consumers is 14,743, showing a decrease, during the last twelve months, of 902. The number of meters in use is 18,845 wet, and 99 dry ones. During the year the illuminating power of the gas was tested daily, the average for the quarters ending June, September, and December, 1879, and March, 1880, being 18.38, 18.20, 18.22, and 18.10 candles—an average of 18.22 candles. During the same four quarters the consumption of gas varied as follows:—29,214,100, 27,611,400, 88,429,900, and 77,560,600 cubic feet. The average quantity of sulphur in other forms than sulphuretted hydrogen, over the whole year, was 24.62 grains per 100 feet of gas.

We have received from Mr. T. O. Paterson, the Engineer of the works, the following statistics in reference to the gas supply:—

	March 25, 1878, to March 25, 1879.	March 25, 1879, to March 25, 1880.
<i>Receipts.</i>		
Gas sold to private consumers	£38,237 2 3½	£38,865 0 9
Gas supplied to public lamps	4,369 1 8	4,391 10 0
Tar and ammoniacal liquor	3,017 11 2	3,082 17 1
Coke	2,507 14 8	2,184 16 5
Sundries	80 0 0	24 14 3
	£48,211 9 9½	£48,548 18 6
<i>Expenditure.</i>		
Cannel and coal used	£17,360 10 8½	£15,980 1 4½
Lime used	166 3 3	—
Salaries and wages	7,640 19 11½	7,195 9 0
Expended on works, &c.	3,688 18 6½	4,554 3 3
Printing and stationery	144 8 1	122 8 0
Interest of money	7,291 17 0	7,242 0 8
Rates and taxes	1,346 4 1	1,789 18 3
Rent of land	160 6 11	385 13 7
1-75th part of money borrowed paid off	2,393 8 8	2,393 8 8
	£40,192 12 2½	£39,662 17 9½
Profit this year	£8,018 17 7	£8,886 0 8½
	£48,211 9 9½	£48,548 18 6
<i>Production.</i>		
Cubic feet of gas sold to private consumers	202,826,800	207,604,500
Do. estimated to have been burnt by street-lamps	13,806,900	12,947,800
	216,633,700	220,552,300
Cubic feet of gas consumed on the works	2,304,200	2,263,900
Do. lost by leakage, &c.	25,810,100	26,983,000
	244,738,000	249,799,000
Loss per cent. by leakage and condensation	10.541	10.801
Tons of cannel used	6,674	4,238
Do. coal used	18,125	20,602
Total coal and cannel used	24,799	24,840
Average price of cannel per ton at works	19s. 11-019d.	19s. 7-618d.
Do. coal per ton at works	11s. 9-011d.	11s. 5-689d.
<i>Cost of Gas.</i>		
Net cost of gas per 1000 feet, reckoned on quantity sold, including 1-75th part of debt paid off	3s. 2-317d.	3s. 1-401d.
Net cost of gas per 1000 feet, reckoned on number of feet made, and excluding 1-75th part of debt paid off	2s. 7-570d.	2s. 6-722d.
<i>Selling Price of Gas.</i>		
Invoice price of gas per 1000 feet in the borough	£0 3 11	£0 3 11
Do. do. out of the borough	0 4 7	0 4 7
Street-lamps—price charged per lamp per ann.	2 10 0	2 10 0
Amount of discount allowed	2,184 10 2	2,385 13 1½
Number of consumers	15,267	14,743
<i>Capital Account.</i>		
Amount borrowed, including depreciation-fund, £214,413 2 11	£214,413 2 11	£214,413 2 11
Amount repaid in previous years	35,607 3 5	38,000 7 1
	£178,805 19 6	£176,412 15 10
Amount repaid this year	2,393 3 8	2,393 3 8
Amount owing, including depreciation-fund	£176,412 15 10	£174,019 12 2
Deduct depreciation-fund	9,063 2 11	9,063 2 11
Present mortgage debt	£167,349 12 11	£164,956 9 3
Total cost of works, including purchase ex- penses, as per last year's report	£204,478 18 2	£208,152 18 9½
Extensions, as per stock account	2,034 0 7½	660 18 9
	£206,512 18 9½	£208,813 17 6½
Total amount paid off	38,000 7 1	42,033 10 9
Present value of works	£168,512 11 8½	£166,780 6 9½
Balance of debts and stock on hand	20,919 1 8½	21,125 6 1
	£189,431 13 5	£187,905 12 10½
Deduct mortgage debt, &c., as above, also amount allowed out of revenue as depreciation	181,412 15 10	179,019 12 2
Profits paid to Finance Committee this year for benefit of ratepayers	£8,018 17 7	£8,886 0 8½
Do. previously paid	103,868 14 10	113,887 12 5
Total paid to Finance Committee	£111,887 12 5	£122,773 13 1½
<i>Town Lamps.</i>		
Number of lamps	1,751	1,766
Number of hours the lamps have been lighted	2,106	1,986
<i>Main-Pipes.</i>		
Length of main-pipes laid this year, in yards	2,688	1,129
Length previously laid	125,270	127,958
Total length laid to date	127,958	129,087
1872—Amount allowed out of revenue as depreciation of old works	£1000.	
1873 Do. do. do.	£4000.	

having exercised sufficient despatch in this matter. He considered the right honourable gentleman would have been very unwise in having at once dashed into the subject without consideration, and he, for one, was heartily glad the agreements were to be referred to a Committee.

Sir W. V. HARCOURT: I am rather surprised that an honourable member representing the Water Companies should desire that we should proceed in any other manner than by inquiring whether any action shall be taken at all on this question. I must say this, that I cannot undertake any responsibility in the matter of this Committee, unless I am allowed to keep it as an open question whether the supply of the existing Water Companies is or is not one that is worth buying. If the House is of opinion that this is not open, I will have nothing to do with the question. The Corporation of London and the Metropolitan Board of Works have told me that this is the condition of their co-operation. The point of their contention is that the water of the Thames is not worth having, and this is the assumption that they proceed upon in the first instance. To exclude, therefore, this first inquiry is to make it worthless. I will be no party to this inquiry if I am to have one of my arms tied behind my back. I consider that the question of an alternative scheme, and the use of it, is the only way of dealing with these Companies, and those who desire to exclude it from the Committee would absolutely give the monopoly to the Companies, and prevent the inhabitants of London from being supplied with fresh water on reasonable terms.

Sir H. HOLLAND: What I thought was that the first thing should be to determine what terms, if any, should be made with the existing Companies; but I did not say that you could not after that decide whether or not to buy the works.

Sir W. V. HARCOURT: It may be the fact that you may buy these things on reasonable terms, but they may not be worth buying at all. It will be for the Committee to consider whether the undertakings are worth buying at any price. I must ask the House to allow the reference to remain as it is, or else I must wash my hands of the whole question. The information contained in the report already published may lead the Committee to a sound conclusion on the subject, and they may refer to it or not as they please; but the matter must be open to their own judgment. The first and preliminary question to determine is whether the works of the Companies who supply water from the Thames are worth buying at all; and after that, if you see that they are worth buying at a reasonable price, then the logical course would be to inquire whether the price is reasonable or not. This appears to me to be the only course to be taken. I consider that the question of whether or not London is to be supplied from the Thames at all, or whether for 20 millions you can have a better and a more abundant supply of water than you can get for 30 millions from the Companies, is the question the Committee have to consider.

Mr. W. H. SMITH: I am sure that if the right honourable gentleman is able to get a good supply of water for 20 millions, he will confer a great benefit on the Metropolis. Speaking as one of the representatives of the Metropolis, I am sure he feels he cannot escape his responsibility in regard to the question. He finds these agreements before him which were intended to be the basis of an Act of Parliament, subject to negotiations, and subject also to evidence and discussion before the House of Commons; and the right honourable gentleman I am sure feels that on him will rest the responsibility of this scheme, whether it results in a larger sum being paid for the water of London than if these agreements were dealt with in the manner contemplated by the late Government. The question is a very important one; it cannot be long delayed, and upon the mode in which it is treated very great and serious results depend. It appears to me that the Committee ought to enter upon the discussion of this question with their hands perfectly unfettered, and with full liberty to consider the whole subject. They should have the power to say to the Water Companies, "Your terms are perfectly unreasonable, your water is not good, and we must consider in what way we can supply the Metropolis with water." But it is quite another matter to invite the Committee to consider a different and a much larger question, and one which might occupy their attention for some years. It is the duty of the Metropolitan Water Companies to make provision for the supply of water, under certain Acts of Parliament, to the whole of the Metropolis. They must come to Parliament sooner or later for further powers to expend money, which to a very large extent involves a charge upon the Metropolis. A delay in dealing with this question means the compulsory expenditure of a very large amount of capital this year, next year, or the year after, under the Companies Acts of Parliament. I think, therefore, that the Government are responsible for seeing that the question is dealt with the least possible delay. It certainly cannot be dealt with by saying, "The terms are ridiculous, the water is bad, and we will go elsewhere to obtain a supply." You must always bear in mind that the powers possessed by the Water Companies have been given to them by Acts of Parliament, and all experience is against the withdrawal of powers which have been deliberately given by Parliament to public companies, and where a large capital has been invested, without compensation, which in this case would come very heavily indeed on the rates. My own opinion is that if an Act of Parliament is passed to send the matter to an arbitrator, the Metropolis will have to pay very heavily. I have in past years had experience in arbitration cases in which Parliament had conceded rights, and this experience leads me to go against such a plan being resorted to in the present instance.

Mr. OSNLOW said that having been a member of the Committee on Fires in the Metropolis, when the question of the water supply came before the Committee, he should like to say a few words. The reference said "to inquire and report as to the expediency of acquiring, on behalf of the inhabitants of London, the undertakings of the existing Water Companies within the Metropolitan area." Supposing the Committee should find that it was not expedient to acquire the works of the existing Water Companies, would they be precluded from going into the question of a fresh water supply? How were they to be able, under the terms of reference, to go into the question of a new supply of water? He would press on the Home Secretary that on the Committee no one should be appointed who had any shares in a Water Company in London.

Mr. FAWCETT: May I say, Sir, that I served on an East Indian Railway Committee last year, which raised a question of as large an amount as this—I think it was £32,000,000. In the appointment of that Committee I believe you ruled that it would be contrary to the practice of the House that any one should be on the Committee who had any pecuniary interest whatever in the railway; and, therefore, as this is a question of the possible purchase of the metropolitan water undertakings, I should suppose the same rule would hold, and that it would be impossible for any one to serve on the Committee who is, directly or indirectly, pecuniarily interested in the Metropolitan Water Companies. I believe your ruling, Sir, went to this, that an honourable member of this House was advised that he could not serve on the Committee because he was interested in the Company simply as a trustee.

The SPEAKER: There is no doubt that the general principle is that no member who is directly interested can serve upon either a public or a private Committee. I do not propose to answer this question at once, without knowing the nature of the interest which any honourable member may possess.

Sir R. A. CROSS: As far as any member on this side of the House is concerned, that question has been looked into, and no one will be appointed on the Committee who is so interested.

The motion was then agreed to.

FRIDAY, JUNE 4.

The Standing Orders Committee recommended, and it was agreed, "That, in the case of the Liverpool Corporation Water Bill, petition of the Corporation of Oswestry for dispensing with Standing Order No. 129 in the case of their petition against the Bill, the said Standing Order ought to be dispensed with."

LIVERPOOL CORPORATION WATER BILL. The Committee of Selection added the following members to the Select Committee on this Bill:—Mr. Sclater-Booth, Mr. Blennerhassett, Sir John Lubbock, and Earl Percy.

Legal Intelligence.

DUDLEY POLICE COURT.—MONDAY, MAY 24.
(Before Messrs. J. ASTON and C. COCHRANE.)

THE DUDLEY GAS COMPANY AND THE CORPORATION.

The Dudley Gaslight Company and their Secretary (Mr. T. Collett) were summoned, at the instance of the Corporation, for "that they, on the 3rd of March, 1880, unlawfully did not keep and sell to Edward Marcus Warmington (the Town Clerk of Dudley), who applied for the same at their office, a copy of the annual statement of accounts of the said Company, made up to the 31st day of December, 1877, in the form, and containing the particulars specified in schedule B to the Act of 34 & 35 Vict., cap. 41.

Mr. HUGO YOUNG, instructed by the Town Clerk, appeared for the Corporation; and Mr. R. C. E. PLUMPTRE for the Company.

Mr. YOUNG, in opening the case, said this was an application for the payment of penalties by the Dudley Gas Company, for not furnishing to the applicant, Mr. Warmington, certain accounts which they were bound by statute to keep. He (Mr. Young) understood that there would be no question of fact here disputed, and it would be simply a question of law as to whether a general Act of Parliament, called the Gas-Works Clauses Act, 1847, and the Amendment Act of 1871, did or did not apply to the Dudley Gas Company. In order to put the matter clearly before the Bench, it would be necessary for him to refer to the various sections of different Acts of Parliament under which the Company took their powers, and to the provisions of which they were subject. It appeared in the first instance that, amongst other Acts which were incorporated in the Dudley Gas Act of 1853, was the Gas-Works Clauses Act of 1847, which was amended by the Gas-Works Clauses Act of 1871. These were model Acts, embodying certain clauses for the convenience of incorporation with certain other Acts, and the former was specifically incorporated with the Dudley Gas Company's Act of 1853. Now, section 30 of the Gas-Works Clauses Act, 1847, simply provided that the Company should not pay a greater dividend than 10 per cent., and he referred to this just to show the interest the public had in the accounts being kept and furnished when required. Section 38 of the same statute provided that yearly accounts should be furnished to the Clerk of the Peace of the county, and he thought they might take it that, independently of the Amendment Act of 1871, which partly applied to the Company, this would be the only obligation under which the Company furnished any accounts at all. Now, by section 49 of the same Act, it was enacted that nothing therein, or in the special Act (that was the Company's Act of 1853), should be deemed to exempt the undertakers from any general Act. He drew special attention to this section, as showing in fact that no special Act should make any sort of provision by which it could exclude itself from being bound by any subsequent general Act which might be passed. This was the position in which the law stood down to 1871, when the Legislature thought that their model Act of 1847, which had been incorporated with the Dudley Gas Company's special Act, needed amendment, and therefore they set to work to amend it, so that in future it should apply to all gas companies trading under special Acts of Parliament. The first section of the 1871 Act was to the effect that it and the Gas-Works Clauses Act of 1847 should be construed together as one Act; and the question in this case was whether the Amendment Act applied to the Dudley special Act, which incorporated the Act of 1847. Independently of the 49th section of the 1847 Act, which had been incorporated, and to which the Company had made themselves liable, they had, in effect, enacted in their own special Act that they should be subject to any subsequent general legislation affecting gas companies. Therefore, by this section, even standing by itself, they would be subject to the Act of 1871, which was a general Act. But, in addition to this, he said further that the 1847 Act, as amended by the 1871 Act, was gone entirely, except so far as it stood side by side with the 1871 Act, and anything additional which was added to the 1871 Act was to all intents and purposes part of the 1847 Act, and, therefore, if they chose, in a certain sense the 1871 Act was incorporated with the Dudley Company's special Act. Now section 3 of the Act of 1871 provided that its provisions should apply to every gas undertaking authorized by any special Act thereafter passed, or by any Provisional Order made under the Gas and Water Facilities Act, 1870. It said positively that in future these general Acts should *ipso facto* be incorporated with the special Act, whether the undertakers chose it or not. This being so, the 35th section of the 1871 Act provided that every year, before the 25th of March, an annual statement of accounts up to the 31st of December next preceding should be made in the form given in a schedule, and that the undertakers should keep copies of such statement at their office, and sell the same to any applicant at a price not exceeding 1s. for each copy; and in case the undertakers made default, they should be liable to a penalty of 40s. for each day during which such default continued. It was for this penalty that these proceedings were taken. Mr. Warmington applied to the Company for the accounts, which were refused him simply because they had not been kept and could not be furnished. He (the learned counsel) then went on to quote the decision of Justices Lush and Quain in the case of the *Commercial Gas Company v. Scott* as analogous, contending that by the express words of section 49 of the Act of 1847, which the Company of their own free will incorporated, they had made themselves subject to any future general legislation affecting gas companies. Therefore, they were bound to supply their accounts in the prescribed form. He believed the total amount of damages at £2 a day would amount to £150, and though he should not ask for that penalty, he should certainly wish for some substantial fine to be imposed.

Mr. PLUMPTRE, for the defence, admitted that the application for the accounts was made on the 3rd of March, and refused because no accounts under the Act of 1871 had been kept by the Company. He argued at length that this Act was not retrospective in its operation, and contended that the case of the *Commercial Gas Company v. Scott*, quoted by his learned friend, was not on all fours with the present case. The principle of the whole question was simply this: Were the Company bound by the Act of 1871? They contended that they were entitled to carry on business as

they always had done, under their own special Act of 1853 and the general Act of 1847. As to the case already cited by Mr. Young as conclusive in his own favour, he might remark that it was upon the language and construction of the Metropolitan Gas Act of 1860 that that case turned, and upon that alone, and as far as it was an authority upon the point before the Bench, it was only so by inference both in regard to himself and his friend. But the Dudley Gas Company had their own private Act of 1853, upon which they took their stand. It had been suggested that they were affected by public legislation; but he ventured to submit that this was a wrong principle. Unless express words could be found, private legislation was not to be interfered with or annulled by public legislation.

Mr. YOUNG, in replying, said the question arose, what was the distinction between private and public legislation? He found on looking at the Metropolitan Gas Act of 1860 that the words used were exactly the same as those in the Dudley Company's Act of 1853. If legislation were carried on in this way, there would be two sets of gas companies in the country—one set furnishing accounts, the other none at all.

The BENCH, after a consultation, held that the Act of 1871 was to be read with the Act of 1847, and therefore the Company were liable.

Mr. PLUMPTRE then took an objection that the information for the summons was laid too late. The offence was committed on March 25, 1879, and the plaintiffs made application on March 3, 1880, to have the accounts for 1878. He further contended that as the accounts did not exist, the Company could not be liable to fine, the offence being based upon, and presupposing the existence of the accounts.

Mr. BARRADALE (the Clerk) advised the Magistrates that they were in time, because the period was not from the date when the accounts should have been made up, but from the time the Town Clerk applied for them.

Mr. YOUNG having pointed out that the Company were required to send in the accounts within six months to the Local Authorities, and keep copies of the annual statement for the convenience of any ratepayer, The BENCH imposed a penalty of £50 and costs.

Mr. PLUMPTRE applied for a case, and this was granted.

WARRINGTON BOROUGH POLICE COURT.—MONDAY, MAY 24.

(Before the MAYOR and a Bench of Magistrates.)

WHAT IS A DOMESTIC SUPPLY OF WATER?

The Warrington Water-Works Company were summoned at the instance of Messrs. Robinson, Son, and Skinner, flint glass manufacturers, for that they, "being the undertakers within the meaning of the Water-Works Clauses Act, 1847, did unlawfully refuse to furnish Thomas O'Neill, the occupier of a private dwelling-house within the limits of the Warrington Water-Works Act, 1855, in a street in which a main or other water-pipe of the Company was laid, with a sufficient supply of water for the domestic purposes of such occupier, contrary to the provisions of the Warrington Water-Works Act, 1855, and the Acts incorporated therewith."

Mr. HEYWOOD appeared for the complainants, and Mr. TAYLOR for the defendants.

Mr. HEYWOOD, in opening the case, said the complaint was made under the 63rd section of the Warrington Water-Works Act, 1855, which stated that the Company should, at the request of the owner or occupier, furnish to every occupier of a private dwelling-house, or part of a dwelling-house, in any street within the limits of the Act, a sufficient supply of water for domestic purposes. He believed the only question to be decided was whether the occupier of a lodge attached to Messrs. Robinson's premises, was to be construed to be an occupier of a private dwelling-house within the meaning of the Act.

Mr. TAYLOR: That is one question only.

Mr. HEYWOOD said the facts of the case were these: Prior to December, 1877, Messrs. Robinson were the owners of this particular property, or the tenants for the time being, and they were in the habit of getting water from the Company, not only for the purposes of the lodge, which he would presently describe, but for the use of the men in the works and for trade purposes. In December, 1877, for various reasons—one being that the water from the Mersey was so much better for their purposes, being much softer, they laid pipes to the river, and thence obtained a sufficient supply of water for their requirements; and since then they had continued to use river water. It was very important that this fact should be pointed out to the Bench, because from the date named hostilities commenced between the Company and Messrs. Robinson—in fact, much had been done by the former to annoy the complainants. The works of Messrs. Robinson extended over a considerable area, and on the ground floor there was what he had called a lodge. It was not a lodge in the ordinary sense of the term, but a house for a lodge-keeper. There were four rooms on the ground floor of the house. There was an entrance to it from the street, and there was also a door from the kitchen into the passage leading into the yard of the works; but there was no communication with the rooms above, which were used as offices. In December, 1877, Messrs. Robinson ceased to take the water for what he would call purely manufacturing purposes, but continued for some time longer to take it for the supply of the lodge-keeper's house, for the water-closets, and for drinking purposes for the men. In the beginning of 1878 Messrs. Robinson sank a well, and being satisfied with the water obtained, determined to discontinue the supply from the Company except for limited purposes. A lengthy correspondence took place between the Company and Messrs. Robinson, and the former made several suggestions as to the terms upon which the water could be supplied to the works; but complainants stated distinctly that they only intended to take water from the Company for use in the lodge-keeper's house, which had always been treated as a separate dwelling or occupation. The Company now denied they were bound to supply the lodge, and he (Mr. Heywood) took it that the only question to be decided was, whether or not the lodge was a separate dwelling. He concluded that something would be said about a proceeding which was certainly a very extraordinary one. Having been unable to make an arrangement with Messrs. Robinson to take water for the use of the men, &c., the Company one day put down a meter in the street near the house. They made no communication with Messrs. Robinson, or the occupier of the lodge, with reference to the matter. The meter remained there for several months, and then, without any intimation to any one, the Company cut off the communication, and had since refused to supply water. The question of waste of water had never been urged by the Company as a reason for adopting such a course. The learned counsel then read the correspondence which had taken place between the Company and the complainants, and proceeded to say that the only ground, as far as he could see, upon which the defendants refused to supply water was that they were of opinion that the lodge was not a private dwelling-house under their Act. This was the ground of dispute, and he did not propose to deal with any other question at present. The lodge was a tenement that entitled the occupier to a vote at parliamentary and other elections. There was a door leading into the works, but it was entirely for the use of the lodge-keeper, who lived in the house with his wife. Of course, it was necessary he should occasionally go to the office, and a door had been put up for his convenience. No person had a right in the house without his permission, so it was as much a separate dwelling-house as the flats in Edinburgh or Paris were. There was no communication between the upper and the lower floors; but the Company claimed a right, if they

supplied the lodge, also to supply the whole of the works. He submitted that this was an erroneous conclusion to draw.

Mr. DAVIES (the Magistrate's Clerk): Is the contention merely that water shall be supplied to these four rooms constituting a private house?

Mr. HEYWOOD: Certainly.

Mr. DAVIES: The supply is for private domestic purposes?

Mr. HEYWOOD thought he had made it clear what his argument was. With regard to the four rooms, he contended the Company were bound to provide a supply of water under the Act, because the lodge was the home of the keeper and his wife. He was clearly a person entitled to be supplied with water for domestic use. The Company contended that the lodge was not a private dwelling-house or part of a private dwelling-house, but it must be a dwelling-house because a man lived in it. The question was, "Is it or is it not a private dwelling-house" because it happened to have offices over it? He contended that this did not alter its character, and that it was a private dwelling-house within the meaning of the Act; and it was clear, therefore, that the Company were bound to provide a proper supply of water for domestic purposes. The Bench might inflict a fine as well as a continuing penalty of 40s. a day, but the complainants did not ask them to inflict the latter, because he had no doubt that if the decision went against the Company they would at once give way and supply the water.

Evidence was then called in support of the complaint.

Mr. William Robinson, a member of complainant firm, said when they ceased to take the Company's water he gave instructions that no water from the main should be used in the works. He was never informed, before the pipe was cut off, of any complaints by the Company. They had an ample supply, without using the Company's water, for everything in connection with the works. In the accounts sent in by the Company the lodge was always charged as a separate item.

Mr. TAYLOR (in cross-examination): After you ceased to pay £27 a year to the Company for their water you obtained your supply from the Mersey?

Witness: Yes.

I may assume that the workpeople did not drink the Mersey water. How then did you propose to supply them with water for drinking?—From a bath spring. We made a cistern for the water to run in.

Did your workpeople drink that water?—They drink no other than I am aware of.

Do you mean to say that you have not the slightest suspicion about your men getting any water but from the well or from the lodge?—They have certainly not had any from the lodge.

Between April, 1879, and the time the water was cut off from the lodge, which was in April, 1880, did you give any orders to the workpeople or to any person that they were not to use any of the Company's water?—I might have done; I am not sure.

I am to understand that you never had any suspicion that the men were drinking the Company's water after April, 1879?—I certainly had no suspicion.

In further cross-examination, witness said he was away at the time the meter was put down, but he heard of it on his return. He did not say anything about it. As the water was cut off from the works he told the lodge-keeper that he had no right to give any of the Company's water to the workpeople.

The witness was also cross-examined at length as to the construction of the lodge and its use. He admitted that in a scullery connected with it they kept the gas-meter for the works, which was attended to by the lodgeman, who was paid by the week, the house-rent being reckoned as part of his wages. If they dismissed him, they would require him to go out of the lodge.

In re-examination, witness said no one in connection with the works had any right to go into any of the rooms of the lodge without the lodge-keeper's leave.

Some further unimportant evidence having been given,

Mr. TAYLOR addressed the Bench on behalf of the Company, and at the outset argued the question whether the lodge was a private dwelling-house within the meaning of the Company's Act of Parliament. He quite agreed that the lodge-keeper was the occupier of part of Messrs. Robinson's works, but he was not the occupier of a private dwelling-house. The man paid no rent, had no right to any exclusive occupation of the place, and could be turned out at any moment.

The MAYOR: His rights cannot be infringed upon by the public.

Mr. TAYLOR: Not by the public.

Major CARTWRIGHT: The question is whether his employer would have power to go into his house.

Mr. TAYLOR: I say he can. It is simply a permissive occupation. Mr. Robinson says to the man, "I will give you 20s. a week, and you may have the use of that place."

The MAYOR: I have a coachman, and he occupies a house on my land. I would never think of going into his cottage.

Mr. TAYLOR: But you can say at any moment, "Out you go."

Mr. CROSSFIELD: There has been no evidence given to show that the man is liable to be turned out of the house at a moment's notice, and without any compensation for rent.

Mr. TAYLOR: Mr. Robinson himself said the house is part of his wages. So it is with a domestic servant. If you turn a cook away she loses her board and lodgings; and yet the law, as I understand it, is perfectly well established that you can at any moment say to a domestic servant, "I don't like you. Here is a month's wages; you must leave my house." None of us would think of going into the bedrooms of our domestic servants, yet they are just as much private as this is. This lodge is a portion of the works, the same as a bedroom is part of a house. If it is not part of the works, why do they have placed there the meter which registers the gas used over the whole of the works? There is not a single fact in the whole of the case which supports the view that it is this man's dwelling-house. It is not for me to impute any blame to Mr. Robinson. I assume that he gave directions that the Company's water was not to be used on the works, but that does not prevent it being used. We have been told that a meter was fixed up at the lodge, and this was done because the Company had good ground for believing that the water was being used otherwise than it should be. The result was found to be as follows:—From May 19 to June 14 the quantity used was 55 gallons per day; from June 14 to Aug. 18 it was 15 gallons a day; from Aug. 18 to Sept. 29 it was 333 gallons; from Sept. 29 to Oct. 8 it was 444 gallons; from Oct. 8 to Oct. 23, 600 gallons; from Oct. 13 to Oct. 21 it diminished to 436 gallons.

Mr. BLECKLY: Was there any leakage? At our works we have seen the consumption rise from 60,000 to 170,000 gallons, and we say there must be a leakage somewhere.

Mr. TAYLOR said where there was a large area they knew there must be leakage, but all this pipe had to do was to go through 18 inches of wall. If there was a leakage, it would have gone on increasing; but what happened was just the reverse, as it diminished slightly towards the end of October. Was it likely that the lodgekeeper and his wife would take the trouble to go into the yard to get pump water for the use of the men when they could get the Company's water nearer at hand? From some

reason or other, there was an undoubtedly undue consumption of water, and under these circumstances the Company were entitled to cut off the supply.

The following evidence was then called for the defence:—
Mr. Berry, the Superintendent and Manager of the Manchester Corporation Water-Works, said he had been in the service of the Corporation for 30 years.

Mr. TAYLOR: Now tell me what is the proper consumption for two persons—a man and his wife.

Mr. HEYWOOD: I submit that the question is entirely irrelevant to the case. Mr. Berry has, no doubt, had a large experience, but the average consumption of water by a family in Manchester has nothing to do with the consumption in Warrington.

Mr. DAVIES: Mr. Taylor says, "We go on the ground of undue consumption," and he proposes to prove this by saying that 600 gallons was the daily consumption. I have no hesitation in saying that the question is admissible.

Mr. TAYLOR: What should be the consumption where people live in lodgings, and do not wash at home?

Witness: 14 gallons per day is the maximum.

The witness was not asked any further questions.

Mr. Ross, the Secretary to the Company, was then called, and said he directed the meter in question to be fixed, as well as the cutting off of the supply of water on the 21st of October. He believed the meter registered correctly. The meters were tested, but he could not tell whether this particular one was. The supply of water was cut off on account of undue consumption. The quantities of water consumed were taken by two of the Company's workmen, who reported to him. The supply was cut off by order of the Directors.

Mr. HEYWOOD: How is it you have not mentioned the question of undue consumption in any of your letters to Messrs. Robinson?

Witness: I have nothing to do with Messrs. Robinson. This was water supplied to the lodge.

You had nothing to do with Messrs. Robinson, then?—I simply cut off the water as directed by the Act, without notice.

What made you suppose a greater consumption of water was going on than was usual?—Because we could not see how the hands could get water other than by taking it from the lodge.

I understand that, during the whole of the time the meter was down, you took the register day by day?—Yes.

And when the consumption rose to 333 gallons per day, did you go to Messrs. Robinson and point the fact out to them? Do you say that the water was fraudulently taken?—I cannot say that.

And you never thought fit to tell Messrs. Robinson of the large consumption?—I never do in cases of this sort.

Why did you not sooner cut off the water, because 600 gallons a day was a pretty stiff figure?—The consumption was allowed to go on for a certain period to make sure of it.

The case for the defendants closed by two witnesses being called to depose as to the fixing of the meter and the correctness of its registration.

Mr. DAVIES having advised the Bench that there could not have been undue consumption of water without some knowledge on the part of the consumer,

The Magistrates retired to consider their decision. On their return, in about a quarter of an hour,

The MAYOR said: It appears to the Bench that the lodgekeeper is the occupier of a house within the terms of the Company's Act of Parliament, and that he is entitled to the water supply asked for.

Mr. TAYLOR intimated that the Company would appeal from this decision. Whereupon, after some further discussion,

The Bench decided to inflict a penalty of 50s. and costs, the defendants agreeing to take no objection on appeal as to the amount of the penalty.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

DEPUTATION TO THE HOME SECRETARY.

On Tuesday last a deputation representing the various Vestries and District Boards of the Metropolis waited upon the Home Secretary, and presented a memorial urging the passing of a Bill without delay suspending until the end of the next session of Parliament the power of the Water Companies to augment the charge made by them for the water supply of property in the Metropolis.

Mr. FIRTH, M.P., introduced the deputation.

Mr. BEAL said the memorial of the delegates was rather weakened by what had taken place the previous night in Parliament. What had been said in the House, they thought, perfectly met the wants of the public; but if the report of the Select Committee should favour purchase, while desiring to deal with the matter with the greatest justice, they strongly condemned a price which, from the fluctuations on the Stock Exchange, showed that a huge bargain in the interest of the Companies, and not in the public interest, had been made. What was wanted was a good supply of potable water. The public right in competing in the supply must also be recognized. It was anticipated that a claim for increased rates under the increased valuation would be made, and it was desirable that this should, if possible, be prevented.

Other members of the deputation having spoken,

Sir W. V. HARCOURT, in reply, said: I have to thank you for the indulgent manner in which you have spoken of my efforts to deal with this question. I naturally came to the matter with but limited experience, and therefore I look forward to the assistance of the Select Committee which will be moved for in Parliament, upon which it will be the object of those who have to deal with the matter to place the most competent men who can be found, in order that this question may be discussed from every point of view. I will not enter into any detail now, because, as I gather from you, the views that I have expressed are not in any way discordant with those you entertain. I have had the opportunity of expressing those views to Parliament and to the Metropolitan Board of Works, who represent, after all, similar interests to those which you represent. I know that a strong feeling exists that the first step taken should be a suspension of the existing powers of the Water Companies. Now, I need not say that Parliament and every man in this country would be extremely cautious not to overrule rights conferred by Act of Parliament, except in cases of grave necessity. I desire fully to appreciate and to know what are the real facts of the case, and, with regard to these Companies, to consider what remedy may be applied, before having recourse to such an extreme measure as repealing rights of property conferred by Act of Parliament. That is not the first step which every one would be disposed to take. I find that there exists an impression that these powers depend upon the Assessment Act; but this is not the case, the real power being to charge upon the actual value of the house; and, whether the assessment be raised or not, the Companies can only charge on the value of the houses. It is a mistake to suppose that the assessments alter the legal right, although, no doubt, they operate in the nature of evidence, and justify and induce the

Water Companies to raise their charges. However, as I stated in Parliament yesterday, I propose that one of the principal subjects for inquiry by the Select Committee shall be the power of raising rents by the Companies, and the manner in which those powers have been exercised. After inquiry into these matters, we shall be in a better position to deal with the question than if we rushed at it in a hurry. I am sure Parliament will take care that no injustice is done to the inhabitants of the Metropolis. If a remedy cannot be found in one way, it will be found in another; but you must give us time to examine the question in all its bearings, and I suppose you will not complain if we do not at once seize upon what may appear the most ready method, but take a little time in order to see if we cannot accomplish our object without taking steps which might alarm people as to the security of their property. Nothing could be more undesirable than to lead people to suppose that the security given to them in their property by Act of Parliament is not safe, but is liable to be invaded. These are the reasons which make me pause. I am much obliged to you for coming here, as it strengthens the hands of Ministers to have such support. All I have to say now is that if in the course of the inquiry by the Committee you are able to put any question, or to make any suggestion, we shall be happy to consider it.

The deputation thanked the right honourable gentleman, and withdrew.

COURT OF COMMON COUNCIL.

At the Meeting of the Court last Thursday—the Lord Mayor presiding—on the Remembrancer suggesting, in view of the present aspect of the Metropolitan Water Question, the advisability of obtaining the opinions of financial and scientific experts on the subject, for the purpose of producing evidence before the Parliamentary Committee,

Mr. MASON moved—"That a Select Committee, consisting of twelve members of this Court, be appointed to consider the Metropolitan Water Supply Question and the preliminary agreements relating thereto, with power to take such part as they may think expedient in the inquiry before the Select Committee of the House of Commons, reporting thereon from time to time to a Committee of the whole Court."

Mr. RUDKIN seconded the motion, which was carried, on the words "the Court sitting in camera" being substituted for "a Committee of the whole Court," at the end of the motion.

WIMBLEDON LOCAL BOARD.—At a meeting of the Wimbledon Local Board on Wednesday last, it was resolved—"That a memorial be prepared and forwarded to the Home Secretary, requesting that, in the consideration of any measures or investigations which may be proposed or undertaken with reference to providing the Metropolis with a purer and more efficient supply of water, or preventing any undue increase of charges made by the Water Companies, the interests of Wimbledon and other suburban areas beyond the jurisdiction of the Metropolitan Board of Works may be taken into consideration."

The following are the returns of the Society of Medical Officers of Health on the Composition and Quality of the Metropolitan Waters in May, 1880:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required gen. by		Nitro- gen.		Ammonia.		Hardness (Clark's Scale).	
		Organic Matter, &c.	As Ni- trate, &c.	Sal- line.	Or- ganic.	Before Boil- ing.	After Boil- ing.		
<i>Thames Water Companies.</i>									
Grand Junction	18.78	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.	
West Middlesex	18.83	0.027	0.118	0.000	0.005	11.5	3.0	3.0	
Southwark and Vauxhall	19.42	0.035	0.118	0.000	0.000	11.0	2.8	2.8	
Chelsea	19.91	0.039	0.148	0.001	0.005	14.3	2.8	2.8	
Lambeth	19.33	0.043	0.159	0.001	0.008	11.3	2.8	2.8	
<i>Other Companies.</i>									
Kent	29.61	0.039	0.148	0.000	0.006	14.6	3.0	3.0	
New River	17.72	0.003	0.410	0.000	0.001	20.0	5.6	5.6	
East London	18.56	0.016	0.137	0.009	0.006	14.6	3.0	3.0	
		0.027	0.159	0.000	0.009	14.6	5.3	5.3	

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potassium acting for three hours.

The water was found to be clear and nearly colourless in all cases but the following, when it was slightly turbid—namely, Chelsea Water-Works Company. C. MEYMOOT TIDY, M.B., &c.

BURSLEM TOWN COUNCIL GAS SUPPLY.

At a Meeting of the Burslem Town Council last Wednesday—the Mayor (Mr. J. Maddock) presiding—the minutes of the Gas Committee, which were presented, incorporated the report of the Gas Manager (Mr. H. Peaty) as to the past year's working, the results showing a profit of £2,045 5s. 1d., being an increase of £398 2s. 7d. over that of the previous year. The Committee recommended that a sum not exceeding £2000 of these profits be placed at the disposal of the Council in aid of the rates.

Mr. W. WOODALL, M.P., in proposing the adoption of the report, remarked that twelve months ago he had congratulated the Council upon the report the Gas Committee then presented, when £1700 was handed over from the gas profits in aid of the rates. This year there had been an increase in gas-rental of nearly 6 per cent., and he was happy to say that on the management account there was shown an increase of 19 per cent. upon the previous year, enabling them now to recommend the appropriation of £2000 in aid of the rates. It must be remembered, however, that at the present time they were certainly conducting their business under what might be regarded as exceptionally favourable conditions. The price of coal, &c., was much in their favour, but it would be idle to shut their eyes to the fact that they might, in years not very far distant, probably be subject to an increase in the cost of coal, &c. It would, therefore, perhaps be injudicious to rely too absolutely upon such large sums being appropriated from gas profits in aid of the rates. The policy of the Gas Committee had been to maintain the works up to their full structural value, but it was felt by the Committee that it was very important for them, by improvements here and there as were found necessary, to compensate for the sensible depreciation which was always going on in connection with such works. The Committee, therefore, proposed to set apart, out of the profits, a fund to meet this depreciation. During the four years that the works had been in the hands of the Council the total profits had exceeded £5000; but, as they were aware, no provision was made for a trading capital, and they had had to avail themselves of their credit at the bank, causing a very considerable charge from year to year for interest. A large amount had also had to be expended for obtaining the Act of Parliament sanctioning the purchase of the works, and for the necessary loan to complete the purchase. They were, however, slowly accumulating a trading capital, and the balance owing to the bankers was decreasing; which, together with the fact that last year they had been able to appropriate £1700, and this year £2000 in aid of rates, led him to think they

had reason to be satisfied with the progress of the gas-works, and to feel that the Council were justified in purchasing them.

Mr. SMITH seconded the motion, which was carried.

Mr. WOODALL then said that some time ago the Gas Committee indicated to the Council their willingness to make a reduction of 5s. per lamp in their charge for lighting the public streets; but a very general feeling had been expressed in favour of the lamps being lighted during the whole of the year, instead of for ten months of the year as at present, and in the Committee's last report it was intimated that they were willing, though it was worth more, to light the lamps for the whole year at the same price that had hitherto been charged for ten months. He therefore moved that the Gas Committee be instructed to light the lamps during the whole of the year upon the terms named.

Mr. BALL seconded this motion, which was also carried; and the Council proceeded to other business.

WEST OF SCOTLAND GAS MANAGERS ASSOCIATION.

(Continued from p. 841.)

At the conclusion of the discussion on Mr. Niven's paper, reported in last JOURNAL, Mr. J. MAYER (Glasgow) read the following paper on

PAINTER'S HYDROSTATIC JOINT FOR GAS AND WATER MAINS.

In scanning the technical journals in my professional capacity, my attention was recently arrested by brief illustrated notices of an invention* which seemed to me to possess such a degree of novelty and scientific excellence, that I at once resolved to make further and more minute acquaintance with it, in order that I might, if possible, bring it under the notice of the members of the West of Scotland Association of Gas Managers at this their eighth annual meeting, providing, of course, that the proposal to do so should meet with the approval of the executive officers, in their efforts to cater for the professional instruction of the members generally. The invention is the fruit of the busy brain of Mr. William Painter, an American engineer, hailing from the city of Baltimore; and it may be spoken of as a totally new mode of forming joints in cast-iron pipes, either for water or gas—a mode which substitutes hydrostatic pressure for the ordinary hemp and lead joint, in which the caulking is done by hand labour. When we bear in mind that the question of leakage or the unaccounted-for gas is so constantly giving untold annoyance and anxiety to gas managers and their employers, the directors of gas companies or works committees of gas corporations, no excuse need be offered for bringing the subject before such a meeting as the present, except that the person who has had the temerity to do so can lay no claim to be regarded as a practical man. But I ventured to offer my services to introduce the subject to your notice, because I knew that there was no "practical" man in connection with the Association who could undertake the duty from any knowledge of, or experience with the invention in actual practice. So much, then, by way of introduction. Let me now proceed to describe this novel invention in pipe-jointing, and indicate what seem to be its scientific merits, and what are believed or known to be its practical and economical advantages.

The invention is essentially a lead joint which is caulked by hydrostatic pressure, and the method of producing it is not only novel and eminently practicable, but it is one which is attended with great economy, in addition to which it retains all that is valuable in the lead joint caulked in the ordinary way, and at the same time introduces many important and valuable advantages. First of all it is desirable to notice that the socket or faucet end of the pipe is cast with a circumferential groove in its inner surface, which should be about $\frac{1}{4}$ -inch square in cross section for a 6-in. pipe, and varying in size with the size of the pipe. This groove has rounded corners, and opening into it there is a threaded hole which is intended for receiving the screw of a brass funnel, and subsequently a cast-iron screw plug. In this groove a gasket or ring of lead is cast so as to be flush with the inner surface of the socket; and this ring eventually becomes the caulking material. It is formed or cast by first firmly laying the pipe with the hole in the socket directly upwards, then introducing into the socket an expanding ring made of sheet steel about 2 inches broad, and covering the space taken up by the groove, and afterwards pouring into the latter the necessary quantity of molten lead by means of the brass funnel just spoken of. The expanding ring of steel, it should be mentioned, is provided with two fixed handles, so attached that when manipulated they cause the ends to overlap, and the ring to fix itself in the position and manner desired. It is covered with two layers of ordinary roofing felt, the outer one so arranged that, when burnt, it can be replaced in a few seconds. The lead is poured into the funnel quietly and steadily, neither too fast nor too slow, thus giving time for the air to escape, and avoiding the chilling of the lead. After the lead has "set," the funnel is unscrewed, the effect of which is that the "gate" breaks off just at the junction with the ring; and a smart blow removes the "gate" from the funnel. The expanding ring is now removed from the socket of the pipe, and the cast-iron screw plug is inserted into the hole, leaving the pipe complete and ready for laying. The pipes should be furnished by the founders fitted with the lead rings or gaskets, as also with the threaded cast-iron plug, for by such an arrangement all the usual cumbrous melting appliances and time-killing manipulations by a special gang of workmen are dispensed with in laying the mains. This is certainly an important advantage.

For general convenience, it is desirable to have the ends of the pipes of standard proportions, so that those of the same internal diameter may all be interchangeable. Of course, the strength of the pipes may be varied to suit special circumstances, without affecting the established dimensions. The size and shape of the groove for the gasket or lead ring, as also its distance from the outer end of the socket, are fixed for all sizes of pipes. Furthermore, the diameter and pitch of the screw hole are the same in all sizes of pipes, so that the chills used in the casting operation and the forcing jacks (shortly to be spoken of) may fit any pipe; but the length of the screw plugs varies according to the size of the pipe.

The end of the spigot is devoid of the usual bead, and in order to compensate for its absence, that end of the pipe is slightly increased in diameter; in this way a certain amount of clearance is allowed all round between the spigot and the socket—say, $\frac{1}{32}$ of an inch—and easy entrance is secured. The amount of the clearance may be varied from, say, $\frac{1}{32}$ in. to $\frac{1}{16}$ in., without materially affecting the quality of the joint; but $\frac{1}{32}$ in. in diameter (or $\frac{1}{32}$ in. all round) is to be considered the standard which gives the best results. Should the spigot rest upon the bottom, and all the clearance be at or near the top, or the reverse, the joint will still be perfect, as a sufficient amount of lead in the groove is provided for. In inserting the spigot end of one pipe into the socket of its fellow, it is guided into concentric position by the conical or tapering form of the interior of the latter; and this is true, whether the sections be joined in line with each or at a considerable angle.

I shall now proceed to show how the gasket or ring of lead occupying the groove in the socket comes into play to bring about the desired degree and kind of caulking required. When a pipe has been laid in position in the trench with its spigot end pushed home into the socket

of the contiguous pipe, and the screw plug removed from the threaded hole formerly spoken of, a semi-fluid material is introduced, and made to exert a great degree of pressure by means of a forcing-jack which fits into the screw. This material finds its way between the lead gasket and the bottom of the groove, partially displacing the gasket therefrom, and forcing it inwards into tight contact with the spigot at all points of its circumference, thus forming a solid and perfect joint. The forcing-jack is now removed, and the screw plug is again inserted, thus completing the operation, which, in the case of a 12-inch main, need not occupy more time than about five minutes. The enormous hydrostatic pressure thus brought to bear on the lead gasket thoroughly imbeds it against the surface of the iron, causing it to conform perfectly to every inequality, spreading it laterally, and fixing it immovably in the groove. In its effect the operation just detailed is similar to that of caulking by hand, with the important advantages, however, that the pressure is here applied in exactly the proper direction to be most effective, and is absolutely uniform at every point. All the lead of the ring is utilized in making the joint; there is no dead or inactive and useless material, as in the ordinary method. The actual amount of the tight contact surface of the gasket is a width of about $\frac{1}{8}$ -in., which is considerably more than is obtained in a hand-caulked joint. It should not be supposed that the permanent tightness of the joint is dependent upon sustained pressure within the groove; for such is not the case. The function of the forcing material is only to transmit the force exerted through the jack to all points of the gasket, thus spreading and caulking it solidly between the spigot and socket of the two contiguous pipes. When this is done its function ceases, and no further pressure of the forcing material upon the gasket is required. The object of the screw plug henceforth is simply to close the hole and retain the material in the groove. The forcing material is of a very simple and comparatively inexpensive character. It consists of three substances—tar, whiting, and sharp sand. The tar is boiled down to the consistency of soft pitch or thick treacle, and the whiting is then sifted free from lumps and stirred in so as to thicken the tar to the consistency of dough or soft putty; lastly, the sharp sand, to the amount of about $\frac{1}{3}$ to $\frac{1}{2}$ of the whiting used is mixed with it, the object being to choke up any small escapes that might occur in forcing up the gasket. In cold weather, the forcing material or semi-fluid should not be thicker when used than soft-working oil putty. It is packed ready for use in paper tubes or cartridges, of the proper size to fit the cylinder of the forcing-jack.

A few words may now be said by way of describing the screw-jack and the mode of using it. As at present constructed, it weighs nearly 50 lbs., but it will probably be reduced several pounds by making it entirely of steel. It consists of a hollow stem, with a screw at the bottom, fitting into the threaded plug-hole, which is the same in all sizes of pipes, and at the upper part there is a cylinder which contains the charge of semi-fluid material. Handles are fixed into the cylinder portion of the instrument, and, by means of a fixed nut and screw, a piston is forced upwards, when the handles are turned, and thus the charge of tarry material is expelled through the hollow stem behind the lead ring. The nut is split so as to save time in returning the piston to the first position in re-charging the cylinder. At first it was provided with a gauge to register the amount of pressure employed, but as that was found to be unnecessary it is now left off entirely, and the jack is so proportioned that it requires an ordinary man to exert about his full strength when seating the ring firmly. The operation of jointing is done without the employment of any direct heat; no skilled labour is required; and the time required for it does not need to exceed one-twentieth of that usually occupied in the operation of making a joint. In referring again to the manner in which the pressure is exerted and the result attained, I think I may say that advantage is taken of the law of the flow of solids, which was so thoroughly and beautifully worked out some years ago by the eminent French *savant*, General Morin. The lead of the ring or gasket does really seem as if it were made to flow, judging by the shape which it eventually takes by the application of the hydrostatic pressure applied in a very simple, but at the same time most efficient manner. As the lead has practically no elasticity, it displays no tendency to return into the plug-hole on the withdrawal of the screw-jack. The system employed leaves no room for imperfect work, and it provides against any loss through leakage.

There are many advantages which this system of jointing gas and water mains seems to possess, and which, indeed, have in practice or by experiment been demonstrated. They may be grouped as economical advantages and practical advantages. Referring to the former, it may be claimed that the hydrostatic joint requires less than one-third of the lead and about one-tenth of the labour employed in the ordinary hand-caulked joint, while the immense saving of gas (when the pipes are used for that purpose) is unquestionable, being due to its uniform and permanent tightness. As regards the saving of lead, a reference to the following table will prove very instructive:—

Diameter of pipes—Inches	2	3	4	6	8	10	12	16	18	20	24
"Hydrostatic" joint—Pounds of lead	1	1½	2	2½	3½	4½	5½	7½	8½	9½	11
Caulked joint—Pounds of lead	1½	2½	4	7	10½	14½	19½	28½	32½	35½	48

No packing with hemp or other material, with its attendant labour, is required. Then, again, no enlargement of the trenches is needed opposite the joints, and hence there is less back-filling and re-paving necessary. There may be a slight increase in the cost of casting the pipes, but, if so, it must be very small; against which there is the fact that the average weight per lineal foot, for a given thickness, is really lessened, by reason of the socket not being necessarily as deep as is usually the case in hand-caulked joints. There is, consequently, not only large economy in material and labour in forming the joints, but the cost of the pipes themselves is likewise actually reduced.

The following are amongst the practical advantages, in addition to one or two that may have been incidentally noticed in my previous remarks:—(1) Less width required in trenches, thereby saving excavating, refilling, and paving. (2) Sockets of less depth, hence a saving in iron and carriage. (3) Pipes may be laid at greater angles, and deflection after laying will not cause leakage. (4) Contraction and expansion, or vibration from street traffic, &c., does not affect its permanence. (5) Water in trenches will not prevent laying of pipes, and they may also be readily laid across water-courses. (6) Labour required in making the joint is less, and any kind of labour may be used. (7) Hydrostatic pressure being used, the gasket is forced home uniformly, thus affording no opportunity for imperfect work. (8) Pressure resulting from fluid conveyed in the mains tends to caulk the gasket tighter, therefore no risk of blowing out. (9) The period of obstruction to traffic is materially lessened. (10) The cost of yarn, fuel, and labour in melting the lead is avoided. (11) Amount of lead used in making this joint is less than one-third that usually required. (12) The hydrostatic joint combines great economy with all the requisites of a perfect joint.

Discussion.

The PRESIDENT: I am sure you will all agree with me that Mr. Mayer has made a good appeal for Painter's hydrostatic joint. The jointing has every appearance of making a good job, and I think that in districts such as ours it should become immensely successful. I should say, however,

* See JOURNAL, ante p. 250.

that the running in of the fillet will be as difficult as the making of a joint is at present, because you would require to have the face of the pipe protected by some clay fillet, so as to get a space filled up.

Mr. MAYER: I stated very distinctly that casings are cast previously in the foundry.

The PRESIDENT: I do not very well see that. One thing that is claimed for Painter's joint is the saving of expense. Now, before a fillet could be cast and applied in the foundry, there would be as much expense incurred as in making a lead joint in the main.

Mr. NELSON: May I ask if the groove is cast or turned in the faucet of the pipe?

Mr. MAYER: I understand the groove is cast, and forms part of the pipe from the first.

Mr. NELSON: There is a practical difficulty here, but probably they have a different way of working in America. It is quite impossible that the core can be drawn out of a mould. I rather think that it is turned, as I can see a difficulty in drawing a pipe either vertically or horizontally with a groove like that in it.

Mr. ROBERTSON said it was not necessary to draw the pipe.

Mr. BRODIE said there was no difficulty so far as this was concerned. He did not see how the length of the faucet could be reduced without impairing its efficiency.

Mr. STEWART: What about this steel ring?

Mr. MAYER: The steel ring is in absolute contact with the inner surface of the faucet, and serves instead of ordinary clay.

Mr. STEWART: I do not see the object of the steel ring. Do you withdraw it before putting in the pipe?

Mr. MAYER: The steel ring is withdrawn after the lead has set.

Mr. DONALDSON: Then it is simply a binder?

Mr. M'GILCHRIST: Or plays the part of an ordinary clip.

Mr. STEWART: As I understood, you put this on the pipe, then you run in the space with lead, then withdraw the clip as soon as the lead is cold, put in a pipe, and afterwards run in the composition and press it in by your process. There is as much trouble here as with the ordinary joint. I do not see any saving.

The PRESIDENT: That is just the point I wished to bring out.

Mr. MAYER: The statement has already been made that the joint is turned and finished for introduction. One joint can be made in five minutes, so that there is not much time lost.

Mr. STEWART: The same thing can be done with an ordinary joint if you have everything ready.

Mr. MAYER: But you must have the lead and all the attendants on the ground.

Mr. STEWART: We are exactly in the same position with the composition.

Mr. M'GILCHRIST: We are all much indebted to Mr. Mayer for the clear account he has given us of Painter's joint; still I am of opinion that the process he has described is no improvement upon the system we have at present in use in Scotland. I do not see how the first cost of the pipe can be in any way reduced, owing to the small quantity of metal that is saved. That saving is more than eaten up by the amount of time that would be taken, not only in casting the pipe, but in manipulating the core. And then there is one fatal objection I have to the joint, and that is that if it is not properly made at first, there is no means of putting it right afterwards, as can be done with an ordinary lead joint. We all know that when a pipe sinks or gets out of order, it can be made as good as ever by simply re-caulking it. I am afraid this never could be done with Painter's joint. Mr. Mayer says it is only unskilled labour that is required to make these joints. So far as I understand, it would require a very skilled person indeed to make them properly.

The PRESIDENT: Though there is a saving of lead by this method, I am of opinion that it would be more expensive than a common lead faucet joint.

Mr. NELSON: I fancy that this joint would have been more successful if Mr. Painter, instead of using lead, had simply used an expansive kind of cement. It is quite common in England, and I am sorry it is not so common here. This cement hardens in about an hour, and in hardening it expands, and expands so thoroughly as to make a perfect joint. By night rust gets into the joint, so that there is no likelihood of it leaking at all—in fact, it becomes an oxidized joint. From the softness of the material used here, I am afraid that, do what you might, gas would permeate it, and by-and-by you would have a leaky joint.

Mr. M'GILCHRIST: Perhaps Mr. Nelson will favour us with the name of the cement that is used in England.

Mr. NELSON: There are four kinds in use. In the North of England all turned and bored joints are fixed up with this cement, and I have not heard of leakages from any of these joints. The only place in Scotland where I know it is used is Hawick.

Mr. DONALDSON: We get it from the North of England. It is simply called cement, but there are three or four kinds. What we use is technically called "Vulcan's cement." I may say it is only one-third the cost of lead.

Mr. BRODIE: I am afraid that cement is only used where the pipes are half turned. Many years ago I made a joint with white lead, and it was first rate, but it was a turned and bored pipe.

Mr. DONALDSON: We have no turned and bored joints in our works—they are all plain castings.

Mr. BRODIE: Seeing the cement does not expand in cooling, it is not likely that a good joint can be made without these boxes.

Mr. NELSON: It is not known in practice, whatever may be the theory.

Mr. MAYER: On this last point I may say that cement made with common plaster of Paris, thoroughly dry and set, will permit gas to pass through—gases will pass through unglazed earthenware, and the lighter they are the more rapidly will they pass through. Mr. Nelson raised the question of casting the pipe with a grooved head. I find that in one of his notes to me, the agent in London says that the inventor has designed a core box in order that no trouble should be experienced in making a sound core; but I think there is no necessity to instruct Scotch founders on this subject. [Mr. Mayer then read one or two testimonials to show that joints made with this material were, even when tested with high pressures, perfectly water-tight.]

A vote of thanks was accorded to Mr. Mayer for his paper.

(To be continued.)

A GOLD MEDAL has been awarded at the Sydney Exhibition to Mr. John Spencer, of West Bromwich, for "Iron Tubes and Fittings."

REDUCTION IN THE PRICE OF GAS AT SHIPLEY.—The Shipley Gaslight Company have given notice that all gas consumed on and after the 1st of July will be charged at a reduced price of 3s. per 1000 feet to those who pay within one month from the date of the quarter's account. No deduction from the price of 3s. 4d. per 1000 feet will, however, be allowed on any account not paid within this time.

GAS-ENGINES FOR HYDRAULIC WORK.—A pair of gas-engines of 12-horse power each, of the "Otto" type, have recently been erected at the

Windsor Street Gas-Works, Birmingham, which, by means of belts, work a set of three-throw force-pumps which lift a large-sized accumulator, giving off 700 lbs. pressure, intended to be utilized all over the works. This arrangement has been carried out by Messrs. John Abbot and Co., Limited, under the superintendence of Mr. Charles Hunt, who, we believe, is the first Gas Engineer to adopt gas-engines for this class of work.

NORTH SHIELDS WATER-WORKS COMPANY. The thirty-fourth annual meeting of this Company was held on Monday, the 31st ult.—T. Jackson, Esq., J.P., in the chair. The Secretary (Mr. H. Clarke) presented the Directors report, which stated that since the last annual meeting there had been 103 services laid on to supply 139 new consumers. The gross receipts for the year were £7959 7s., and the expenses, including interest on loans, £5269, leaving a balance of £2690 7s., which, with the sum of £629 10s. 11d.—the balance remaining last year after paying the dividend and other payments—made a total of £3319 17s. 11d. to the credit of profit and loss account. The Directors recommended a dividend of 6 per cent., which would amount to £2400; and after adding to this £97 17s. 5d., his Grace the Duke of Northumberland's 1-7th share, there would remain (after paying these amounts) a balance of £822 0s. 6d. to the credit of the account. The report was adopted, and the meeting closed with a vote of thanks to the Chairman.

LIVERPOOL CORPORATION WATER ACCOUNTS. The Liverpool City Treasurer (Mr. A. Tweedie) has just issued his account of the Corporation receipts and expenditure for the year 1879, from which we learn that the Water Committee had an income of £188,069, their expenditure being £190,179. The principal items of income are £102,272 for water-rents, £66,095 for water-rate, and £9406 for water supplied to shipping. The first item on the expenditure side is £91,380 paid in interest. A sum of £4465 was disbursed in promotion of the Corporation (Vyrnwy) Water Bill. The extraordinary receipts are set down at £29,127, and the expenditure includes £8941 for the deep boring at Bootle. The ordinary expenses for the past year were greater than ever, being nearly five times what they were in 1848, and nearly twice what they were in 1857. At the same time the ordinary receipts were less in 1879 than in 1873, though the disbursements were more. But in 31½ years the aggregate ordinary income has exceeded the expenditure by £32,693, the respective figures being £3,864,255 and £3,831,562. There are outstanding mortgages to the amount of £2,299,317.

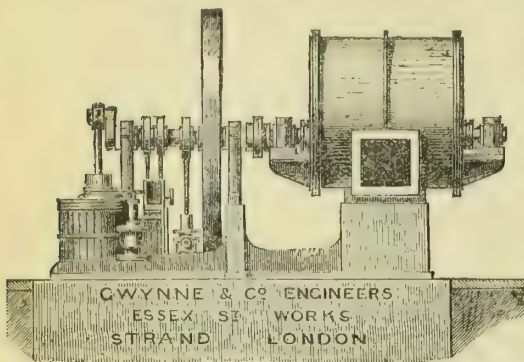
NORWOOD (MIDDLESEX) WATER COMPANY, LIMITED.—The Board of Trade report with respect to their proceedings preparatory to granting a Provisional Order to the above-named Company, which Order forms part of the Confirmation Bill now before Parliament, has just been issued. It states that the application was for authority to the Company to extend their authorized limits of supply into the districts of East Bedford, Felt-ham, Cranford, and Hanworth. All the local and road authorities gave their consent to the Order with the exception of the Vestry of Cranford, who asked for a local inquiry. The Board accordingly appointed Major Marindin, R.E., one of their inspecting officers, to hold a public inquiry at Cranford, and to report to them in the matter. He reported that in order to supply the other parishes, containing 4899 inhabitants, it was necessary to lay pipes through the intervening parish of Cranford, which contains 557 inhabitants, and that the promoters did not propose to take powers to supply the parish of Cranford except upon the requisition of the Vestry of 20 householders. As there appears to the Board of Trade to be no valid objection to laying pipes through the parish of Cranford, the interests of which would be protected by the provisions of the Water-Works Clauses Acts, they decided to dispense with the consent of the Vestry, and to empower the promoters of the Order to lay their pipes through the parish for the purpose of carrying water to the other parishes, but without any obligation on the part of the Company to supply the inhabitants of Cranford, except at the request of the Vestry.

THE LIVERPOOL CORPORATION (VYRNWY) WATER SCHEME.—The *Liverpool Mercury* of Thursday last says: "We understand that the Water Committee have come to terms with the Severn Commissioners and the other bodies who have been opposing the Vyrnwy Bill, and that it is now likely the measure will receive parliamentary sanction this session. The exact terms of the compromise have not yet been allowed to transpire, but we hear that the Water Committee are pledged to give compensation to the extent of 10 million gallons per day to the Severn interests, in addition to some 30 or 32 freshets during the summer months. The interests of the Great Western Company are to be compensated by a payment of £25,000. The resolution of the Gloucester Town Council on Tuesday not to further oppose the Bill may be accepted as an indication of the course that will now be taken by Bridgnorth, Shrewsbury, and other towns which have hitherto been in opposition; and should no hitch occur, the Bill will probably pass through Parliament without any more difficulty. In order to give the large quantity of compensation water demanded, it will be necessary to add to the expenditure of the Vyrnwy works by raising the embankment; but this will be a small cost compared with the expense of carrying a contested Bill through the House of Commons. It is estimated that, after giving the 10 million gallons for compensation, the available supply for Liverpool will not be less than 40 million gallons per day. If these terms of compromise are finally acted upon, and we get the promised large supply for Liverpool, the Water Committee will be well out of what at one time threatened to be a very serious difficulty."

PORTISHEAD WATER COMPANY.—The tenth half-yearly general meeting of this Company was held on Saturday, the 29th ult.—Mr. F. Weatherly in the chair. The Secretary (Mr. F. R. Daniel) read the Directors report, which stated that the period of three years since the Company commenced supplying water to the public expired on the 31st of March last, and consequently completed the term during which the works and revenues of the Company were, under agreement, leased to Messrs. Warren and Minns. The Company were now, therefore, in receipt of the actual water-rentals, and bore the cost of working and maintenance, instead of receiving from the lessees a fixed rental free of charges. The leasing arrangement made by the contractors in anticipation of the more rapid development of the district than had occurred had been more financially advantageous to the Shareholders, but the Directors hoped that ultimately the results of direct management would be found generally satisfactory, and give the Shareholders an immediate interest in the extension of the Company's business under the present improving prospects of the district. A dividend at the usual rate of 3 per cent. per annum under the leasing arrangement was recommended. The Chairman, in moving the adoption of the report, said from his knowledge of the district he had a very strong opinion of the future great success of the water undertaking. It had not improved as they could have wished, owing to the delay which had arisen from the misfortune at the docks; but only let that work be carried out with the singleness of purpose which should belong to every undertaking, and he thought the Shareholders would see Portishead a flourishing place of business, and the adjacent hills covered with good residential houses. The report was adopted, and the dividend recommended therein declared. The retiring Directors and Auditors were re-elected, and a vote of thanks to the Chairman closed the proceedings.

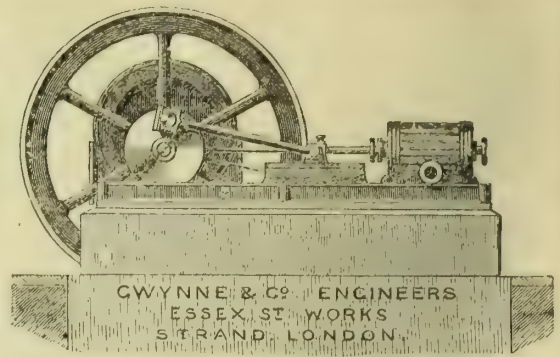
The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship."

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce machinery of the very highest quality, and most approved design and workmanship. The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

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WITH

Wrought-Iron Spindles and ENGINES COMBINED.

SOLE MAKERS,

GEORGE WALLER & CO.

MAKERS OF ENGINES, EXHAUSTERS,
INDEX AND DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, AND OTHER PUMPS,
SCRUBBERS AND PURIFIERS,
CONDENSERS, BOILERS, &c.

G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

[SEE ALSO ADVERTISEMENT, PAGE 894.]

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"Cooking & Heating by Gas;" on Burners, &c.
Copies, by post, Threepence, direct from the Author,
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testimonials and references.

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WANTED, a Situation as Manager of
a Chemical Works, or at a large Gas-Works
where Residuals are manufactured. Qualifications: Dis-
tillation of Tar, Treatment of Products, making of Sulphate
and Liquor Ammonias.

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BOROUGH OF NEATH, GLAMORGANSHIRE.

THE Town Council of this Borough
are prepared to receive APPLICATIONS for the
Managership of the Corporation Gas-Works in this
Borough. The Manager will be required to discharge all
the duties incident to the management and conduct of the
Gas-Works, and the keeping of the accounts thereof (with
the assistance of one person to act as Clerk and Collector),
and to devote the whole of his time to the discharge of
such duties in connection with the Works as shall be
directed by the Corporation or its Gas Committee. Salary
£200 per annum, payable quarterly, with an allowance of
coal and gas for private consumption at own residence.
Applications and testimonials (such applications to state
when the applicant would be at liberty to enter upon the
duties of his office) to be sent, addressed to the Town
Council, and endorsed "Application for Gas-Works
Managership," under cover to me, on or before the 12th of
June, 1880.

By order,
ALFRED CURTIS, Town Clerk.

Neath, May 24, 1880.

WANTED, by the Advertiser, a Young

Man aged 25, and Married, a Situation as
MANAGER of a small Gas-Works. Applicant has a
thorough knowledge of the Manufacture and Distribution
of Gas in all its branches. Has had several years ex-
perience as Manager of a Works (make 15 millions). Has
no objection to go Abroad. Satisfactory reasons for change.
Address No. 663, care of Mr. King, 11, Bolt Court,
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WANTED, the following Second-hand
PLANT:—

A SCRUBBER, about 12 ft. high, 3 ft. 6 in. wide,
with Water Tank and Distributing Apparatus, and 6-in.
Connections and Four-Way Valve.

A PURIFIER, about 9 ft. by 6 ft., and 4 ft. deep, with
Sieves, Lift, 6-in. Connection, and Four-Way Valve.

Price, &c., to be addressed to GEO. WHITMAN, Company's
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GAS SHARES FOR SALE—Ten £5

SHARES of the Hawick Gas Company, guaranteed
dividend 10 per cent., payable yearly on the 26th of May.
Address offers to No. 666, care of Mr. King, 11, Bolt
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PURIFIERS for Sale, Cheap.—Two

8 ft. by 4 ft. by 4 ft., with all Connections and
Hydraulic Valves for working either one or both. T-iron
Rail and Lifting Screw complete. Or the Covers, which
are as good as new, of 10 B. W. Gauge, would be sold
separately.

Apply to L. MONK, Manager, Gas-Works, LANARK, N.B.

FOR SALE—A Second-hand Square

STATION-METER, to pass 40,000 cubic feet per
hour. Erected about 12 years. Made by Messrs. J. and
J. Braddock, Oldham. Now in use at the Plymouth Gas-
Works. To be removed to make place for a larger sized
Meter. To be sold a bargain.

For price and particulars apply to W. W. ANDREWS, 238,
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GAS PLANT FOR SALE.

THE Committee of the Burton-on-Trent

Corporation Gas Department have for Sale One
Set of TWO PURIFIERS, 24 ft. by 10 ft., 3 ft. 9 in. deep,
12 in. Connections, and Two 12 in. Four-Way Dry Valves
by Walker, Lifting Apparatus, &c.

One Set of TWO PURIFIERS, 14 ft. by 14 ft., 3 ft. 9 in.
deep, and Six 12-in. diameter Valves by Young, Lifting
Apparatus.

The above having been replaced by larger can be removed
at once.

Further particulars may be had on application to the
undersigned.

JOHN MUMF, Manager.

Gas-Works, Wetmore Road, June 5, 1880.

GAS PLANT FOR SALE.

THE Maidstone Gas Company having

enlarged their Works, offer the following Apparatus
for Sale in good condition:

SCRUBBERS.—One Tower Scrubber 30 ft. high by 10 ft.
diameter, with Distributor, and partly fitted with Livesey's
boards.

CONDENSERS.—One Set of Annular Condensers, con-
sisting of 9 Pipes 17 ft. high, outer diameter 2 ft. 6 in.,
fitted with 12-in. Valves complete.

ENGINES.—Two 12-Horse Power Horizontal Engines
in very good condition.

STATION-METER.—By Milne and Son, in first-class
condition, ornamental case, with Valves and Bye-pass
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HYDRAULIC MAIN.—Six 8 ft. by 18 in. Hydraulic
Main D wrought iron; 24 8 ft. 9 in. by 18 in. Hydraulic
Main D wrought iron. Nearly new.

BRIDGE AND ASCENSION PIPES.—90 6 in. by 4 in.
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RETORTS.—31 Rounds, 15 in. diameter and 9½ ft. long,
in two pieces. 2 Ovals, 21 in. by 15 in. and 9 ft. long, in
one piece. All of Stourbridge Fire Clay, and in good
condition.

For further particulars and price apply to
JOHN WEST, Engineer and Manager.

Gas Works, Maidstone, April 21, 1880.

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TO CORRESPONDENTS.

- R. G.—*Shall insert report next week.*
 B. N.—*Will write you privately in the course of the week.*
 W. B.—*At an early date we shall have pleasure in referring to your appliances.*
 W. H.; G. and Co.—*Received.*
No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 15, 1880.

Circular to Gas Companies.

WE anticipate special advantage to the British Association of Gas Managers from the election of the Acting President of the meeting just concluded, to the presidential chair for the ensuing year. The Inaugural Address which Mr. Hunt delivered more than realized the high expectations which had been formed in reference to it. It was, in regard to each of the many subjects with which it dealt, a most thoughtful and valuable review of the progress which has been made, and its interest and value were greatly enhanced by the evidences of original work which were apparent throughout. The address may be looked upon as the key-note for the meeting of 1881. Members preparing papers to be then read will try the harder to make them thorough and exhaustive, because of the example of the President, and we hope he may be gratified by seeing a continuance, if not an increase, of that independent research which he advocated, and which was conspicuous in the papers of this year.

It is in another direction, however, that we look for the special advantage to which we have referred as likely to result from the re-election of Mr. Hunt. In the usual course, after the President has delivered an address, in which he may have made suggestions likely, in his opinion, if carried out, to conduce to the advantage of the Association, he immediately retires from his office. His influence then ceases to be so great in applying these suggestions, and another does not take them up with the same heartiness or appreciation of their value, and so, for the time, they fall to the ground. In our issue of last week, we referred to the desirability of making use of the organization of the central and of the district Associations for the purpose of acquiring more exact information and data upon disputed or doubtful points in reference to gas manufacture. We were glad to find Mr. Hunt

giving the weight of his advocacy to the same idea, and we are not without hope that, before he next meets the members of the Association, some more definite form may have been given to it, even if there is no actual fruit in the shape of a compilation by the Committee of returns obtained in accordance with it.

Mr. Hunt said: "It seems possible that we might with "advantage imitate the practice of kindred societies . . . "by the encouragement and prosecution of original research;" and further, "Do we not fail somewhat in our aims by not "giving, to a certain extent at least, point and direction to "the labours of the investigator, and by abstaining in our "collective capacity from all attempts at elucidating some of "the apparent mysteries of gas manufacture?" There seems a general disposition to respond affirmatively to this question, and if the Committee of the Association set themselves to the work of supplying the acknowledged omission, they will evidently find much ready co-operation among the members, and will greatly add to the claims of the Association upon all interested in the business of gas making. One of the main difficulties in the way of such concerted action on the part of the Committee appears to us to consist in the infrequency of their meetings. If it is the custom of the Committee, as we understand it is, not to hold any meeting after the annual assembly until April of the next year, the interval has been long enough to allow the impressions of the past meeting to be dimmed or forgotten, and the time to the approaching one is too short for the preparation for it of more than routine business. To "strike while the iron is hot" is often a great saving of labour, and a meeting of the Committee shortly after the general meeting would probably aid greatly such work as is suggested. We repeat that the re-election of Mr. Hunt furnishes an unusual opportunity of enlarging the operations of the Association, and we hope that it will be made the most of. One thing is certain, that if the President and Committee are in earnest, they will not want for loyal support and active co-operation from their Secretary, Mr. Bennett.

And now we may ask—What is the nature of the work which can fairly and properly be taken in hand by the Committee? what the nature of the investigations in which they may with propriety ask the aid of the members, and the Companies they serve, in prosecuting? Two proposals were before the late meeting—the one by the President, which we have quoted; the other by Mr. G. E. Stevenson, of Peterborough. The paper read by the latter gentleman advocated the preparation annually of an exhaustive analysis of the accounts of such Gas Companies as would furnish the necessary particulars, and the publishing of this analysis as an appendix to the annual volume recording the proceedings of the Association. This proposal received but little favour at the hands of those who discussed it. There was a general opinion that the information so collected would do little to help professional gas makers, while it would furnish weapons of attack upon individual Companies and their executive, to do which is certainly not the mission of the Association. It is very difficult, in any comparative statement of the kind, for those unacquainted with the local circumstances of each case to make deductions of a reliable character. Mr. Field's analysis of the accounts of the Metropolitan Gas Companies simply, presents contrasts and disparities so striking that they are hard to be understood even by those very well informed, and in returns collected over the wider area of the whole country the difficulty would be proportionately greater. Whatever value might attach to such returns, they would be of rather a mechanical character. There are already strong inducements to show good results in working, and especially large dividends; and there is reason to fear lest the pursuit of these objects should be followed with too eager a desire for the immediate return, and time and attention be grudged to the patient study of difficult questions, which, if solved, might amply well repay the effort. The discussion upon the paper, while unfavourable to the exact proposal which it made, yet showed that Mr. Stevenson had given expression to a very general feeling in advocating the use of the Association machinery for the ascertaining of facts and statistics upon points of general professional interest. There was, we believe, no exception among those who took part in the discussion; all alike recognized the value of the work that might be done, and desired that the effort should be made to realize it.

Returning, then, to the first proposal—that of encouraging research into doubtful questions—it only needs that the track should be marked out, and it is evident there will be no lack of eager and intelligent travellers upon it. Neither will there be lack of occupation, for the number of moot points among gas engineers is very large. For instance, there is a great difference in the quantity of gas obtained from the same

quality of coal. A short time ago this question exercised the minds of the committee of an important municipal gas undertaking. Not only did the reports from their several stations seriously conflict, but even the experimental trial of the same sample of coal, when made by several engineers, gave results which were entirely irreconcilable. A special sub-committee was, of course, appointed to inquire into the matter; but we very much doubt if their report cleared up the difficulty. Now, if the conditions in this case had been alike, the results would have agreed, and a proper statement of the exact circumstances under which the experiments were made, showing in what, and to how great an extent they differed, would have enabled competent men to make fair deductions from them. One man has a rooted antipathy to high heats, while another counts them as the very corner-stone of success. One holds it to be economical to make up the required illuminating power of his gas by the use of cannel, while the other would reduce his make to save the use of cannel. Again, it is admitted that by several processes the yield of gas from coal may be largely increased above the average, and its illuminating power maintained by the absorption into it of certain volatile hydrocarbons at present sent away in the tar. At what cost is this result obtained? to what extent is the value of the tar reduced? and is it possible that the loss in this item balances the gain in gas? Questions of this sort could be satisfactorily determined if a number of men would conduct experiments, not by any means necessarily upon the same coal, but each keeping throughout to one sample, and working under different conditions of temperature in the retort and varying methods—within practical limits—of condensing and purification to be laid down by the Committee. Again, the questions that were incidentally raised as to the permanence of the full lighting power of gas which had been enriched by any means or by any material applied to it after the retort; and the depreciation of gas by being stored for a length of time, or by travelling long distances, seem to us to be very simple questions that might be definitely and conclusively set at rest once for all, and on which there is yet much conflict of opinion. At the same time there are others that we need not state, but which will occur to practical men, in which such combined, yet independent research would be of immense value.

The consideration of this question opens up a possibility which is to us most attractive, and to which we shall probably recur. If the Association takes in hand this work of drawing together the threads of many investigators labours, and is able, as it would be, to show clear advantage resulting, would it not establish a claim upon Companies and Corporations which they would readily recognize? We believe that on the recommendation of the Committee, backed by evidences of the kind of service proposed to be rendered, those bodies generally would be prepared to subscribe, and that liberally, to a fund having the object of extending the work. Thus the dream of a permanent home for the Association might be realized; and that home would be not simply a more or less ornamental building in which the general business might be transacted and meetings held, but a centre of the active life of gas science and industry in the country.

Another of those discussions, with which we are now so familiar, respecting the disposal of the surplus profits of gas undertakings belonging to Corporations, arose at the last meeting of the St. Helen's Town Council, when a very close division took place on the question whether a certain portion of the gas profits, left after various apportionments of the gross accumulated profits to capital account and reserve-fund, should be handed over to the borough-fund for the general benefit of the ratepayers, or be added to the reserve-fund recently established by the Committee. Strangely enough the vote was taken on an amendment which did not express the point upon which the discussion had really turned. The Gas Committee presented a report in which, after placing the round sum of £2000 to the credit of a reserve-fund, they proposed to hand over to the borough-fund £1126; when a rather vaguely-worded amendment to the effect that this sum should be applied to reduce the price of gas, was moved, and met with many supporters, including the Mayor, who, when the final vote was taken on a revised amendment devoting the amount in dispute to the reserve-fund, found himself in the position of having to give a casting vote, the numbers being equal, and he then distinguished himself by voting against the proposal which he had permitted to take the place of that to which he had previously given his adhesion. Certainly the two amendments were not identical; but the same principle—that the gas profits belonged to the gas consumers—was common to both, and it is therefore difficult

to see the consistency of the Mayor's action. A Director of the defunct Gas Company was present, and made the statement that, under the circumstances, the Company would have reduced the price of gas, the position of affairs fully warranting a reduction of threepence per thousand feet. This course, however, was rejected, as above stated, the decision eventually arrived at causing some surprise in the Council—a feeling which is likely to be echoed outside.

Negotiations are to be entered into between the Corporation of Newcastle-under-Lyme and the Gas Company at present supplying the town, for the purchase by the Corporation of the undertaking of the Company. The question has been in abeyance for some time since it was first mooted, for various reasons, the chief apparently being that some of the more progressive members of the Corporation, at the time when the idea first took shape in a clause inserted in the Corporation Act of 1877, authorizing the purchase, have since failed to retain their seats in the Council, and the eclipse of these ardent spirits appears to have so far daunted the remainder of the members of the Corporation, that they have not moved in the matter with any great energy until the present time, when the imminent lapse of the period during which the Corporation will be allowed to make up their minds has induced them to bestir themselves. The whole question having been referred to the Lighting Committee, that body has reported favourably of the proposed purchase, and the Council unanimously resolved to take action in the matter, and we shall probably soon see whether the transfer is to be settled amicably or otherwise, as it seems to be inevitable.

The details of the gas accounts of the Rochdale Corporation, given in last week's issue, are commendably explicit. The item of most interest observable in the prefatory statement of the general results is the great success claimed for the St. John purifying apparatus and carburetter, which in six months winter working is credited with effecting a saving of £870, or an average yearly economy of about £1000. This is a surprising statement, and one which is scarcely intelligible on any theory of condensation generally accepted at present, by which gas may be enriched by its own accompanying liquid hydrocarbons. The production of gas was over 5 million cubic feet in excess of the corresponding period of the previous year, and the illuminating power was more than 18 candles—the usual standard for Rochdale gas—while the consumption of cannel was about 2400 tons less, the difference being made up with ordinary coal, the total weight of coal and cannel used being only about 40 tons more than in the period with which the comparison is made. The difference in the two results is certainly remarkable, and will doubtless attract attention from other quarters. It is difficult to believe that it is owing entirely to an apparatus of the kind mentioned; but no other explanation is offered, and we are bound to suppose that all other conditions have remained the same. Setting aside the increased rate of production, it is evident that a great impulse will be given to the solution of the question of the treatment of gas in contact with tar and hydrocarbons, by the publication of statements of this kind, of independent origin, and of accuracy guaranteed by the irrefutable logic of cash expended for work performed. Such are the facts as they are given to us, and we shall look with much interest for the production of any further evidence tending to confirm or refute the inference which in this instance has been drawn from them.

Chesterfield has the advantage of having its gas and water supplied by one and the same Company, which, in these days of trading Corporations, is an arrangement of increasing rarity. Still the Chesterfield Corporation can scarcely be called happy, and some of their grievances have found their way into the local newspapers. A complaint is made that although the price paid for the public lamps was raised in consequence of the high price of coal in 1875, the subsequent fall in the value of the latter commodity has not been followed by a reduction to the old prices of the era before the coal famine. The Directors of the Company state, however, that the price even now paid does not give them a profit, so that eventually we find that the existing terms were agreed to for another year. Respecting the selling price of the gas to private consumers, the wish was expressed by a deputation of the Council who recently waited on the Directors of the Company, that a reduction from the present charge of 4s. per thousand feet might soon be made; but as the Company barely pay an average dividend of six and a quarter per cent. on the whole of their stock, and the consumption of gas is not of an elastic nature at present, the Directors did not see their way to promise an early reduction. We may indulge the hope, however, that the consumers will be allowed to participate in

any improvement which the business of the Company may show.

The *Engineer*, in a recent issue, drew attention to the advantages of gas coke as fuel for steam boilers, in an article which is full of valuable information for those who are so wedded to the use of steam coal for this purpose, that they are apt to unduly depreciate the value of the cheaper article. To gas managers, who are accustomed to use coke for every kind of boiler, it may well seem late in the day for the advocacy of coke as fuel in this country, much as though it were a product of recent introduction. Roundly stated, gas coke suffers in the estimation of engineers—who want a fuel to stand a very strong draught—on the ground of its lightness; while with a bad draught it cannot properly be consumed, and its bulk (as compared with coal) necessitates a correspondingly large furnace. But apart from the instances of furnaces which are too small, or have insufficient draught, or of a blast strong enough to blow it away, there is undoubtedly a large number of users of coal who might as well or better employ coke, while it would in most cases be much to their pecuniary advantage to do so. Wherever a great amount of radiant heat is required there can be nothing to equal coke; hence, for short or vertical boilers, it is unapproached in duty by any kind of coal. In one of the instances quoted by our contemporary as of recent date, the evaporative power of gas coke of ordinary quality was nearly 9 lbs. of water per pound of coke, while in the same boiler coal only evaporated 5 lbs. of water per pound. Another case carefully investigated gave 8.1 lbs. of water vapourized per pound of coke, both of which results, we need scarcely say, being remarkably high. These facts cannot be too widely known, as they go to show that, weight for weight, and totally irrespective of price, coke is in some cases, and perhaps more frequently than is popularly supposed, of double the value of steam coal for heating boilers. This being the case, it would be well worth while in many instances to persevere in its use, even to the extent of making suitable arrangements for consuming it to advantage, if such did not previously exist, especially bearing in mind its valuable property of burning without smoke. Of course, much of this recommendation will also apply to furnace coke; but gas coke has the advantages of more general distribution and lower price than the specially-made article, while in some respects it is better suited for general use.

Water and Sanitary Notes.

ONCE again it happened last week that a discussion on the question of the Metropolitan Water Supply took place at an hour so far advanced towards sunrise that the morning papers could do little more than mention the fact that something was said, and a certain thing done. Such was the fate of the discussion which took place on Sir William Harcourt's motion with respect to the constitution of the Select Committee which is to investigate the Metropolitan Water Question. This is rather awkward for Sir Richard Cross, who reiterates certain explanatory statements which he evidently desires to make public, but which fail to appear in the daily papers. At the same time there is a certain amount of agreement or co-operation between the present Home Secretary and the late Home Secretary, the former consulting the latter, and apparently acting on his advice. But in the deliberations of the Committee we may expect there will be considerable diversity of opinion, especially if Sir William Harcourt should continue to hold some of the views he has expressed in Parliament. His post on the Committee is that of Chairman; and on Tuesday there was a little contention in the House as to the parties who should be permitted to appear by counsel before the Committee. The privilege was granted to the Corporation, the Metropolitan Board, and the Water Companies; but Sir Richard Cross desired some extension, so as to provide for a representation from the extra-metropolitan water area.

In the discussion as to the constitution of the Select Committee, Sir R. Cross argued that it was to the interest of the consumers as well as of the Companies that an agreement should be come to with the latter, if possible. "Wherever you procure a supply from," said Sir Richard, "you must bear in mind that London is interlaced with pipes in connection with the present supply, and that this laying down of pipes will be a very serious matter with regard to any new supply." Perhaps, when the new Home Secretary gets a little more initiated into the practical bearings of the Water Question, he will feel in some degree the importance of carrying the Companies with him, if it be possible, instead of

defying them and setting them at naught. The Select Committee begins its sittings to-day, and according to present arrangements will meet every Tuesday and Friday until the inquiry terminates. The associated Companies have retained as their counsel Sir Edmund Beckett, Q.C., together with Mr. Pope, Q.C., Mr. Venables, Q.C., Mr. John Clerk, Q.C., and Mr. G. P. Bidder, Q.C.

Last Saturday week, at the annual dinner given by the Chairman of the Metropolitan Board, Sir W. Harcourt referred to the introduction of a new water supply for the Metropolis as something to be accomplished by the Board "in conjunction with other great bodies, like the Corporation of London," the mode adopted being that of an aqueduct equal in its magnitude to the Thames Embankment; and the Duke of Cambridge "hoped he might live long enough to see this great work accomplished." Sir James M'Garel Hogg, on his part, warned the ratepayers that they must not expect a great scheme of that sort to be carried out without having to pay for it.

The idea of introducing a competing supply into London is one which appears very tempting to some people, and is now being dangled persistently before the public eye. But the suggestion is obviously intended more especially as a kind of threat towards the Water Companies. Many things have to be considered in reference to a competing supply, but there are two of a very ominous character which relate to the engineering part of the question. First, where is the water to come from? and, secondly, how is it to be distributed? If the water be brought from a distance, the cost will be great, and the inhabitants of remote watersheds will plead their rights in the matter. There is also a grave objection to any scheme which will make the water supply of three or four millions of people dependent on the soundness and safety of a single aqueduct. If, however, a supply is to be sought nearer home, it may be doubted whether the chalk strata can be relied upon for a permanent supply adequate to the needs of the whole Metropolis. Concerning cost, there is an obvious element of uncertainty as to the estimated outlay for so vast an undertaking. But, supposing the supply obtained from a distant point, or from one near at hand, it has to be conveyed to the dwellings of the consumers, and it is in the highest degree unlikely that the Metropolis will consent to the fearful annoyance consequent on the tearing up of every road and footway in London for the purpose of laying down another set of mains and carrying the supply into the houses. The existing distributory works of the Companies must needs be purchased, and, although the threat of competition may be supposed to have some weight with the Companies, the prospect of something like a small earthquake will certainly not be relished by the busy and very crowded population of London. The water supply of the Metropolis constitutes a vast and complicated system, demanding far more care and consideration than people commonly suppose. We also question whether a new supply at a cost of twenty millions would be so good a bargain for the public as that which is represented by the scheme of Sir Richard Cross. For the purpose of carrying out a competing scheme, a large sum of money would have to be raised, whereas the arrangement devised by the late Government was a mere transfer without the raising of any capital.

The quarrel with the scheme of Sir Richard Cross, and with the provisional agreements which survive the disappearance of the Bill, is based on the supposition that the terms of purchase are extravagant. But it is an understood fact that the Companies were willing to submit the case to arbitration. As matters now stand, it is to be regretted that the Companies did not maintain their ground, and signify that if their undertakings were to be purchased, arbitration was the only method to which they would consent. The terms asked are simply those which would give to the Shareholders the income they now enjoy, with the addition from time to time of that which would accrue to them if they were left undisturbed. If the compact offers them anything more than this, there is reason for dissatisfaction on the part of the purchaser; but at present we are not aware that the terms of purchase go any farther than to give the Shareholders an equivalent for their present and prospective advantages. The only argument that can be adduced to the contrary consists in the high quotations recently apparent on the Stock Exchange in respect to the Companies' shares. But there are some cases in which the shares would undoubtedly have risen had there been no Purchase Bill in Parliament. Granting, however, that the prospect of the transfer has been the main cause of the rise—and of this there can be no doubt—this does not necessarily prove that the bargain is unjust. The popular cry at the present time is for terms of purchase

which shall leave the Shareholders in a worse position than heretofore. It virtually amounts to a demand that the private incomes of a large number of families shall be arbitrarily reduced, in order that the command of the Metropolitan Water Supply shall be given to a public authority. So far there is, as we have before intimated, a kind of sentiment entertained which approximates more closely than is agreeable to the revolutionary maxim that private property is public robbery.

The half-yearly meeting of the Southwark and Vauxhall Water Company was held last Thursday. In their report the Directors stated that 1308 new houses had been brought into charge during the past six months, and 7616 yards of new mains had been laid in the Company's district. The dividend declared on the ordinary stock was at the rate of $7\frac{1}{2}$ per cent. per annum. It appeared from the statement of the Chairman, Alderman H. E. Knight, that the expense incurred by the London Water Companies in opposing the Water Bills of the Metropolitan Board in 1878 was "something like £15,000." At this rate, the total expenditure connected with those Bills, including both sides, must have been £30,000—an utterly useless outlay. The Directors of the Southwark and Vauxhall Company, considering the very small dividend they had been paying, had not felt justified in discharging their share of the outlay until quite recently. In discussing the late proceedings in Parliament, with reference to the London Water Supply, the Chairman said the Companies were prepared to stand by the agreements which they had entered into with the Government, but "they did not care one iota whether the agreements were to be carried out or not." Concerning the rating powers possessed by the Companies, these had been granted by Parliament, and in reliance thereon the public had subscribed £10,000,000. As to a new supply to supersede the present, he did not believe such a thing to be practicable. With regard to the Company's own Bill, providing for the extension of their works, it was thought desirable to await the result of the inquiry which was just about to begin. They had, therefore, decided to withdraw it, although altogether about £2000 had so far been expended on its promotion. The expenditure of the Companies in respect to the long negotiations initiated by Sir Richard Cross will also have to be met, if the scheme comes to nothing. It will thus be seen that the water agitation is not without cost, the burden of which must really fall on the public as ratepayers and water consumers.

We regret that our esteemed contemporary, the *Standard*, should so far depart from its usually polished style as to adopt the phrase "Water Cheating" for the title of a letter in which the writer complains that the London Water Companies raise their charges in proportion to the annual value of house property. The fact that an occupier is charged more now than formerly may be due to the circumstance that he was charged below the scale in previous years. But, in any case, the letter signed "Sigma," to which this offensive heading is given, is founded on an entire misconception of the principles which must necessarily govern the water supply of any town. When we read such intemperate effusions as the one now mentioned, we feel rather amused in the prospect of that rude awakening which will befall certain parties when the charge is levied by a "public authority."

The annual report of Colonel Bolton, the Water Examiner appointed under the Metropolis Water Act of 1871, has just been published as a parliamentary return. It shows that the total certified expenditure of the eight Metropolitan Water Companies to December 31, 1879, was £12,242,019, being an advance of £274,696 during the year. The estimated population, which in December, 1878, was 3,938,166, was 4,289,544 in December, 1879, and the number of houses had risen from 552,072 to 573,792. The average daily supply of water per head of the population last year was 32.56 gallons, and per house 238.52. In 1878 the quantities were 33.11 and 237.40. Thus the supply per head has diminished, while the supply per house shows an increase. This would imply a somewhat closer packing of the population.

A very useful treatise on "Water Supply" has just appeared from the pen of Mr. J. H. Balfour Browne. It gives in a succinct and lucid manner a mass of information on the water question, and is written down to a very recent date; but has the singular defect of possessing neither table of contents nor index. Mr. Browne, in the views which he advocates, or to which he inclines, is far more in agreement with Dr. Frankland than with Dr. Tidy. But, apart from the author's views, the book is of value as a repertory of facts and arguments bearing on the Water Question as it affects the country at large. The subject is treated from a sanitary standpoint, and does not enter into financial considerations, unless we

except a few remarks towards the close, as to the way in which Water Companies raise their capital.

According to an answer recently given in the House of Commons by the President of the Local Government Board, it appears that the Government consider it impossible during the present session to obtain the passing of a Bill to regulate the Conservancy of Rivers. Undoubtedly the question is both large and complicated, and we fear it is one that will stand over for some time.

The Local Government Board having refused to sanction the scheme propounded by the Lower Thames Valley Main Sewerage Board for the disposal of the sewage of that district by a system of irrigation at Molesey, this troublesome question still awaits solution. The late inquiry, extending over seven weeks, is said to have cost £30,000. A Provisional Order has been issued, extending for three years the time allowed to the Board for the diversion of the sewage from the Thames—a very encouraging state of things for the ratepayers.

The Metropolitan Board have resolved not to take any steps towards throwing open the gardens of Lincoln's Inn Fields to the public. There are "difficulties" in the way, and an Act of Parliament will be wanted, besides which the Board do not seem to feel particularly concerned about the matter. But we apprehend something more will be heard about it.

RIVER WATER.

CONTINUING our notice of Dr. Meymott Tidy's recent lecture delivered before the Chemical Society, on the subject of "River Water," we arrive at that point where Dr. Tidy deals with the analyses whereby Dr. Frankland seeks to show that river water does not undergo appreciable oxidation in a run of a few miles. Dr. Tidy does not question Dr. Frankland's facts, but he disputes the conclusions. With much force and clearness, Dr. Tidy contends that the actual reduction of organic carbon and nitrogen between two spots in a river is a fact of much greater value than any analyses indicating the reverse, for the reason that Dr. Frankland cannot say that the organic matter found at spot B, where he collected his second sample, is the identical organic matter that was in the river at spot A, where he took his first sample. "Unless he can prove this 'identity of the organic matter in the two samples,'" says Dr. Tidy, "I submit that experiments showing a similar quantity 'of organic carbon at two spots as proof of non-oxidation,' cannot be compared, as a matter of evidence, with experiments showing a reduction of organic carbon between two 'spots as proof of oxidation.'" Dr. Frankland's experiments with polluted water shaken up in bottles, and exposed to light and air while thus confined, are shown to be altogether different from those conditions which occur in the case of running water in an open channel.

Dr. Tidy had an apparatus constructed consisting of twenty troughs, each ten feet long, each trough fixed so as to have a fall of one inch, and discharging into another placed under it at a few inches distant, inclined in the opposite direction. This arrangement existed throughout the series, so that a constant flow of water was thus obtained for a length of 200 feet, the supply being derived from a cistern at the top, which was replenished by the water being continually pumped up again from the bottom of the series. The troughs were lined with glass, cemented to the wood. The flow was at the rate of about one mile in an hour and a half. Six gallons of New River water mixed with from one to eight per cent. of filtered London sewage taken from the Abbey Mills pumping-station, after being run two or three times through this apparatus—sometimes only once—lost all its offensive smell. The change in this respect is said to have been "most remarkable." New River water, unmixed with sewage, showed in a mile run a decrease of organic carbon and nitrogen to the extent of 0.027 part per 100,000, the decline in the carbon being from 0.114 to 0.093, and in the nitrogen from 0.026 to 0.020. With 5.55 per cent. of sewage, the carbon was reduced in the mile run from 0.436 to 0.274, and the nitrogen from 0.156 to 0.100. With 8.33 per cent. of sewage the carbon fell from 0.673 to 0.286, and the nitrogen from 0.203 to 0.071. The last traces of the organic matter were the most difficult to oxidize. The first part rapidly disappeared, but as the organic matter in the water lessened, the rate of oxidation declined. But, as Dr. Tidy observes, the experiments were only comparable with the action of a river in the matter of run. The lining of the troughs was smooth, and the purifying agency of fish and plants was entirely absent.

We have only cited some of Dr. Tidy's experiments. The uniform results point to the same conclusions, and are diametrically opposed to the reasonings of the Rivers Pollution Commissioners. The latter state: "It will be safe to infer

"that there is no river in the United Kingdom long enough to effect the destruction of sewage by oxidation." Dr. Tidy, on the contrary, is led to "the inevitable conclusion that the oxidation of the organic matter in sewage, when mixed with unpolluted water and allowed a certain flow, proceeds with extreme rapidity, and that it is impossible to say how short a distance such a mixture need flow under favourable conditions before the sewage matter becomes thoroughly oxidized." This much Dr. Tidy feels warranted in asserting, and its practical importance needs scarcely to be pointed out: "It is certain to my mind that there is no river in the United Kingdom but what is many times longer than is required to effect the destruction of sewage by oxidation."

From a discussion of the natural method of purifying running water, Dr. Tidy proceeds to consider what can be effected by artificial means. Here he lays down the principle that the powers of science and art must never be invoked (and he holds this emphatically in the matter of a drinking supply) to deal with a water which is primarily impure. "Given an impure source," he says, "there is no help that I can see but the entire abandonment of the source." "Art," he continues, "may be fairly asked to improve a good water, but it is simple madness to ask her to deal with a bad water." In urging the claims of rivers as one of the sources of water supply, Dr. Tidy explains himself to mean rivers free from sewage. This does not necessarily imply rivers that have never received a trace of sewage. In this sense it may be questioned whether there is any water in the world absolutely uncontaminated. But the demand is for rivers "the purity of which at the suggested intake can be proved by chemical analysis, and the maintenance of which purity law can demand." Where such a state of things exists, art can do much. The water must be efficiently engineered, including due provision for storage, subsidence, and filtration. Concerning the rate of filtration, Dr. Tidy approves of two gallons per square foot of filtering surface per hour.

Finally, we come to a consideration of the extent to which statistics justify us in condemning or approving the supply of river water for drinking purposes. That disease may be caused by drinking impure water is a fact which Dr. Tidy considers proved beyond doubt. But in the case of river water the argument against its use is based, first, on the existence of germs; and, secondly, on the supposition that the oxidation process which might affect organic matter would probably leave organized bodies untouched. Without discussing the truth or untruth of the germ theory, the following question is raised:—Admitting that germs of disease pass with the sewage into a river, is there any evidence, chemical or otherwise, to indicate that these germs are not amenable to the same laws which govern organic matters generally? Admitting them to be organized cells, are they not so low in the scale of life that they may be fairly regarded as occupying a sort of borderland "between the organic and the completely organized?" If the germs are not to be considered as mere organic matter, but as organized bodies (like fish, in fact), Dr. Tidy argues that they ought to increase and multiply, so that as we pass down a river, every town supplied from that source ought to exhibit a constantly increasing death-rate from the special disease. But statistics fail to show such results. It is also invariably found, as a question of time, that the progress of such a disease as cholera is not down a river, as the germ theory would indicate, but in the opposite direction.

Dr. Tidy has obtained the vital statistics, for ten years, of eighteen towns supplied by deep-well and spring water to compare with the same ten years statistics of eighteen towns supplied by river water. The total population in each case is about 900,000. The well water towns show an average death-rate of 22.72 per 1000, and the river towns a death-rate of 22.66, thus leaving a small balance in favour of rivers as a water supply in comparison with deep wells and springs. Wells have the advantage in deaths from fever, in the proportion of 8.488 per 1000 against 9.126. In cholera the proportion is still greater, being 0.710 against 1.147. On the other hand, river towns show to advantage in diphtheria, 1.457 deaths per 1000 being registered in river towns against 1.695 in well towns. The difference is most remarkable in the case of diarrhoea, the river towns having 8.644 such deaths as against 11.223 in the well towns. On the whole, the statistics fail to show that there is any manifest difference, in the matter of health, between the towns supplied from wells and those supplied from rivers. Other statistics, compiled by Mr. Baldwin Latham, have relation to London during the eleven years 1868-78. It is noticed as remarkable that in 1872, when Dr. Frankland reported the greatest amount of organic

impurity in the river water supplied to London, the tables show the lowest death-rate, the zymotic death-rate being at the same time below the average. On the other hand, it is noticed as equally remarkable that in 1870, when the Thames and the Lea had the least amount of organic impurity, the death-rate and the deaths from fever and diarrhoea were above the average. A comparison of the death-rate in the river districts and well districts of London during the ten years 1868-77 shows that the mortality from enteric fever, scarlatina, diarrhoea, diphtheria, and dysentery is in each case slightly lower in the districts supplied with river water than in the districts supplied with well water; while, so far as cholera is concerned, the returns in both are identical. It is curious that the general death-rate is lowest in those districts which receive a mixed supply, partly well and partly river water.

The facts seem to warrant the conclusion that be the *materies morbi* what it may, organized matter or chemical poison, "it is subject to the same laws of destruction as the ordinary organic matter in sewage." As a matter of sentiment, Dr. Tidy acknowledges that he should prefer water from springs and deep wells. But the facts which justify the use of rivers are not to be denied, and may often prove practically valuable. Two questions are asked—first, Has there ever been a well-authenticated case where river water, having received sewage, dilution being considerable and circumstances favourable for oxidation, has, after a flow of ten or twelve miles, been manifestly the cause of an outbreak of disease? Dr. Tidy knows of no such case. Secondly, Has there ever been a well-proved case of an outbreak of disease resulting from the use of drinking water, where the chemist would not unhesitatingly, on analysis, have condemned the water as an impure source? Again Dr. Tidy knows of no such instance. The argument is therefore sustained that water analysis is a test of the wholesomeness of water. Indeed, if water analysis has not this virtue, Dr. Tidy fails to understand the value of water analysis at all.

A remarkable and well-known passage in the Sixth Report of the Rivers Pollution Commissioners is quoted. Speaking of the deep-well water of the Kent Company, the Commissioners say: "The supply of such water to the Metropolitan area generally would be a priceless boon, and would at once confer upon it absolute immunity from epidemics of cholera." It is now asked, "Do facts warrant that bold promise?" Speaking as a medical man, and citing the general experience of his brethren, Dr. Tidy observes: "We may fairly stand surprised when those outside our profession, who have never had the battles we have had to fight with the disease, have committed to paper such a startling promise as 'absolute immunity.'" Reviewing all the facts, Dr. Tidy states his conclusions. In substance these are—first, that when sewage has travelled a few miles along a river bearing a due proportion in volume to that of the sewage, the removal of the whole of the organic matter will be effected; and, secondly, that whatever may be the cause of certain disease—i.e., whether germs or chemical poisons—the *materies morbi* which finds its way into the river at the sewage outfall is destroyed with the organic impurity after a certain flow.

In the discussion which followed the reading of Dr. Tidy's paper, Dr. Frankland pointed out that a highly ferruginous tributary of considerable volume entered the Wear between Bishop Auckland and Durham, and materially improved the character of the water. The statement of the Rivers Pollution Commissioners respecting the goodness of the river water at Durham, was only that the water was good "considering its source." With regard to the disappearance of sewage from the Thames between Lechlade and Hampton, Dr. Frankland stated that for several miles above Hampton the Thames runs through an immense deposit of flint, gravel, and sand, which sops up its water like a sponge, and restores it again at a lower level. Thus vast volumes are "exhaustively filtered" through gravel and sand, and the organic matter is consequently oxidized by means of a porous medium. Dr. Frankland objected to the rough experiments of Dr. Tidy, that they failed to represent the condition of things existing in a river. After an extended criticism of Dr. Tidy's lecture, Dr. Frankland submitted that the question, Can running water be, at all times, safely used for dietetic purposes a few hours or days after it has been mixed with sewage? is to be answered in the negative. A written statement sent in by Dr. Mills coincided in many particulars with the remarks of Dr. Frankland. Professor Huxley, as we intimated last week, sustained the germ theory in its more alarming form. Dr. Mills, in a communication which he has since published, says, "The weeds in a river's bed, into which sewage is poured, constitute a natural sewage farm, capable of absorbing chlorides, phos-

"phates, and organic matter in the ordinary way." This authority adds, "A great deal of the purification of the Thames must be owing to this cause, ordinarily never considered." And he says, "I should regard with grave apprehension any proposal to dredge the bed of the Thames above London." It is satisfactory to find that at all events the Thames is purified in some way, and it would seem that other rivers have also something in their favour. Dr. Tidy's lecture is full of interest, and even those who are opposed to his views acknowledge that, in several respects, his researches are of great value.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE USE OF GASEOUS FUEL.

SIR,—I should, under any circumstances, have felt disposed to reply to Mr. Fletcher's letter contained in your last issue, but the position I lately took at the meeting of the British Association of Gas Managers leaves me no choice. At that meeting I spoke somewhat strongly in respect to the statement Mr. Fletcher had made at the Society of Arts, feeling that it was advisable that in our Association any public statement of importance which was, or appeared to be, fallacious should be challenged.

Mr. Fletcher is a gentleman who is entitled to respect on account of the work which he has done in the production of apparatus which develops a high calorific power from coal gas; but although I so respect him, and am ready to believe that the burners which he employed in his experiments are superior to any others of a similar kind, I am constrained still to doubt the correctness of the results obtained, the more especially as part of his conclusions are founded on the assumption that the calorific power of gas for the boiling of water is directly proportional to its power to raise water through a limited number of degrees and at low temperatures. An illustration to the contrary will be found in the report of my observations last week at the meeting I have referred to. Mr. Fletcher's last statements work out to 900 units per cubic foot of gas, instead of, as previously, 1013, according to my calculation. The latest result is startling enough; but while I am quite satisfied that the Warrington gas is good, I can scarcely believe it to be so good as Mr. Fletcher's statements indicate.

Accepting for the moment, however, Mr. Fletcher's 900 units for low temperature, and assuming 90 per cent. to be realizable for the boiling of water, the power per cubic foot of gas sinks to 810. The true method is to actually evaporate water from the boiling point, paying due attention to atmospheric conditions, although it is true that those who are experienced can very well arrive at correct conclusions by heating known weights of water through a few degrees only.

What value, however, can be attached to experiments made with "a jet which has been tested at 10-10ths?" What means did Mr. Fletcher take to ascertain and fix the pressure, granting that the burners might have been right as to rate, at 10-10ths? Did he use a common syphon pressure-gauge, or a sensitive King's gauge? I must conclude that it was one of the first-named kind; for an experimenter who is content with a mere "jet" instead of an accurate meter or gasholder is not, I think, likely to attach so much importance to pressure as is requisite. Possibly Mr. Fletcher has not reflected that under different atmospheric conditions the same jet will require different operating pressures in excess of that of the atmosphere to pass equal volumes of gas.

Mr. Fletcher admits that "there is something wrong somewhere," as the available duty, even with a very imperfect apparatus, is greater than that stated as the maximum theoretical duty possible. Where stated and by whom stated? Does Mr. Fletcher know the composition of the gas he has used? or does he speak generally of ordinary gas, say of 16 to 20 candle power? If one knew the composition, the theoretical duty could easily be calculated.

As Mr. Fletcher still claims to have obtained a higher thermal effect than theory indicates, and as, moreover, he says, "I have been informed that the available duty, as obtained in the injector furnace, is also greater than the maximum theoretical duty of the fuel used, I cannot see the propriety of his expression, "that there is something wrong somewhere," unless by that expression he means to challenge the results obtained by philosophers of the highest repute. If he means this, then, after the statements he has made, he owes a duty to himself and to the world to pursue his investigation in the most refined and exact manner. He might thereby discover some unknown facts, which would, as I hope, tend to his own material prosperity and to the benefit of mankind.

In the meantime, I must continue to doubt the accuracy of results which are admitted to have been obtained in experiments somewhat crudely conducted.

55, Millbank Street, London, June 12, 1880.

F. W. HARTLEY.

[The remarks our correspondent refers to above, as having been made at the meeting of the British Association of Gas Managers last week, will be found reported on p. 950.—Ed. J. G. L.]

IN addition to the awards already noticed, a special first prize at the Sydney Exhibition has been given to Messrs. Crossley Bros. for the "Otto Silent Gas-Engine."

IN reference to our remarks on "Gas Affairs at Bedford," in the "Circular to Gas Companies" of the 1st inst., we have since been informed that testing apparatus has been in operation, in accordance with the Company's Act of Parliament, since 1864, and "uniformly shows an illuminating power of not less than 16 candles." Also that, though the Company were satisfied that they had furnished yearly statements of their accounts, they (in order to satisfy the Corporation) sent duplicates for the past 14 years, considering that some of them might have been mislaid. It is, however, right to point out to the correspondent who calls our attention to the matter, that these circumstances do not materially alter the facts upon which our comments were based.

Parliamentary Intelligence.

HOUSE OF LORDS.

THURSDAY, JUNE 10.

The British Gaslight Company (Staffordshire Potteries) Bill and the Prescott Gas Bill were referred to a Select Committee, consisting of Lord Clinton (Chairman), Lord Foxford, Lord Leigh, Lord Greville, and Lord Hanmer; to meet on Monday, June 14.

HOUSE OF COMMONS.

MONDAY, JUNE 7.

Petitions against the Local Government Provisional Orders Bill (Stockton and Middlesbrough Water Order) were presented from (1) Timothy Hutchinson, (2) Corporation of Darlington.

Requisitions to withdraw petitions against the following Bills were presented:—Preston Improvement, from John Fletcher; Southwark and Vauxhall Water, from (1) Grand Junction Water-Works Company, (2) West Middlesex Water Company.

LONDON WATER SUPPLY.

SIR W. V. HARCOURT moved that the Select Committee on London Water Supply consist of 17 members. He said: I had agreed with the right honourable gentleman opposite (Sir R. A. Cross) as to the names of the gentlemen to form the Committee, but in consequence of Sir John Mowbray having stated that he is unable to serve, I am obliged to give notice to add another name—that of Mr. Hubbard, one of the members for the City of London—in place of that of Sir John Mowbray. As to this Committee, a desire has been expressed that power should be given to the parties to appear by counsel. To this I have no objection, and I have therefore given notice to move that the Corporation of London, the Metropolitan Board of Works, and the Water Companies shall have power to appear by counsel.

SIR E. COLEBROOKE: I had given notice of a similar motion with regard to the Water Companies. I know that one of the oldest and largest Companies desire to state their case in this way.

SIR H. JOHNSTONE: I do not wish to obstruct the business of the House, but I think it my duty to make an objection to the name of my honourable friend the member for Truro (Sir J. M. Hogg). I am sure that my honourable friend will act impartially, as he always does, but in his capacity of Chairman of the Metropolitan Board of Works he promoted a rival scheme two years ago, and I would ask, therefore, if it is in accordance with usage that he should sit on a Committee of this sort. I think it would be better that, instead of my honourable friend, a perfectly independent member, of impartial views, who has never expressed any opinion or acted against the Water Companies, should be on the Committee.

THE SPEAKER: I must inform the honourable member that the question now is not whether one honourable member or another shall be on the Committee, but that the Committee shall consist of 17 members.

SIR R. A. CROSS: I am exceedingly glad, Sir, to hear what the right honourable gentleman says—that everybody concerned in this inquiry shall be allowed to secure proper counsel. I wish also to state, as I have said before, that the great object which the late Government had in view in proposing any course at all with regard to the Water Companies was that the Companies interested, with the representatives of the ratepayers and consumers, should be brought round a table. The great object of our Bill was, to get the Companies upon the floor of the House, so that we could talk the matter over, and hear what terms they proposed, and that afterwards we could submit those terms to the judgment of a Committee. It has been directly stated to the country that the late Government wished to force certain high prices on the consumers of London, but nothing was farther from our intentions. We intended nothing more than that the Water Companies should state the lowest terms they would accept, and that we should lay those terms before the water consumers, and submit them to a Committee. I think that was the first step to be taken in trying to obtain a proper water supply for London; for, wherever you procure a supply from, you must bear in mind that London is interlaced with pipes in connection with the present supply, and that this laying down of pipes will be a very serious matter with regard to any new supply. I think it will be to the interest not only of the Companies but of the consumers that you should get the companies along with you. That was our object, and whenever the consumers and the Water Companies meet together round a table, I have no doubt now, as I had no doubt before, that if matters are properly managed we shall come to terms which will be satisfactory on both sides. I have only risen to state what the object was which we had in view, because it has been so often misrepresented, as if we had been trying to force on the consumers of London prices which they were not willing to pay. I take the most straightforward course of contradicting that statement, and I say that all we did was to get the lowest terms at which the Water Companies were willing to sell, so as to submit those terms to the consumers and to a Select Committee, and see if they could be accepted.

The motion was agreed to.

The name of Sir William Harcourt was then put and agreed to. On the name of Sir James McGarel Hogg being read,

SIR H. JOHNSTONE said: Sir, after the announcement of the Home Secretary, that the Water Companies will have power to appear by counsel, I think the allusion I made to my honourable friend the member for Truro comes with greater force than before, for it will now be in the power of the Metropolitan Board of Works to employ counsel if they think fit, and in the interest both of the public and of the Companies, I consider it far better that the tribunal should be constituted with the greatest regard to impartiality. I can scarcely think that my honourable friend is impartial on this matter, for, having come two years ago with a rival Bill to take away the rights of the Water Companies and obtain a fresh supply, he has appeared in Parliament as a direct opponent of the Water Companies. I would appeal to him himself whether on this subject he is a strictly impartial person. Only as lately as Saturday evening last, he announced himself as one who was ready to entertain any rival scheme to supply London with water. For these reasons I think that of all men in this House he is one who ought not to be put on a Committee of this character. We wish to have a full and impartial inquiry, and while I have no doubt that he is a man of a judicial mind, and will approach the question judicially, I do not, under the circumstances, see the necessity of putting him on the Committee, and I should be glad to see some other honourable member placed on the Committee in his stead. If justice is to be done in this matter, let it be done, but let it not be done with a gentleman on the Committee who has expressed a strong determination to take away the property of the Water Companies, and to supply London by means of a rival scheme. The honourable gentleman has appeared in the House, in connection with this subject, as a suppliant for an indemnity, and we had to grant him one for the expenses he had incurred in the matter of the Water Supply of the Metropolis, for a Bill had to be passed by the late Government to relieve the Metropolitan Board of charges which otherwise they would have been subject to for opposing the Water Companies on their own responsibility. After this, I

say it is against all precedent and constitutional usage for one who has deliberately formed views against the interests of the Water Companies to be on a Committee of this kind. Having expressed himself so strongly, and gone to enormous expense against those Companies, he is the last man who should be put on the Committee, and some person of equal impartiality, and less committed, should be placed there in his stead.

Sir W. V. HARCOURT: I hope my honourable friend will not persist in his opposition. I think the canon he has laid down would make the appointment of any Committee extremely difficult. If you lay down a rule that no member shall be on a Committee who has ever expressed an opinion on the subject which is to come before that Committee, I think you will have very few Committees in this House. On the contrary, it is persons who have expressed strong opinions who constitute such Committees. What we have to do is to see that on the Committee one view does not predominate over another, and I think it will not be said that the honourable member for Truro will have a predominating voice on a Committee of 17. It is said that the honourable member has opposed the Water Companies; but he has not opposed them in his private, but in his public capacity. You might oppose the appointment of a private person, who might have a bill of sale on these things; but that is a different matter. The honourable member for Truro has acted entirely in a public capacity. If he were interested in Water Companies, there would be a parliamentary objection to his appointment on the Committee; but, as it is, the objection comes to nothing; and as the Corporation of London are represented by two of their distinguished members—or will be when the Committee is constituted—it appears to me that the Metropolitan Board of Works ought to be represented on the Committee by their Chairman.

Sir R. A. CROSS: I entirely agree with what the right honourable gentleman has said, and I may say that the first name which suggested itself to me was that of the Chairman of the Metropolitan Board of Works. There is a distinct difference between private interest and public duty, and as the Chairman of the Metropolitan Board considers the matter, not from the point of view of private interest, but from that of public duty, I should be very sorry if he were not placed upon the Committee.

Colonel MAKINS: I think, Sir, it is to the interest of my honourable friend himself that he should not be nominated on this Committee. It was not calculated to strike the public with confidence in Parliamentary Committees when, acting with reference to a Gas Bill in exactly the same way in his official capacity, he left his chair and instructed his counsel on the other side of the table. It was remarked upon as calculated to shake the confidence of the public in Parliamentary Committees. There must be persons in the House capable of protecting the public rights almost as well as the honourable member for Truro.

Sir J. M. HOGG: Sir, as my honourable friend the member for Scarborough (Sir H. Johnstone) appeals to me, all I can say is that I shall leave my case entirely in the hands of the House and with the Home Secretary and the late Home Secretary. I should not have risen but for the observations of my honourable friend (Colonel Makins) below me, who ventures to tell me in this House that, as a member of a Committee, I acted in an improper way.

Colonel MAKINS: If I expressed anything of the kind, I unreservedly withdraw it. I merely said it gave the appearance to the public—

Sir J. M. HOGG: I accept my honourable friend's withdrawal of his remarks. I say that when I sat on a Committee I did my duty, as I ought to do; and if I am placed on this Committee—I do not ask it, but if the House places me on the Committee I shall do my duty there impartially, as the honourable member for Scarborough has said. As to my interest in gas or water companies, I have no private interest in them. I never had gas shares or water shares in my life. The interests of water companies are not the interests I seek, but the interests of the public. For ten years I have held the position I hold now, and as long as I have that position I shall endeavour to uphold the interests of the public, and not the interests of water companies or any other private bodies.

Sir E. COLEBROOKE: I think the honourable gentleman is not quite just to the honourable member for Scarborough. It is not merely a question as to the opinions he has expressed, but as to the manner in which he has committed himself to views which the Water Companies do not consider to bear justly on them. We have a right to ask, as my right honourable friend below me (Sir W. V. Harcourt) has said, that all persons meeting round a table to discuss a matter shall meet in a position of equality. Now the Metropolitan Board of Works are to be represented by their counsel and agents, and they are also to be represented by their Chairman. I do not think this is quite fair. A great desire has been expressed that the Water Companies should not be represented on this Committee, and a right honourable gentleman on the Treasury Bench went so far as to ask you, Sir, whether they ought not, by the rules of the House, to be excluded. But you might go farther, and say that the members for the Metropolis should be excluded. I think this would be a pity, and that it is desirable that they should be represented. Now that there are wild schemes afloat, and that there is talk of an aqueduct from the West of England, I think it is time for the ratepayers to look sharply into this matter. But I agree with my honourable friend the member for Scarborough that the Water Companies will be satisfied if they can speak for themselves in a fair way, and I think the Board of Works should be satisfied with the same concession. However, if the House is desirous that the Chairman of the Board of Works should be on the Committee, we must take it for what it is worth. I have no doubt the honourable gentleman will do his duty in the matter, but his vote will count as well as another's. I would ask my honourable friend the member for Scarborough not to press his objection.

Alderman FOWLER: Taking it as a principle that all interests are to be represented on the Committee, I think the Committee would be incomplete without the presence of so distinguished a member, especially on the Metropolitan Water Question, as the Chairman of the Metropolitan Board of Works. I gave notice this evening to add the name of the honourable member for Lambeth (Alderman McArthur), who will be Lord Mayor; but the Government have met that by proposing to add the name of my right honourable friend the member for the City of London (Mr. Hubbard). I think the City of London, the Metropolitan Board of Works, and all other interests, should be thoroughly well represented on this Committee.

The name of Sir J. M. Hogg was then agreed to, as were the following:—Mr. Chamberlain, Sir Richard Cross, Alderman Lawrence, Mr. Brand, Mr. Pemberton, Mr. Caine, Baron Henry de Worms, Mr. Firth, Sir Gabriel Goldney, Lord George Hamilton, Mr. Thorold Rogers, Mr. Selater-Booth, Mr. John Holmes, and Mr. Parnell.

TUESDAY, JUNE 8.

Petitions against the Local Government Provisional Orders Bill (Stockton and Middlesbrough Water Order) were presented from (1) John Bowes, (2) Lewis Fry.

LONDON WATER SUPPLY.

Sir W. V. HARCOURT: Sir, I beg leave to move the motion that stands in my name—"That Mr. Hubbard be added to the Select Committee on the London Water Supply."

The motion having been put and agreed to,

Sir W. V. HARCOURT said: Sir, I now move—"That the Corporation of the City of London, the Metropolitan Board of Works, and the Metropolitan Water Companies be heard by themselves, their counsel and agents, before the Select Committee, if they think fit."

Sir H. D. WOLFF: I rise to a point of order. The other day, when another Committee was appointed, we were told that the Committee would decide what parties should appear before them. I should like to know why another course has been taken on this occasion. It seems to me that there are other parties who should be heard by counsel, as, for instance, the Vestries. But the right honourable gentleman limits the appearing by counsel to certain parties whom he has selected. There must be a certain form of order in these matters. We were told the Committee would be authorized by the House to give permission to parties to appear, whereas the right honourable gentleman has on this occasion selected certain parties who, he thinks, should be represented by counsel. I should like to know why a different course has been adopted on this occasion from what was taken before.

Sir W. V. HARCOURT: I may say that it was my desire to pursue the course the honourable gentleman has indicated, but my predecessor, the right honourable gentleman opposite (Sir R. A. Cross), impressed it on me that this particular course should be taken. I was very anxious that the question should be reserved till the Committee met; but the right honourable gentleman opposite felt so strongly that this was the proper course, that I thought I had no alternative but to accede to his wish.

Sir R. A. CROSS: That is entirely correct. If the honourable gentleman the member for Portsmouth will refer to the report of the statement I made to the House, he will see that there was an understanding that all these parties should have a hearing. I pointed out the other day that there were other parties who would like to be heard, and I am sure the right honourable gentleman will grant them the same facilities as the Companies and the City of London. I quite agree with my honourable friend that other parties ought to be heard. I think the Vestries have a right to appear, and also a number of persons who are water consumers outside the area of the metropolitan district. I think everybody ought to be heard who wants to be heard, and who has a direct interest in the settlement of the question, as I understand the wish of the right honourable gentleman to be that, if possible, we should come to a settlement of this question by means of this Committee.

Mr. OTWAY: I do not know if I have apprehended the point of the honourable member for Portsmouth, but if I have it has not been answered by the right honourable gentleman opposite (Sir R. A. Cross). The question is not that these parties are not to be heard, but that they have not obtained their sanction from the Chairman of the Committee, but that it has been formally moved by the Secretary of State for the Home Department; whereas, in another case, the permission to appear was only to be obtained from the Chairman of the Committee. There is no doubt that there is a different procedure in this case from the other. In this respect the observations of the right honourable gentleman, the late Home Secretary, do not appear to me to answer the objection. Where great interests are at stake, clearly the parties who are so deeply interested should be heard by themselves or their agents. Here you have millions of property at stake, and if we are to believe all the articles published in the papers, that property is very much threatened by the possible proceedings of this Committee. It is an obvious necessity of fair play that the owners of this property should have an opportunity of stating their case. Therefore, although the procedure may be different, as my honourable friend states, from that of another Committee, it seems to me to be a just and proper one, that the owners of the property should be heard, and whether sanction is given by the motion of the right honourable gentleman, the Home Secretary, or by the Chairman of the Committee, does not much matter.

Sir W. V. HARCOURT: I wish to have the matter understood. My own personal view was that I had no right, in moving for the Committee, to determine who were the parties to be heard; this, I thought, was for the Committee to determine when they met, and I always understood that all these parties would be heard. I found my right honourable friend opposite thought the other course was the best to take, and I assented to it.

The motion was then agreed to.

LIVERPOOL CORPORATION WATER BILL.

On the motion of Mr. DODSON, Sir Gabriel Goldney was discharged from further attendance on the Select Committee on the Liverpool Corporation Water Bill, and Mr. Ewart was added to the Committee.

WEDNESDAY, JUNE 9.

A petition in favour of the Ackworth, Featherstone, Purston, and Sharlston Gas Bill was presented from Featherstone Local Board.

The *locus standi* of the following petitioners against the Southwark and Vauxhall Water Bill was disallowed:—(1) Hampton Local Board, (2) Wandsworth and Putney Gas Company, (3) Inhabitants of Seething Wells, (4) Lea Conservancy Board, (5) Grand Junction Water-Works Company, (6) Lambeth Water-Works Company (except against certain clauses, and so much of the preamble as relates thereto), (7) Kent Water-Works Company (except against certain clauses, and so much of the preamble as relates thereto), (8) Chelsea Water-Works Company (except against certain clauses, and so much of the preamble as relates thereto), (9) Corporation of Kingston-upon-Thames (except against part of clause 5, and so much of the preamble as relates thereto).

GAS AND WATER ORDERS CONFIRMATION BILL.—A petition (the petitioners not praying to be heard) against the Norwood (Middlesex) Water Order was presented from owners and occupiers of property in Cranford.

LIVERPOOL CORPORATION WATER BILL.—Requisitions to withdraw petitions against the Bill were presented from (1) Captain Devereux Herbert Mytton, (2) Wallace James Arthur France, (3) Shropshire Union Railway and Canal Company.

THURSDAY, JUNE 10.

LIVERPOOL CORPORATION WATER BILL.—Requisitions to withdraw their petitions against this Bill were presented from (1) Earl of Haddington and others, (2) Lancashire and Yorkshire Railway Company.

KIDWORTH GAS COMPANY.—The annual general meeting of this Company was held on the 7th inst.—Mr. W. Grant in the chair. The Secretary (Mr. J. Cayzar) read the report of the Directors, from which it appeared that the Company are progressing satisfactorily. A new chimney has been built at a cost of £50; but it will prove a great saving in coals. The gas registered by the meters was 2,409,900 feet, which was an increase of 185,100 feet on the previous year. The receipts had been, with last year's balance, £697 12s. 1d., and the outstanding accounts amounted to £164 6s. 2d.—making a total of £1198 4s. The expenses for the year had been £821 5s. 5½d., leaving a balance of £376 18s. 6½d. A dividend of 6 per cent. was recommended, which would take £240, leaving a balance of £136 18s. 6½d. The report was adopted, the retiring Directors (Mr. White and Mr. Horton) were re-elected, and a vote of thanks was passed to the Directors for their services during the past year.

Legal Intelligence.

CLERKENWELL COUNTY COURT.—FRIDAY, JUNE 11.
(Before Mr. G. WHITBREAD, Judge.)

THE GASLIGHT AND COKE COMPANY v. M'KINLAY.

This was a claim made by the plaintiff Company to recover from the defendant £2 9s. 9d. for gas supplied.
Mr. S. MOSLIN appeared for the Company, and Mr. POPHAM for the defendant.

The claim of the Company was originally for a larger amount, which had been reduced by a payment to the sum now claimed, the dispute being as to the charge of £2 10s. 6d. for 14,200 cubic feet of gas supplied. The officers of the Company proved, by the state of the meter, that the amount of gas named had been consumed. It appeared that from September to December, 1878, the value of the gas consumed was only 5s. 8d., and from December to March, 7s. 9d.; while for the quarter ending June it rose to £2 10s. 6d., the sum disputed.

Mr. POPHAM contended, on the part of the defendant, that if the quantity of gas consumed in the two heavy quarters of the year was as stated, it could not have risen to such a very large amount for the light quarter, the gas being used in the stable, where much less was required in summer.

Evidence was given by the persons in charge of the stables to the effect that certainly no more gas was consumed in the summer than in the winter.

His HONOUR said he was bound to take the evidence of the meter as to the quantity of gas which had passed through it. There was no remedy except to have the meter examined, which defendant might have done.

Judgment for plaintiffs for the amount claimed.

Miscellaneous News.

MONTE VIDEO GAS COMPANY, LIMITED.

The Eighth Ordinary General Meeting of this Company was held on Friday, the 28th ult., at the City Terminus Hotel, Cannon Street, E.C.—Mr. JOHN BRAMLEY-MOORE in the chair.

The SECRETARY (Mr. John T. Denniston) having read the notice convening the meeting, and the minutes of the preceding meeting, the following report of the Directors was taken as read:—

The Directors submit to the Shareholders the annexed audited statement of accounts for the year ending Dec. 31, 1879.

The net revenue amounts to £47,774 12s., out of which provision has been made for bad debts and depreciation of works and plant, and £9,000 has been transferred to contingency account, leaving a balance at the credit of profit and loss of £32,673 2s., which is sufficient to provide a dividend for the year at the rate of 6 per cent. Of this, 3 per cent., free of income-tax, has already been paid as an interim dividend to the end of June, 1879, and hopes are entertained that at no distant date the Board will be able to recommend the declaration of the balance.

The Shareholders were informed by circular on the 19th of March last that the Government of Monte Video and the Junta, or municipal body, had respectively entered into agreements with the Company by which payment for public lighting has been secured.

The agreement with the Junta guarantees, by the hypothecation of certain assessed taxes, the payment of current public lighting accounts, from Jan. 1, 1880. The agreement with the Government deals only with the amount of outstanding debt up to the end of 1879, the total of which the accounts show to be £64,172 12s. 2d. inclusive of the Government acceptance not yet matured. The amount in arrear is being paid off at the rate of about £1000 per month during 1880, and it is agreed that after this year the instalments are to increase annually until the whole sum is liquidated.

In view of the deferred collection of this Government debt the balance of profit of the year 1878 has been passed to a suspense account, where it will remain, as already explained to the Shareholders, until the receipts from the Government warrant its being further dealt with.

His Excellency Visconde de Mauá, having tendered his resignation, ceased to be a Director, and his colleagues avail themselves of this opportunity to record their high appreciation of the valuable assistance he has given them in their efforts to promote the welfare and success of the Company, and the Directors trust that before long His Excellency will resume his seat at the Board.

Mr. Bartlett James and Mr. J. L. C. De Salles, two of the Directors who retire by rotation, being eligible, offer themselves for re-election.

The Auditors, Messrs. Price, Waterhouse, and Co. and Mr. Edward Cheshire, retire, and offer themselves for re-election.

Dr.	Balance-Sheet, Dec. 31, 1879.	Cr.
Capital authorized—		
30,000 shares of £20 each, £600,000	0 0	
2,904 shares of £20 each, unissued	58,080 0 0	
27,096 shares of £20 each, fully paid and issued to date	£541,920 0 0	
Contingency account	31,000 0 0	
Added this year from profit and loss	9,000 0 0	
Sundry creditors, London	176 6 10	
Do., Monte Video	2,098 1 2	
Bills payable	2,436 0 7	
Dividends unclaimed	46 16 0	
Interest in suspense, not received, Dec. 31, 1878	£3,355 13 8	
Less received from Government, 1879	762 11 4	
	£2,593 2 4	
Add, charged to Gov., 1879	2,688 19 11	
	5,282 2 3	
Suspense account, for balance of profit, 1878	32,515 4 0	
Profit and loss, balance as per account below	32,673 2 0	
	£657,147 12 10	

Revenue Account.	
Cost of manufacture and expenses at Monte Video	£45,414 3 9
Directors' fees, salaries, and London expenses	2,878 12 1
Income-tax	1,005 8 4
Exchange (balance)	155 1 7
Interest (balance)	431 5 6
	£49,884 11 3
Balance to profit and loss account	47,774 12 0
	£97,659 3 3

Profit and Loss Account.

Dividend paid May 21, 1879 (final for 1877)	£16,257 12 0	Balance, Dec. 31, 1878	£48,772 16 0
Balance carried to profit in suspense, 1878	32,515 4 0		
	£48,772 16 0		
Bad and doubtful debts	£2,287 12 1	Revenue account for 1879	£47,774 12 0
Less received on old debt	277 12 7		
	£2,009 19 6		
Written off works and general capital accounts	4,080 14 8		
Depreciation of furniture	10 15 10		
Transfer to contingency account	9,000 0 0		
Balance	32,673 2 0		
	£47,774 12 0		£47,774 12 0

The CHAIRMAN said he had to propose—"That the report and accounts now read be received and adopted;" but before doing so would like to make a few remarks with reference to the great difficulties they had to contend with in the conduct of the Company. These difficulties had mainly arisen from political circumstances and the disturbed state of the country with which they had to deal, also the impecuniosity with which the Government of the country had to contend—all contributing indirectly to place the Company in difficulties. It had often brought the Directors into collision and conflict with the Government, but at the same time it was necessary to exercise much indulgence, because it was impossible for them to pay entirely when they had no means at their command. This would account for the considerable debt that the Government owed the Company; but the Board hoped and fancied they saw better times approaching when this debt would be paid. They had made arrangements with the Government and the Municipality that the arrears should be paid up, and that in future the collections for the gas should be handed over day by day to the Company. If these conditions, which had taken a long time to bring about, were faithfully carried into execution, and the Government had the good faith and ability to do it, he (the Chairman) had not the slightest doubt that in time the Shareholders would receive regular dividends. This, as the Shareholders were aware, depended upon circumstances and contingencies over which the Board had no control, but every influence that could be brought to bear by the Directors to accomplish this would be availed of. There was every disposition, despite all the changes of Government, that these conditions should be carried out; therefore they could only look forward with hope to the future. With regard to the prospects of the Company, he might mention that the concession, as was well known, would terminate in the ordinary course of things in a few years.

A SHAREHOLDER asked how many.

The CHAIRMAN said in seven years, but he was able to state that negotiations had been entered into to extend this time with the sanction of the Chamber of Deputies. As to the accounts, he would not inflict upon the meeting a series of figures which he knew the impossibility of their following; but would just state that in the year 1878 the consumption of gas was 96 million cubic feet, and in the year 1879 it was 101 millions. He mentioned this to show that prosperity was returning to the city, and that a great many of the inhabitants who had left it and gone away, from motives of economy, were returning. This accounted for the increased consumption of gas and receipts. By the accounts submitted it would be seen how good were the prospects of the Company, if the Government carried out their engagements of paying up as they were now doing. As to the contingency account, it stood at £31,000 in 1878, and £9000 had been added during the past year. The net revenue for the last twelve months was £47,744, and the amount written off for depreciation of plant was £4080. He expected, if the recent arrangements with the Municipality were carried out, the Board would be able to pay dividends in a short time, exclusive of the debt of the Government, which would come in afterwards to the good. In regard to the resignation of the Viscount de Mauá, he would like to state that the Board were of opinion that five Directors were quite sufficient to carry on the duties of the Company in London. The Directors were, every one of them, acquainted with the country, the language, and the customs of the people, and therefore he need hardly say one word in their praise more than this, that they ought to be very efficient Directors; and, speaking for his colleagues, he might say they certainly were. But it was desirable that there should be, if possible, at a future time, or as early as opportunity offered, some party connected with the Company of great influence abroad. For this reason they had suggested that when a vacancy should be open it would be desirable for the Viscount de Mauá to return to the Board. He possessed great influence and local knowledge—perhaps more than any other living man. He (the Chairman) thought he did not exaggerate at all when he said this, and therefore the desirability of keeping the vacancy for his return to the Board was obvious. When the Shareholders had considered this, he thought they would agree with the Board in the desirability of doing as they proposed. [The Chairman then proceeded to refer to certain statements made in a pamphlet which had been circulated among the Shareholders in anticipation of the meeting. Much of the subsequent discussion was in reference to these statements, and would not be intelligible unless Mr. Hodgson Jones's address to his "Brother Shareholders" were before our readers; and of this our space will not admit.]

Mr. TATHAM disagreed with the remark of the Chairman that it was difficult to follow items of account when read out at public meetings. His experience had convinced him of this, that, although perhaps a large body of the Shareholders did not take the trouble to go into accounts, yet in the City of London there were numbers of people who did do so, and were quite as capable of understanding what was put before them as the gentlemen at the Board were. If the Shareholders would turn to the revenue account, they would find this item: "Cost of manufacture and expenses at Monte Video, £45,414 3s. 9d." This item was so unusual as to be unique in gas accounts. He was a shareholder in many gas companies, and he could look down and see whether, from year to year, this or that item had increased or diminished. They all knew that the question of coal was very important to a gas company, and he would like to know whether that had increased or diminished. He would like to know the proportion the public lighting bore to the private revenue. Anybody who knew anything about South American gas companies—and he was a director of one of them and a shareholder in others—would know that the whole sense of security and basis of prosperity of a South American gas company rested not so much upon the public lighting and the price paid as it did upon the broad basis of a popular and general consumption of gas. It was the basis of success not only of English gas companies, but every foreign gas company. A word as to the election of Baron de Mauá. No one who had been in the Plate, as he had, and had travelled about could fail to note the esteem in which that gentleman was generally held, and everybody acknowledged his general ability; but they must all be aware that there were

questions pending which made the Shareholders wish to know whether the Board, in dealing with this gentleman, were perfectly unfettered. If they felt that the Baron's experience was vitally important to them, acting with him as a colleague, one could hardly imagine them holding the scales with that evenness which would be demanded by the Shareholders on his (Mr. Tatham's) side of the table. Without attempting to cast any aspersion of any kind, he ventured to suggest, as the Viscount de Mauá had retired, whether it was worth while that he should be elected to a seat at the Board. His friends would have proposed him (Mr. Tatham) as a Director, but he had a letter from the Chairman to the effect that his brother Directors did not wish to elect another gentleman at present to a seat at the Board, and he at once retired, because he would be the last man in the world to attempt to sit on the other side of the table against the advice of those who sat there.

Mr. MICHOLES said the previous speaker had taken a great many words out of his mouth. The Shareholders had already heard that he had proposed himself as a Director, not for the sake of the remuneration, to which he was indifferent, but in the interests of the Company; in fact, he would serve them for nothing. The Directors were, he thought, too well paid. He then, at some length, expressed his high disapproval of the re-election of Viscount de Mauá as a Director. As to the dock, he said, from the first, he warned the Directors not to become dock proprietors, but to stick to their original trade. The Chairman, however, overruled him, and said that the dock would be a most valuable adjunct; but at a subsequent meeting he stated that it weighed heavily upon the Company. Again, he could not understand the amount of £9000 carried to the contingency account, and wished it explained. What really seemed to be wanted was an infusion of new blood into the directorate. It was all very well for the Chairman to tell them that all the Directors knew the language of the country; but they did not want any foreign language to tell them what was right and proper in the conduct of business affairs. In his opinion, if another Board were elected the shares would become more valuable. In conclusion, he begged the Board to adjourn the meeting, and constitute a Committee of Inquiry to whom all the correspondence, documents, and books should be open, and let the Committee report to a future meeting.

Mr. URWICK thought it was of no use going into the past. They had to do with the present, and if they all pulled together, and infused fresh blood into the Board, there was no reason why the Company should not succeed and become a thriving concern. He hoped the Baron de Mauá would not be reinstated as a Director. In the accounts the Directors used to give the Shareholders the number of private houses and public lamps supplied, and how the increase went on year by year; but now they had nothing to guide them, and nothing by which they could check the accounts. He was glad to see that the cost of producing the gas had decreased considerably. In the year 1874 the cost was £71,000, and the sale of gas £108,000; but then they used to receive a dividend of 8 per cent. In the next year the cost fell £10,000, and the receipts were £101,000, but they still had 8 per cent. Now they could congratulate themselves that the cost was £45,000, and the receipts £92,000, yet they only saw in this year's balance-sheet a prospect of 6 per cent. Then there was an increase in Directors fees this year of £415. What extra work had been done in the offices? He thought the report was very bare of information, and that the arrangements for the proposed extension of the concession should have been distinctly described. He complimented the Board on attempting to get an extension, for they had not yet had the chance of benefiting by it. The Board said that the Government were now paying day by day; but did the advices by the last mail inform them that such an arrangement would be adhered to? He thought that a dividend ought to be really in sight, if not in their pockets. It was very hard for them to have to wait so long, and especially for those who, like himself, had paid premiums for their shares, and saw them so much depreciated—a result largely due to a want of energy on the part of the Board. He had come to the meeting with the intention of moving that the report should simply be read and not adopted, but he left this to the Shareholders. He thought it was time they should express their opinion that they were satisfied with neither the Government out there, nor with the efforts made by those here who represented the Shareholders.

Mr. LOWE said that the way the accounts were presented rendered it almost impossible to follow with clearness what were the earnings and losses. He wished to ask the Accountants to draw up the accounts in a regular and systematic way, and not vary them as in past years. The Directors, he contended, should reduce their fees to £1000, as formerly. He looked upon the arrangement regarding the concession with a good deal of alarm, and, therefore, considered that the Directors were not to be congratulated on it in the least. He thought that under the present circumstances of the Company the Baron de Mauá's services had been improperly lauded by the Chairman, and he denied that the Baron possessed the immense local influence that had been alleged. He moved the adjournment of the meeting for a month.

Mr. SINCLAIR seconded the resolution.

The CHAIRMAN pointed out that there was a first-rate Committee sitting in Monte Video, and in them the Shareholders might have the fullest confidence. The necessities of the Company were well looked after by these gentlemen in every respect.

Mr. BARTLETT JAMES (a Director) said in regard to the increase of Directors fees, it arose in consequence of a sum paid to him for his expenses during his visit to the Company's property. The fall in revenue was explained by the fact that since 1874 Monte Video had not been quite the prosperous place it was before. The inhabitants had fallen in number from 150,000 to 100,000, and for the last three or four years there had been much distress in Monte Video and its vicinity. Therefore, looking at these circumstances, over which the Board could have had no possible control, he thought the revenue might be regarded as not unsatisfactory. He then entered into explanations upon other points regarding the management, and the pamphlet before referred to.

A SHAREHOLDER: When are the sums due to the Company by the Government likely to be paid?

Mr. BARTLETT JAMES said the Government had engaged to pay £12,000 in 1880, £17,000 in 1881, £22,000 in 1882, £18,000 in 1883; thus making up the total debt of £64,000.

Some of the Shareholders having expressed their satisfaction with the explanations of Mr. Bartlett James and the Chairman, the resolution for the adoption of the report was put, and carried with two dissentients.

The two retiring Directors, Mr. Bartlett James and Mr. J. L. C. De Salles, were then unanimously re-elected, as were also the Auditors, Messrs. Price, Waterhouse, and Co., and Mr. Edward Cheshire; and the meeting closed with a vote of thanks to the Chairman and Directors.

BECCLES GAS COMPANY.—The ordinary general meeting of this Company was held on the 7th inst., when a dividend of 8 per cent., free of income-tax, was declared. The recommendation of the Directors was also adopted to reduce the price of gas to 4s. 9d. per 1000 feet from the beginning of April last.

SOUTHWARK AND VAUXHALL WATER COMPANY.

The Half-Yearly Ordinary General Meeting of this Company was held at the Offices, Sumner Street, Southwark, on Thursday last—Alderman H. E. KNIGHT in the chair.

The SECRETARY (Mr. Alfred Jelley) having read the advertisement convening the meeting, and the minutes of the last ordinary and late extraordinary meetings, which were confirmed, the following report and statement of accounts were taken as read:—

Your Directors have the pleasure to again refer to the continued prosperity of the Company and the improved efficiency and condition of the works and plant. 1308 new houses have been brought into charge during the half year ended the 31st of March last, and during the past half year 7616 yards of new mains have been laid within the Company's district.

The contract for the supply of coal to the Company's works having expired on the 1st of the present month, tenders for the future supply have been obtained by advertisement, and a satisfactory contract entered into for two years supply.

The Solicitors of the Company have been instructed to prepare a clause for insertion in the Metropolitan Water-Works Purchase Bill, in order to carry out the resolution of the Shareholders as to the relative interest of the ordinary stock and class D shares.

Your Directors have not as yet considered it desirable to act upon the resolution of the Shareholders, passed on the 11th of December last, authorizing them to create and issue a further sum of £160,000 from time to time as they may think fit, either as ordinary shares or preference shares.

Your Directors have carefully considered the several Bills introduced into Parliament which would affect the interests of the Company. A lengthened inquiry has been held before the Inspector appointed by the Local Government Board in respect of the Lower Thames Valley Main Sewerage Bill, but the report has not yet been made.

Your Directors are at present unable to supply any further information respecting the Metropolitan Water-Works Purchase Bill. The Company's Bill was reintroduced into the House of Commons on the 25th ult., and read a first and second time. Future action in respect of these measures will receive the most careful consideration of your Directors.

Enclosed herewith you will receive the half-yearly statement of accounts of the Company to March 31, 1880, which has been duly certified by the Public Auditor appointed by the Local Government Board, and by the Auditors of the Company. Referring to the statement of liabilities and assets, the sum of £21,658 8s. included in the £39,658 8s. has been deposited in the Court of Chancery, in pursuance of the Standing Orders of Parliament in connection with the Company's Bill. This sum has been invested in Consols, and interest thereon is accruing. The law and parliamentary charges in the half year have been increased by the discharge of exceptional liabilities, for which, together with other purposes, a balance had been carried forward.

Your Directors recommend that a half year's dividend at the rate of £7 10s. per cent. per annum on the ordinary stock and class D shares of the Company, and £5 per cent. per annum on the preference stock of the Company, be declared, payable on and after the 15th day of July next.

DE.—REVENUE ACCOUNT, FOR THE HALF YEAR ENDED MARCH 31, 1880.

Maintenance.	
To Maintenance and repair of impounding and service reservoirs, filtering beds, works, and pipes, or for obtaining and storing of water, including the cost of materials and labour	£264 13 0
Maintenance and repair of mains, pipes, fittings, meters, and works connected with the distribution of water, including the cost of materials, labour, and renewals	£8017 8 6
Repairs of engines, &c., at the several works, included in Messrs. Harvey's accounts	4060 0 0
Pumping and engine charges, including the cost of coals, wages, &c.	10,773 4 5
Filtration, including cost of materials and labour	908 3 7
Salaries of Engineer, Superintendent, and Clerks, and wages of Inspectors and Turncocks	3,308 1 7
Rents	17 2 8
Thames Conservancy	1,152 12 6
Rates and taxes	3,991 2 3
	£32,434 8 6
Management.	
Allowance to Directors	£1,020 16 8
Allowance to Company's Auditors	21 8 9
Salaries of Secretary, Accountant, and Office Clerks	1,382 12 1
Superannuation	216 13 4
Commission to Collectors	1,839 13 4
Stationery, printing, and general establishment charges	632 11 10
Law and parliamentary expenses	2,763 4 1
Official Auditor and Water Examiner	91 18 8
	8,068 13 9
Dividend and interest account for transfer of profits	45,165 11 6
Balance carried to next account, to provide for losses	4,000 0 0
	£89,668 18 9

CR.—REVENUE ACCOUNT.

By Balance brought from last account	£4,000 0 0
Surcharges on water-rental to Sept. 30, 1879	2,183 2 3
	£6,183 2 3
Less allowances for empty houses	£2,348 2 1
Do. for overcharges	1,762 14 1
Do. for bad debts	1,521 7 7
	5,635 3 9
Water-rents accrued to the date of this account	88,955 6 7
Rents received	63 16 2
Registration and transfer fees	161 17 6
	£89,668 18 9

The CHAIRMAN, in moving the adoption of the report, expressed his great pleasure at again meeting the Shareholders, and congratulated them not only at meeting them in a state of advancing prosperity, but also in being able to inform them that this prosperity had been attained concurrently with greater efficiency in supplying their district, both as to quantity and quality, and with greater economy in the water used. The Company were never doing their work so well, and were never so prosperous as now. He should follow his previous custom to go through the accounts, referring to those items which appeared to him to require explanation, to make the Shareholders as far as possible as well acquainted with the affairs of the Company as the Board were. There was nothing whatever in the share and loan capital account to call for any remark. As to the capital account for the half year ending the 31st of March, the Shareholders would find on the debtor side that the amount of expenditure under the second item was only £392, as against £1360 in the previous half year. This great decrease was owing to the fact that in the previous half year the Directors had an immense amount of work to do with their engines, and they had been spared this expenditure in the past half year. The item of main and service pipes connected with the distribution of water was £2196 this half year, as against £905 in the previous half year. This was an amount which always increased, and must increase, in connection with the extension of the Company's district. As was stated in the report, they had laid 7616 yards of new mains in the half year, and the increase in the item he had referred to was caused by the laying of new mains in their parliamentary district. The only

other item he need refer to in the capital account was the last—the excess of income received over payments, which was now reduced to £13,000 from £16,000 in the previous half year. Passing to the revenue account, he observed that there were many items which he would have to deal with rather fully and carefully, in order to explain to the Shareholders the reasons for the variations. If they looked at the column on the left-hand side, they would see an item of £12,017, which was the total under the head of maintenance, and it was made up of £4000 in the repairs of engines, &c., at the several works—included in Messrs. Harvey's account. It was the £4000 which they paid every half year off that account, and of which only two instalments now remained to be paid; and as to the balance of £8017, he must explain why it was so much increased, for it compared with £5200 last half year, and £5400 in the corresponding period of the previous year. The increase in the maintenance was caused by the determination of the Board to have their plant in a thoroughly efficient state. They had been fortunate enough to earn more money and increase their dividend, but they had not done this at the expense of the stability of their plant. This past half year it was reported by their Engineer that certain mains throughout the district required overhauling and relaying. Perhaps they had half a mile of 12-inch, and then a quarter of a mile of 6-inch main, and then another portion of 12-inch main. The 6-inch main being in the middle of the two portions of 12-inch main, obstructed the flow of water. Many of such cases had been remedied in the past half year, and the consequence was that the Company had been distributing water much more efficiently than before. In Rotherhithe the Deptford main had been replaced by a new main which had cost £1500. This main, however, was a very valuable addition to their plant, because, instead of having continuous complaints from that district, they were now supplying the residents in a thoroughly satisfactory manner. They had spent, as he had said, £1500 on this main, and had charged it to revenue, and this had come out of the £2800, which they had spent in excess of last half year. They had also been called upon by the Board of Works to lower a main which had been previously laid across the Effra River—or Effra Sewer, as they called it now. When this main was laid, instead of taking it under the river it was carried straight across, and therefore the Board of Works, finding it was in the way, had called upon them to lower it. That cost the Company £700. There was also another main across the Effra River which they were required to lower, but this would not be such a costly work. They had also had to pay a contractor an accumulation of accounts, which, instead of being delivered every year, had been allowed to run on since 1874. It had all been paid off during the past half year. These facts would, he thought, show why the increase had been from £5000 to £8000. He was not surprised at the charges for maintenance gradually increasing, because it was their determination, whenever they found anything faulty in their works, to put it in order, even at the expense of charging the cost to revenue. That, he thought, would explain the reasons for the difference in the total of £12,000 this half year, as against £9000 last half year. In the filtration charges the item stood at £908 against £1322, so the Company had saved something—he supposed it was in the labour and other items. He could not tell exactly why it was, but he thought there was no doubt it arose from the extra supervision of the Engineer and his officers. The work had been more cheaply and efficiently done than before. The increase on the one hand and the decrease on the other brought out this result—that they had £32,400 this time against £30,500 last half year, an increase in round figures of £2000 under the head of maintenance. The next item was the management, and under this head the amount expended was £8068, against £4566 last half year, and £5640 in the corresponding half year of 1879. There was therefore an increase of £3500 in the item, as compared with last half year; but he was very pleased to be able to tell the Shareholders that he could give them an explanation of this which was thoroughly satisfactory to himself, and he believed would be to them also. The first item was that of stationery, printing, and general establishment charges, which was £632 this half year, against £388 last half. That included insurances which were always paid in the last half of the year. Then in the past half year the Company had had two or three special meetings, with all the expenses of stationery, &c. It was true that this was a small amount out of the £3500 for which he had to account. When they came to the item of law and parliamentary, he always thought the Shareholders might see if there had not been a leakage in that direction. This half year the item stood at £2703, against £51 in the previous year. This went a long way to account for the deficiency. They carried forward a larger balance of profit in the previous half year. The Directors had not chosen to divide all the money they had made, but had kept something in hand, knowing that there had been expenses incurred which they must pay. They, therefore, carried forward something like £18,000 last time—money which they had earned, and the Shareholders were really entitled to put into their pockets. The law expenses were first made up of an amount of £1100, which had been paid in settlement of an action incurred by the Company in a case against them. It was a trial which resulted in a verdict against the Company, as the Shareholders would remember, and rather than go further to law and uncontrolled expenses, the Directors decided to submit the case to arbitration. The case was arbitrated upon by gentlemen agreed to by both sides, and resulted in the Company paying £1100. The arrangement was thoroughly satisfactory to the Board, and he thought it would also be to the Shareholders. Then, in 1878, the Metropolitan Board of Works introduced a Bill into Parliament attacking all the Metropolitan Water Companies. They all opposed that Bill, to defend the interests of the proprietors; but in opposing it considerable expenditure was incurred—something like £15,000, he believed. At that time the Company were paying a very small dividend, and they did not feel justified in paying the £1200, which was their share, out of the small amount of their earnings, so they arranged with the other Companies that this was an item which might stand over till they could pay it. They felt that when they were paying 6 per cent. and carrying forward such a balance as the present one, the time had arrived when they ought to discharge this liability. They, therefore, paid their share of those expenses, which amounted to £1228. This would show the enormous expenses thrown upon the Water Companies in resisting the attack made upon them. That explanation would account for the whole of the item he was referring to; but he might tell the Shareholders that what might be called the legitimate legal expenditure incurred by the Company amounted to less than £200, and he thought this was very satisfactory, because it included Messrs. Bircham's charges for watching Bills in Parliament which might have affected their interests, and also all the items which occurred under legal expenses in defending their interests from petty summonses and petty attacks from various people throughout the district, as well as other liabilities. This pretty well disposed of the excess in the cost of management, with the exception of £500, which was accounted for by the extra allowances given to the Board. He hoped he had made all this clear, and that the Shareholders thoroughly understood how the item had increased. Going to the other side of the account, they would find under the head of allowances for empty houses, overcharges, and bad debts, that the item was £5635, against £4261 last half year and £5500 in the previous half. It was a large increase, and one which the Board did not like to see; but

in this instance it had arisen from circumstances altogether beyond their control, because it was caused by a number of houses in one portion of their district having been pulled down for a public improvement. This caused the Company to lose the water-rates from those houses. There was also an exceptional number of new houses taken into charge; but they were not occupied for some time, and the Company were necessarily obliged to receive one or two months rates instead of six. That had operated very heavily in the past half year. The water-rents accrued to the date of the account amounted to £88,900, which might be called £89,000, compared with £87,000 last half year and £85,000 in the corresponding period of 1879. This showed a very satisfactory increase, and he was happy to say it was mainly due to an increase of new houses and new mains laid on throughout the district. To return to the other side of the accounts, the Shareholders would find that the item of dividend and interest account for transfer of profits was £45,165, against £50,597 last half year, and £49,000 in the previous half; and they might naturally say, "How is it you have only £45,000 to take to profits this half year, as against £50,000 last half, when you have earned more money this half year?" Well, the items he had mentioned explained the difference, and satisfactorily accounted for there being a less amount carried to profits, though more had been earned. He thought he had touched on all the items in the revenue account to which he desired to draw attention. In the next account there was the item of interest on temporary loans, which was £224 against £300 in the last half year, and £500 in the corresponding period of 1879. This was a satisfactory decrease, and it showed really that the Company had not been obliged to trespass so much on the kindness of their bankers as in previous half years. The balance brought from last account was £45,000, against £37,000 in the previous half year, and £28,000 in the corresponding half of 1879. From the £45,000 they had to deduct the £26,000 paid last half year for dividend, against £21,000 in the previous half year, and £17,000 in the corresponding period of last year. There was a balance, after deducting this £26,000, of £18,000, which would be added to the earnings of the half year under consideration, and out of which they would pay the dividends they now proposed. There was a balance applicable to dividend of £42,271, against £45,000 last half year, and £37,000 in the corresponding half of the previous year; so that, although there was less than last half year, the amount was £5000 in excess of that applicable at the corresponding period of last year, and the increase in the maintenance and the law bill accounted for the diminution in the amount as compared with last half year. Passing to the next account, he said the temporary loans stood at £39,658; and the Shareholders might say, "With this large amount, how do you make it accord with what you have told us under the item of interest on temporary loans?" It was explained in this way: In promoting their Bill in Parliament they had to deposit £21,000 under the Standing Orders. That £21,000 they borrowed from their bankers, and it was included in the £39,000. The £21,000 was invested in Consols, and the Company would receive dividends on it, which would leave them a profit on the interest they paid. This left really £16,000 of these loans, and since the accounts were printed this had nearly all been cleared off. There remained only £2000 or £3000 to pay. On the asset side of the account an item which he thought required explanation was that of "suspense." The parliamentary deposit stood, as he had said, at £21,000; then beneath that was expenditure on account of the Company's Bill in Parliament, £1333, and expenditure on works £2577. To the time the accounts were made up the expense of promoting their Bill amounted to what was shown. This included a great deal of surveyor's business and preliminary business in the preparation of the Bill. The item of £2577 was the expenditure incurred in making preparation to enable the Engineer and the Board to arrive at a sound judgment as to the works it was necessary to construct for the supply of their district. He hoped the items he had touched on were those which in the Shareholders opinion required to be dealt with, and he would be glad to give any further explanation that might be wished. Turning to the report, he observed that he had already referred to the fact that 7616 yards of new mains had been laid, and these had all been laid within the Company's parliamentary district. Those mains produced at the present time a certain amount of earnings, and as houses were built they would bring a constantly increasing revenue. The Company's contract for coal expired two or three weeks since, and the Directors thought it a favourable opportunity to issue advertisements for tenders. This was done, and tenders were received from eight or ten highly respectable firms.

A SHAREHOLDER: What is the price?

The CHAIRMAN said he could not give it for the moment.

The CHIEF ENGINEER (Mr. T. W. Rumble) said the price of the coal the Company most used was slightly lower than in the previous contract.

The SHAREHOLDER asked what the previous contract price was.

The CHAIRMAN said the information should be given when the figures were obtained. Continuing his remarks on the report, he said that the next paragraph referred to the Metropolitan Water-Works Purchase Bill, which Sir William Harcourt had said was dead and gone. An inquiry was about to be made, and whether the Bill was dead and gone or not, the Directors were anxious to carry out the Shareholders decision respecting the division of the amount to be received under its provisions, and they had ordered this decision to be carried out, and instructed their Solicitor to prepare, for insertion in the Company's Bill, clauses which it was absolutely necessary should form part of it. Sir Francis Head moved an amendment in favour of the D Shareholders, and several of the Shareholders afterwards came and said they did not approve of it. The clauses were therefore necessary, and he told them that before the Committee of the House of Commons was the proper place for them to state their differences. The Shareholders would remember that they authorized the Board to issue £160,000 of unallotted capital at their last meeting. Up to the present time they had not found it necessary to issue any portion of it, and they were very anxious to keep good faith with Mr. E. J. Smith, the Valuator who acted on the part of the Government in the question of the Purchase Bill, although by issuing this stock they could have put a large profit in their pockets. £160,000 at 100 prem. meant £160,000 in their pockets, which they were perfectly entitled to, providing the capital was required for the purposes of their undertaking. The capital, however, in the opinion of the Board, was not required, and therefore they had not used the powers given to them for its issue; but should it become necessary, they would unhesitatingly issue it, and allot it proportionately among the Shareholders. Several Bills had been introduced into Parliament, but there were no particular Bills introduced last session which affected the Company very much. There were two or three which might have interfered with their mains had they been carried out; but everything was done that was necessary for protecting the Company's interests. They thought the Lower Thames Valley main drainage scheme such a barbarous measure that they could not pass it by without notice. They opposed it, and had notes taken of all the evidence, and he was happy to inform the Shareholders that the recommendations respecting the proposal would be of such a nature that some other means would have to be found for disposing of the sewage of the district. He next came to the Metropolitan Water-Works Purchase Bill and the Company's own Bill, and the Shareholders

SUPPLEMENT TO THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XXXV.

LONDON, JUNE 15, 1880.

No. 892.

BRITISH ASSOCIATION OF GAS MANAGERS.

SEVENTEENTH ANNUAL MEETING.

THE aspect of the Hall of the Institution of Civil Engineers at the commencement of the proceedings of the Annual Meeting of the Members of the British Association of Gas Managers on Tuesday morning last, was such as to presage no ordinary success for the gathering which was then about to be inaugurated. In the first place, the hall itself—for the use of which the Association is indebted to the kindness of the Council of the Institution, who with their Secretary, Mr. Forrest, showed the Committee of the Association the utmost courtesy in the course of this, their first direct relationship—was a decided improvement, for the purposes of the meeting, upon the theatre of the Society of Arts, where the London meetings of the Association have been held in previous years. The hall is cheerful and well lighted, and furnished with every facility for the reading of papers and the delivery of lectures, and the members had much reason to be pleased with the accommodation provided for them. The attendance was from the commencement very good, even for a London meeting, which gratifying circumstance was, let us hope, due in no small measure to the great richness and variety of the scientific aliment promised in the list of papers to be read. A universal feeling of favourable expectation seemed also to prevail respecting the Inaugural Address of the President, Mr. Charles Hunt, who is generally credited with the power of dealing with the subject matters of his profession in a manner at once vigorous and original.

The interest deepened in a marked degree when, with commendable punctuality, the President began the delivery of his most interesting address, which appeared in the supplement to last week's issue of the JOURNAL. At this time the hall was fairly filled, and thanks to the clear enunciation with which the address was read, it could be followed with perfect ease by every person present. Commencing with a brief reference to the circumstances under which he found himself unexpectedly called upon to assume the presidential chair, Mr. Hunt did not dwell long upon the personal details which have first to be mentioned in addresses of this kind; but he still found words to express the cordial sympathy with which the return of Mr. Bennett, the esteemed Secretary of the Association, to his active duties in connection with the meeting, after his late severe illness, must be generally greeted; and to allude feelingly to the deaths of Mr. Fewtrell, late of this JOURNAL, and of several other friends and members of the Association who have passed away during the year just gone by. The continued vitality of the Association, shown in its most satisfactory increase in numbers during the last decennial period, was then pointed out, and its present objects and utility briefly explained, the President passing on immediately to give his views of the direction in which the operations of the Association might, in his opinion, be best extended.

That continued growth, in organizations of this kind, is absolutely essential, no one will be disposed to deny. Without it, stagnation and ultimate decay are inevitable. The accretion of new members in increasing numbers forms one kind of growth; but some constitutional progress besides and apart from this is not only desirable but necessary, to keep up the interest of members imbued with the mutability of human nature. During the past decade, the establishment of district associations of suitably modified constitution, but with identical objects, has, to some extent, if not altogether, to be considered as a growth of the parent Association. But the

growth of the ensuing ten years, as it cannot, in the nature of things, be of a similar character, demands careful, not to say anxious consideration, on the part not only of those who are officially responsible for the well-being of the Association, but of all the members, individually and collectively. Mr. Hunt's suggestion that the collected Proceedings of the Association should embody a complete record of the progress of the science of gas lighting all over the world is good, but, from the character of the subject, is likely to be very costly in execution. His second suggestion—that the Association, as a body, should assume a directive attitude respecting original research, by assisting experimentalists, or by appointing Special Committees to follow out certain lines of investigation which might be indicated by the profession generally as likely to add to the common stock of information—appears far easier of adoption, and this without prejudice to the undoubted value of the former idea. No great expense or fundamental change in the constitution of the Association would be necessitated by the adoption of this latter proposal, if it may be so termed in its present form, and it is a feature of striking importance in the method of working of the German Gas and Water Works Managers Association, and, as such, has been frequently mentioned in these columns. And in furtherance of this suggestion, nothing could be more apparent in the tenour of several of the papers subsequently read at the meeting, and still more conspicuously in many of the discussions, than a general consensus of opinion that more independent and reliable testimony is needed respecting certain seeming mysteries and novel processes in gas engineering, than is obtainable under the present system. It was certainly surprising to see how many comments and even criticisms, expressed in the course of the two days devoted to reading and discussing papers, became explicable by the application of this feeling as a key to the speakers aspirations; and it is therefore to be expected that any definite proposition of the kind would be met with much cordial appreciation. It may well be hoped that active measures of this kind, leading to definite advancement of knowledge, would be even more satisfying to a living association than any work of a mere chronicling or cataloguing character.

The mention made by the President of one of the effects of the amalgamation of the London Gas Companies—namely, that of the ensuing extinction of manufacturing stations in cramped and populous localities—is interesting in relation to the question of the nuisance arising from these works. Such nuisance as may be found inevitable from the operations of gas-making as at present conducted, is at once rendered unimportant when the works are established in remote places, which is the practical outcome of the amalgamation movement. Gas should certainly be rendered as pure as possible before being supplied to the consumer, and it is evidently desirable that the processes by which this end is achieved, being usually somewhat obnoxious, should not be carried on under his nose.

The electric light, of course, occupied some share of the President's notice, and it was pleasing to observe the manly treatment which it received at his hands. Without indulging in any cheap but dangerous prophecy, which in his peculiar case, and before such an audience, might have easily become claptrap, he brought forward some interesting facts on the subject which distinctly bore in favour of gas, at the same

time that he expressed his hearty goodwill for the development of the electric light in realms which it might make conspicuously its own.

Perhaps the most useful portion of this most able address, in regard to the progress of gas lighting at large, is to be found in the striking remarks in which the simple, old-fashioned question of the extended use of gas as a domestic luminaut in competition with oil-lamps was at once invested with the commanding interest which is its due, but which, in these days of effort for new applications of gas for other and formerly unheard-of purposes, runs considerable risk of fatal neglect. While the consumption of gas for what may be called legitimate purposes ranges in towns similarly circumstanced from 2000 to 4600 cubic feet per head of population per annum, it would be obvious folly on the part of the gas producers of the former localities to seek for novel and revolutionary expedients for extending their business, while remaining so far distanced by other traders in the line in which their primary efforts must be always exerted. Legislative protection should never, as a set-off against the benefits which it confers, cause such a numbness and partial paralysis as is revealed by the existence in any cases of such positive failing in duty, as well as in business aptitude, to which alone the above disastrous comparison is due. That any Gas Companies should be restricted in development by a morbid fear of incurring bad debts, is a principle comparable only to that acted on by a man who objects to bathe until he can swim, for fear of being drowned if he goes out of his depth.

The subject of heating retorts by gaseous fuel was not overlooked by Mr. Hunt, who has upon former occasions expressed his approval of the new system as a distinct and notable advance in the process of carbonizing coal. This class of furnaces, being all simplifications, and to some extent imperfect embodiments of the Siemens regenerative gas-furnace, and which received attention in the course of the subsequent proceedings, when the members had the privilege of being addressed by the distinguished originator of the system, is becoming in more than one sense a "burning question" with English Gas Engineers. It is sometimes said that Englishmen are slow to adopt inventions which they did not themselves originate, although they are not so tardy when they can improve on the original ideas so much as to make them practically their own private property. In this case we are certainly behindhand in comparison with our neighbours across the Channel and beyond the Rhine; and as we have begun to confess this truth, let us see that the second observation will also hold good. In one small matter only will we offer a correction of the President's remarks. The radiation from these furnaces is not so considerable as he appears to suppose, the walls being constructed with a non-conducting layer, which greatly reduces this otherwise serious defect in a separate structure.

With respect to mechanical stoking, the Presidential utterances were brief yet cogent. The manner in which the practical success of any appliance of this kind was shown to depend upon the preliminary treatment of the coal, reminded one of the fact that the substitution of an eye near the point of a needle, instead of at the end, rendered the construction of sewing-machines practicable. On such seeming subsidiary discoveries does mechanical progress depend.

Condensation is becoming a problem of the day in relation to the preservation of the illuminating power of gas from unintentional deterioration, and it was not surprising to find Mr. Hunt devoting some pains to express his ideas on the subject. As the matter was fully discussed later, it may suffice here to observe that it may happen that the researches now being carried out by Mr. Greville Williams, under the auspices of Mr. R. Morton, go far to corroborate Mr. Hunt's general opinions on this matter. If it should be experimentally proved that the contact of gas with tar at high temperatures is worth securing in practice, it does not appear difficult to so far modify the present hydraulic main as to make it perform to some extent the work of partial distillation of its contents, by the aid of heat derived from the retort stack.

Mr. Hunt's remarks on the unfortunate way in which gas producers have in past times allowed themselves to be divorced from gas consumers, should be taken to heart by all those to whom his previous observations respecting restrictive regulations and obstructions to the free use of gas must have appeared almost personally directed. While acknowledging the value of the suggestion that general powers should be conferred on Gas Companies, and other gas manufacturers at present working in legislative leading-strings, to let on hire to their customers any appliances for the better

utilization of their product, it is impossible not to feel that very much in the way of assisting or instructing the consumer may be done without parliamentary authority. Mr. Hunt acknowledged this, and the acknowledgment may with most people be extended to include the general proposition that in this, as in other things, where there is a will to act, the means are generally found at hand. No amount of pressure can compel people—gas manufacturers or others—to act in the true spirit of legislation with which, in their hearts, they do not agree. Let us take it for granted that all gas manufacturers have a real desire to extend their business, although the proceedings of some among them would at first sight appear to contradict this assumption, and then we shall have to believe that in many cases the manufacturers themselves require educating in this matter before they can educate their customers.

The President dealt in general terms only with reference to the use of gas as a direct motor in the gas-engine, dwelling chiefly on the surprisingly close approximation to the theoretical power of heat as a mode of motion which these motors have practically yielded, even to the present time, although their successful development is one of the very latest mechanical achievements of the day. The President struck another key-note when he expressed the hope that gas manufacturers themselves would employ these engines more generally in their own works, and thereby, in the most practical manner possible, help in popularizing their use by the public. It has formed a well-grounded grievance to the inventors and manufacturers of gas-engines, that gas producers, although possessing such an interest in the successful introduction of these machines, have allowed the makers of them to bear the entire onus of proving to a sceptical public, not only the advantages of the machines themselves, but also the safety and economy of the use of gas in this form. This latter is now a universally accepted fact, but not by virtue of any great efforts on the part of those who will reap the profit of supplying the raw material for transformation into power.

The vexed question of ventilation in houses always puts on a more complicated aspect when illumination by gas is taken in connection with it. Yet, viewed in a proper light, to use a pun of the very mildest character, gas may be made, instead of aggravating the difficulty, to show a ready way out of it. The heat of gas burned primarily for light is properly a very valuable accompaniment of it, as giving the means of controlling currents of air, which may be utilized in removing, in a perfectly unobjectionable manner, all the products of combustion from confined spaces, and also to ventilate the apartment at the same time more efficiently than any other agent known. Speaking of common expedients for using gas to heat rooms, by appliances variously known as gas-fires, "cheerful" gas-stoves, and other devices of a similar kind, the President was righteously in favour of gas-stoves which boldly aim at making the best use of the material on its own merits, and not dressing it up to look like something which it is not, and which, moreover, it never can be made to imitate successfully, save in points in which the thing imitated is itself most objectionable. We do not disguise a gas-lamp to make it look like a rushlight, and there is no sufficient reason for making a bad imitation of a coal fire, with the attendant waste of as much valuable gaseous fuel as, when properly applied, would do all that is needed.

Finally, Mr. Hunt briefly touched upon the improvements in gas-burners which have recently attracted so much attention within and without the ranks of his professional brethren. The value of the heat evolved in the combustion of gas, as an index of the possible intensity of the light produced, is a question which bids fair to assume a position of paramount importance in the immediate future. Brilliant light is a manifestation of intense heat, and without the latter the former is unobtainable. So far there is no dispute; but we cannot so certainly reverse the proposition, and say that intense heat is necessarily accompanied by brilliant light. The one phenomenon may exist without the presence of certain factors which go to make the other. How far these factors may be manipulated in practice has yet to be determined. We have lately seen an addition of 30 per cent. of light produced by modifications in the treatment of the same quantities of gas and air, and this large advance on what was once considered practical perfection, should make us hesitate to assign limits to progress in the same direction. But the fact that progress is accepted as possible, is a matter for mutual congratulation between the producers and consumers of the material, to the improvement of which such wide bounds can alone be set. The utility of gas will never be circumscribed, and the science of its production will never be finite, while its capabilities in even one of its manifold applications are still

undetermined. Infinity of usefulness and in power of development is a large qualification—too large for application to any of the substances, manufactured or otherwise, known to man. We would be far from seeking to claim it for gas, but we do hold that the limit of its useful development is at present scarcely even to be surmised. And it is only due to Mr. Hunt to say that, in concluding his admirably lucid and comprehensive address with considerations such as these, he was not indulging in a vain and inconsequent peroration, but was simply formulating truths which patient listeners to his previous remarks must have felt when considering how the future—always the future—for the work that is to be done in it, was the Golden Age to which the President's hopeful outlook was directed. There was none of the lingering fondness for a past of leading-strings, which would have been so appropriate in an apologist for a declining art; no feeble deprecation of wholesome competition was there; but instead of fear there was confidence, instead of regrets there were hopes; the past and present were almost despised in anticipation of the fruition of the time to come; and all this was based, not on wild imaginings or vainglorious assertions, but upon solid facts which are patent to all.

After the delivery of the address, which was received with warm appreciation, came the reading of papers in the order as printed to appear in the JOURNAL, and subsequently in the Transactions of the Association. We shall reserve our comments on these various contributions to contemporary science until their appearance in our columns.

The lecture on Tuesday evening, by Mr. Greville Williams, F.R.S., on "The Past, Present, and Future of Coal Tar," was well attended, and the lecturer's most interesting description of the various compounds made with the constituents of that extraordinary substance was very well received. Some of the lecturer's reminiscences in connection with the early discoveries of substances previously undreamt of, in the unpromising-looking material of which he confessed himself so fond, were very entertaining; and the recital of some of the complex processes by which the more occult preparations are separated and purified, was calculated to impress his hearers with the feeling almost of reverence for the patience, amounting truly to genius, and the skill by which those processes were so laboriously worked out; and it would be impossible to disagree with the sanguine expectations which he expressed regarding the further discoveries that the same means may yet make in connection with a product which, within recent times, was quite worthless. Gas managers may possibly demur to the suggestion that coal will ever be distilled mainly for the tar which it yields; still, to a large and increasing class of manufacturers, the tar is even now held in such importance that they would scorn to term it a "residual product."

The last event to be chronicled in connection with this year's meeting, but by no means the least in interest and importance, was the visit made by the members to the Beckton station of The Gaslight and Coke Company. Leaving London Bridge on Thursday morning by the saloon steamer *Alexandra*, the members and their friends, to the number of over 400, were enabled to spend several hours of a pleasant day in the inspection of these works, which are yearly becoming more complete. The greatest attention was shown to the visitors by Mr. F. J. Evans (one of the Directors of the Company), Mr. Trewby, Mr. Wyatt, and the numerous gentlemen officially connected with the works, who conducted the party over the vast establishment. Great extensions have been made in the buildings and apparatus since the occasion of the last visit of the members of the Association, and the process of expansion is going on so rapidly that, as Mr. Wyatt remarked, in a very few years Beckton will be twice as large as it is at present. But even now it is difficult to properly realize its full dimensions, and, in fact, this can best be done by noting the scale on which the residual products have to be dealt with. The extensive chemical works which form the latest phase of the development of the establishment are admirably qualified to bring into one comprehensive view the magnitude of the operations to which they are an appanage. Here were seen in bulk some of the principal substances on which Mr. Greville Williams had previously dilated, and had it not been for that gentleman's remarks, it might have appeared to some of the visitors the easiest thing in the world to manufacture anthracene, carbolic acid, benzene, and the other articles produced in these works under Mr. Fenning's superintendence. With this interesting part of the programme the pleasurable business of the day was brought to close. The visitors having been photographed, and

partaken of the hospitality of The Gaslight and Coke Company, returned in the steamer to North Woolwich, where luncheon was served in the gardens, and finally reached London Bridge, where, with their dispersal, terminated one of the most successful meetings which the members of the Association have ever enjoyed.

REPORT OF PROCEEDINGS.

TUESDAY, JUNE 8.

The Seventeenth Annual General Meeting of the Members of the Association commenced this day, at the Institution of Civil Engineers, Great George Street, Westminster—CHARLES HUNT, Esq., C.E., of Birmingham, in the chair.

The minutes of the previous meeting, and the statement of accounts, which had been printed and circulated among the members, were taken as read.

The SECRETARY (Mr. W. H. Bennett) read the names of the gentlemen proposed for membership, and the motion—"That the gentlemen whose names have just been read be elected members of the Association," was agreed to *nem. con.* The following is the list:—

ORDINARY MEMBERS.

Algeo, R.	Menai Bridge.
Anderson, T., jun.	Bath.
Askew, B.	Northwich.
Bennett, C. V.	Ramsgate.
Blackburn, C. H.	Rawul Pindee, India.
Brookman, A. H.	Tenby.
Coulson, W.	Hornsea, near Hull.
Deane, W. A.	Richmond, Surrey.
Dougall, A., jun.	Radcliffe.
Gough, A. L.	Guayaquil, Ecuador.
Greaves, T.	Melton Mowbray.
Green, G.	Hoddesdon.
Hardie, W., jun.	North Shields.
Harrison, C.	Accrington.
Heydon, J.	Mansfield.
Humphrys, F. C.	Ilkeston.
Humphrys, N. H.	Westbury.
Iremonger, C.	Ventnor.
Jones, H. E.	Commercial Gas-Works, Stepney.
Kemp, R.	Bagshot.
Lloyd, E. J.	Dudley.
Miles, J.	Melton Mowbray.
O'Farrell, J. G.	Newbury.
Parker, T. D. C.	Hong Kong, China.
Phillips, W. H.	Padstow.
Pike, H. S.	Hinckley.
Porrie, C. E.	Slough.
Simmons, C. W.	Carshalton.
Tetlow, J.	Raistrick.
Thompson, R.	Melbourne, Australia.
Vinson, W. E.	Gloucester.
Wells, W.	Farnham.
White, D.	Bangor.
Wright, E. A.	Brecon.

EXTRA-ORDINARY MEMBERS.

Glover, J. W.	Royal Avenue, Chelsea.
Macpherson, D. D.	Manchester.
Owens, S.	Whitefriars Street, London.

INAUGURAL ADDRESS OF THE PRESIDENT.

The PRESIDENT then delivered his Inaugural Address, which appeared in the supplement to last week's JOURNAL. In the course of it he announced, in reference to the progress made, by the Association during the year just ended, that the elections at this meeting—after making the necessary deductions for removals, and for the loss by death of five members—brought up the total number of members to 702.

AWARD OF THE MEDAL OF THE ASSOCIATION AND PREMIUMS FOR LAST YEAR'S PAPERS.

The PRESIDENT announced the award by the Committee of the medal of the Association to Mr. W. Sugg, for the paper he read at last year's meeting, on "Lighting by Gas and Electricity;" also the first premium of £10 to Mr. W. Carr, for his paper on "Gas-Engines;" the second of £7 to Mr. J. W. Sandeman, for his paper entitled "Economy in the Manufacture of Concrete, with Remarks on its Application to the Construction of Gasholder Tanks;" and the third to Mr. W. Cowan, for his description of "The Automatic Pressure Changer."

APPOINTMENT OF SCRUTINEERS.

Messrs. C. L. Hartley (Middleton) and P. Simpson (Rugby) were appointed Scrutineers of the votes for the election of Office Bearers of the Association for the coming year.

READING OF PAPERS.

The reading of papers and communications was then commenced. These we shall, as in former years, now enumerate in the order in which they were taken, leaving the printing of them and the discussion upon them, for subsequent numbers of the JOURNAL. The order in which the papers were read was as follows:—

Tuesday Morning.

1. "Some Experiments on the Thermal Power of Gas Cooking and Heating Apparatus." By Mr. T. Travers, of Cork.
2. "Testing Gas Coals." By Mr. Harrison Veevers, of Dukinfield.

Tuesday Afternoon.

3. "Retort Furnaces." By Mr. Frank Livesey, of the South Metropolitan Gas-Works.
4. "Regenerative Furnaces, as applied to the Heating of Retorts." By Mr. G. E. Stevenson, of Peterborough.
5. "The Construction of Gasholders." By Mr. G. Barker, of Birmingham.

Wednesday Morning.

6. "Statistics of Working Results." By Mr. G. E. Stevenson, of Peterborough.
7. "Gasholder Tanks: Difficulties and Mistakes in their Construction." By Mr. George Livesey, of the South Metropolitan Gas-Works.
8. "An Apparatus for Preventing the Oscillation caused by the Exhauster, and for the Removal of Tar." By Mr. John Somerville, of the South Metropolitan Gas-Works.

Wednesday Afternoon.

9. "Standard for the Estimation of Illuminating Power." By Mr. F. W. Hartley, of London.
10. "The Chemistry of Spent Lime." By Mr. W. Foster, M.A., F.C.S., &c., Professor of Chemistry at the Middlesex Hospital.

[A paper on "Concrete Tanks," by Mr. W. Romans, of Sheffield, was, for want of time, taken as read; while the other paper announced—one by Mr. G. Bray, of Leeds, on "Some Fallacies Regarding Gas-Burners, with Remarks on Street Lighting"—was withdrawn because the state of his health would not allow him to proceed with the experiments necessary to check his results before presenting them at the meeting.]

LECTURE—EVENING MEETING.

In the evening a lecture on "The Past, Present, and Future of Coal Tar" was delivered, before a very appreciative audience, by GREVILLE WILLIAMS, Esq., F.R.S., &c. The lecture, a report of which will be found on p. 945, was illustrated by some highly-successful experiments that were received with much applause; and at its conclusion a hearty vote of thanks was passed to the lecturer, on the motion of the PRESIDENT, seconded by Mr. W. J. WARNER.

WEDNESDAY, JUNE 9.

After the reading of papers noted above, the following general business was proceeded with:—

ELECTION OF OFFICERS.

The report of the Scrutineers was to the effect that the following gentlemen had been elected Office-Bearers for the ensuing year:—

President.—Charles Hunt, Esq., of Birmingham.

Vice-Presidents.—Messrs. G. W. Stevenson (London), R. O. Paterson (Cheltenham), and R. Harris (London).

Treasurer.—Mr. H. Newall.

Secretary.—Mr. W. H. Bennett.

Committee (to replace those going out of office by rotation).—Messrs. W. Ford (Stockton-on-Tees), W. A. Valon (Ramsgate), and J. Tindall (Walsall).

Finance Committee.—Messrs. G. Livesey, C. Woodall, and J. Eldridge.

Auditors.—Messrs. Alfred Hersee and Alfred Lass.

The PRESIDENT said he hardly knew whether he ought to thank the meeting for having imposed upon him another year of work; for he began to think that the performance on one occasion of the onerous duties of the office of President was quite enough for any one. Nevertheless, he did thank the members from the bottom of his heart for the very high honour they had conferred upon him, and it was his earnest wish that this time next year they would not have to say that either the honour, or the dignity, or the usefulness of the Association had suffered at his hands.

MEMBERS IN ARREAR.

The SECRETARY then read a list of the names of gentlemen who had neglected to pay their subscriptions for two years,

exclusive of the current year, and who were thereupon struck off the list of members.

PLACE OF NEXT YEAR'S MEETING.

Mr. P. SIMPSON (Rugby) moved that the meeting next year be held at Birmingham. It was, he said, true that the Association had met once before in Birmingham, and that might, with some people, be made an objection to agreeing to his proposal; but it was a long time ago, when the Association was very small (only 37 in number); and, in fact, it was then quite a different society to what it was at the present time. Birmingham was the centre of the gas manufacturing industry, and it was a very suitable place in which to hold the meeting.

Mr. BARRATT (Grantham) seconded the motion.

Mr. E. GODDARD (Ipswich) supported the resolution. He said he was present at Birmingham on the former occasion, and he was quite sure the Association would receive a hearty welcome if they agreed to go there again.

No other place being proposed, the motion was put and agreed to.

The PRESIDENT said that he took their unanimous selection as a great compliment to himself; and he would join his efforts with those of his fellow-members in the Midland Counties to give the Association as hearty a welcome as possible—not in a spirit of munificence, if he might be allowed to use the word, nor as endeavouring to out rival the generous hospitality they had experienced in other localities; but none the less, he hoped, having in view the true objects and interests of the Association.

VOTES OF THANKS.

The PRESIDENT next proposed a vote of thanks to the readers of papers, which, he said, he was sure would not suffer by comparison with those read at previous meetings.

Mr. W. CARR (Halifax) seconded the resolution, which was carried unanimously.

Mr. C. R. MEAD (Sutton) moved a vote of thanks to the Committee, saying that those who had never filled the office could hardly tell the amount of duties the gentlemen on the Committee had to undergo.

Mr. R. DARNEY (Faversham) seconded the resolution, which was also carried unanimously.

Mr. CORBET WOODALL proposed a vote of thanks to Mr. Henry Newall for continuing to act as Treasurer. As a member of the Finance Committee, he said he could testify to the great interest which Mr. Newall had always taken in the Association. Their financial affairs had recently been under special consideration, and whatever this might issue in, he was sure the Association would always retain a very pleasant and grateful recollection of the valuable services which Mr. Newall had from the first rendered.

Mr. E. GODDARD seconded the motion. He said, as one of the Trustees, he had had a good deal to do with Mr. Newall in his capacity as Treasurer, and he could only say that the way in which he had always conducted the treasurership had been highly commendable.

The motion was carried unanimously.

Mr. J. SOMEVILLE proposed a vote of thanks to the Scrutineers, which was seconded by Mr. J. ELDRIDGE, and carried unanimously.

Mr. SIMPSON, as one of the Scrutineers, suggested that in future four should be appointed in place of two, as they would then get through the work in half the time, and it would not be such a tax on those who undertook the duty.

Mr. T. NEWBIGGING (Manchester) moved a vote of thanks to the Auditors. They all knew that Mr. Lass was a most able professional accountant, and Mr. Hersee also was a very competent auditor.

Mr. E. GODDARD seconded the motion, which was carried unanimously.

The PRESIDENT next moved a vote of thanks to the Institution of Civil Engineers. He said the Association had hitherto held their London meetings in the room of the Society of Arts; but this year they could not do so, owing to previous arrangements having been made, and an application was sent to the Council of the Institution of Civil Engineers, which met with an immediate response. Their thanks were especially due to Mr. James Forrest, the Secretary of the Institution, for his kindness and courtesy, and he (the President) had much pleasure in moving—"That the best thanks of the Association be given to the Council of the Institution of Civil Engineers, and to Mr. Forrest, the Secretary, for their great kindness and courtesy on this occasion."

Mr. R. O. PATERSON seconded the motion, which was carried unanimously.

A vote of thanks having—on the motion of the PRESIDENT,

seconded by Mr. W. J. WARNER—been accorded to Mr. King for his services to the Association, in connection with the report of the proceedings,

Mr. R. MORTON proposed a vote of thanks to the Acting President, Mr. Charles Hunt, for his conduct in the chair during the meetings, saying it did not require any words of his to commend the resolution to all the members. They had listened with very great pleasure to his opening address, and he must say that he did so with peculiar pleasure, having been associated with Mr. Hunt for a number of years. He had watched his progress onwards with great satisfaction, until, within the last half hour, he had been elected President of the Association. He should like also to say that he thought his conduct in the chair had had a great deal to do with the harmony which had prevailed throughout. They had had some excellent papers, and looking back over the meetings of the Association from its commencement, he did not remember one when they had had a better class of papers read, or more interesting or valuable discussions upon them.

Mr. J. ANNAN (Wolverhampton) said he should much like to have the pleasure of seconding the proposition. Mr. Hunt belonged to the South, but he had come amongst them in the North, and, being his nearest neighbour, he must say they could not have sent a man better suited to them. The gas managers in the Midlands wanted some one of genial disposition, and Mr. Hunt had brought them all together into one focus, and made them acquainted with one another in a degree which never existed before he came to them. If he made as good a President of the Association as he had for the Midland Association, he (Mr. Annan) could only say they had done very well in electing him.

The motion was carried by acclamation, and

The PRESIDENT, in acknowledging the vote, said he was much obliged to the proposer and seconder for their kind observations. It was with considerable reluctance that he consented to act on this occasion, but he felt in doing so he was only performing a duty which would be expected of any of the members under similar circumstances, and with their approbation he was more than satisfied. He concluded by proposing a vote of thanks to their esteemed Secretary, Mr. Bennett, who, he said, was hardly recovered from an illness from which he had suffered for a considerable time; but, notwithstanding this, he had thrown himself into the work of the meeting with an energy which had not been surpassed on any former occasion.

Mr. MEAD, as a very old friend of Mr. Bennett's, said he had much pleasure in seconding the proposition. Mr. Bennett had worked industriously and well for the interests of the Association from its foundation, and it was only due to him to thank him sincerely for his services, and to say that they hoped to see him fully restored to health as soon as possible, and that they might see him many more times at their annual meetings.

The resolution having been carried unanimously,

Mr. BENNETT, in reply, said he had to thank the President very heartily for the kind allusions he had made to him in his opening address, and also for the remarks which had just fallen from him, as well as from Mr. Mead. To the members generally he had to offer his sincere thanks for the manner in which they had received those remarks. He could assure them it had afforded him very great pleasure, and an unexpected pleasure, in fact, to be able to meet them on this occasion.

The proceedings of the general meeting then terminated.

ANNUAL DINNER.

In the evening the Annual Dinner of the members was served at the Cannon Street Hotel, and there was a very large gathering on the occasion. The President occupied the chair, and was supported on the right by Mr. William Woodall, M.P., and on the left by the Secretary, Mr. W. H. Bennett. The vice-chairs were occupied by Messrs. R. O. Paterson, Alfred Williams, and R. Harris. The following is the list of the Stewards:—Messrs. R. O. Paterson, T. Newbigging, J. Hepworth, W. H. Bennett, W. Carr, R. Harris, H. Woodall, J. West, W. Sugg, and P. Simpson. At the conclusion of the dinner, the President, in very happily-chosen language, proposed the toasts of "The Queen;" "The Prince and Princess of Wales and Members of the Royal Family;" and "The Army, Navy, and Auxiliary Forces." To the last toast Colonel Cowen responded. The toast of the evening—"Success to the British Association of Gas Managers"—was (in the absence of Mr. R. H. Jones, J.P.) entrusted to Mr. George Livesey, and replied to by the President; who, in turn, proposed "Our Guests." Mr. W.

Woodall, M.P., and M. Aertz, of the Brussels Municipal Gas-Works, responded. The remaining toasts were—"The President Elect," proposed by Mr. R. P. Spice (in the absence of Mr. H. P. Stephenson); "The Past-Presidents," proposed by Mr. T. Newbigging, and responded to by Mr. J. Douglas (in the absence of Mr. E. Goddard, J.P.); "The Vice-Presidents," proposed by Mr. F. W. Hartley, and responded to by Mr. R. O. Paterson and Mr. R. Harris—Mr. G. W. Stevenson being absent; "The Committee," proposed by Mr. Magnus Ohren, and responded to by Mr. J. Hepworth; "Prosperity to the Benevolent Fund of the British Association of Gas Managers," proposed by Mr. Corbet Woodall, and responded to by Mr. W. J. Warner; "The Secretary," proposed by the President, and responded to by Mr. W. H. Bennett; "The Scottish and Provincial Associations of Gas Managers," proposed by Mr. G. Livesey, and responded to by Mr. J. M'Gilchrist and Mr. W. Carr; "The Press," proposed by Mr. C. Sellers, of York, and responded to by Mr. W. King; and "The Stewards," proposed by the President, and responded to by Mr. W. Sugg, whose name was specially connected with the toast, in consequence of his having taken upon himself the providing of the musical part of the programme. The efficiency with which this was carried out gave great satisfaction, and added much to the enjoyment of the evening.

THURSDAY, JUNE 10.

At ten o'clock the members assembled on board the *Alexandra* steamboat, and were taken to Beckton, where an opportunity was afforded them of inspecting the whole of the works of the Chartered Gas Company, especial attention being directed to the recently-erected plant for the treatment of residual products. A more extended notice of this visit appears elsewhere; suffice it here to say, that the visitors were met on the pier by Mr. F. J. Evans—representing the Directors of the Company—Mr. G. C. Trewby, the Resident Engineer, and Mr. V. Wyatt, the Constructing Engineer, by whom they were courteously conducted through the works.

LECTURE ON THE PAST, PRESENT, AND FUTURE OF COAL TAR,

By GREVILLE WILLIAMS, Esq., F.R.S., &c.

DELIVERED TUESDAY EVENING, JUNE 8, 1880.

Mr. President and Gentlemen,—I have accepted with the greatest pleasure the invitation with which I have been honoured by your Committee to deliver before you a lecture on the Past, Present, and Future of Coal Tar. The subject is so vast that it will be evident to you at once that each department will have to be treated with brevity, and my whole care will be to prevent that brevity from causing indistinctness or confusion. My hope is that what I have to say will at least present a sharp clear outline, and with this intention I will define at stating what I mean by the Past, Present, and Future of Coal Tar. By the Past, I mean the history of coal tar previous to the great discovery of the aniline dyes made by Mr. Perkin. By the Present, I mean the discoveries made from that time until now; although I am compelled to include one or two observations of older date. In speaking of the Future of coal tar, I propose to call your attention to some of the ingredients of that substance, which, although of perfectly definite chemical constitution, have not yet been utilized, and are, in fact, thrown away.

In pursuance of this arrangement, I will ask you to just glance with me at the earlier researches which were made long before it was ever dreamed that coal tar would attain its present enormous and ever-increasing importance.

I think it may safely be said that the first cardinal discovery connected with coal tar was made in 1820, when Garden discovered naphthalene in coal-tar oil; and yet naphthalene was destined to be one of the last of the coal-tar hydrocarbons to be utilized. Even so late as 1866, when I wrote the article on "Naphthalene" for Watts's "Chemical Dictionary," I remarked that great efforts had been made to find a use for it, but that none had been entirely successful, although lamp-black was sometimes prepared from it by condensing the dense smoke which burning naphthalene evolves. I also said that efforts had vainly been made up to that time to prepare fast colours from it; but I also added that there was no doubt whatever that in a few years, perhaps months, the difficulties in utilizing naphthalene would be overcome. It needs not to be said that this prophecy (which required no great powers of prevision) has now been amply verified, as I shall show you later on that the most superb colours are now produced from it; and, as I believe its uses will soon become greatly extended, and consequently its commercial value increased in

proportion, I strongly recommend you no longer to regard as valueless the deposits you may meet with.

The next great discovery to that of naphthalene was made five years later—namely, in 1825—when the illustrious Faraday discovered benzole, or, as we now term it when pure, benzene. He found it in the liquids produced by the compression of oil gas, but it is also formed in a great number of chemical reactions. I shall have more to say about it presently. Seven years later—that is, in 1832—Dumas and Laurent discovered anthracene, which at one time was called paranaphthalene. For nearly forty years it remained a mere chemical curiosity; but now it is second in importance to none of the products of coal tar. In the same year that Dumas and Laurent discovered anthracene, Reichenbach discovered in wood tar a substance which he called creosote; and, two years after—namely, in 1834—Runge discovered carbo-lic acid, which is known also by the names phenol, phenic acid, and coal-tar creosote. The wood-tar creosote and the coal-tar creosote were for a long time considered as the same substance, but they are now known to be specifically distinct. In the same year that Runge discovered carbo-lic acid he also found aniline to exist in coal tar; the quantity is, however, so small that it cannot be profitably extracted, and that is why we always prepare it from benzene. The actual discovery of aniline was, however, made by Unverdorben, as I shall show presently.

The year 1834 was, indeed, a fruitful one for the chemistry of coal tar; for, in addition to his other discoveries, Runge obtained the first colour reaction from coal tar, and this discovery was made in a very curious manner. You are all aware that one of the principal characteristics of ammonia is the fact that it gives white fumes when brought near a rod dipped into hydrochloric acid. Now Runge (who may be considered the father of the chemistry of coal tar) happened on one occasion to prepare some oils by distilling the tar, and he was desirous of ascertaining whether these oils contained any ammonia. A glass rod not being at hand, he dipped a slip of deal wood into hydrochloric acid, and held it over the oil, when it gave white fumes indicative of the presence of ammonia or of volatile organic bases; but, to his surprise, the part of the wood which had been wetted with the hydrochloric acid turned to a deep crimson colour. This reaction being unique, he knew at once that he had discovered a new and remarkable substance, and he gave it the name of pyrrol. Great efforts were made by himself and other chemists to separate this substance in a state of purity, but all failed. When, as a very young man, I entered the University of Glasgow, my lamented friend Professor Anderson having undertaken to isolate pyrrol, he confided the practical details of the work to me; and certainly few chemical pupils ever had a more interesting subject to work upon. It is enough here to say that the investigation was completely successful. Previously it had always been supposed that pyrrol was a gas possessing a most repulsive odour; but it turned out that instead of being a gas it was a liquid boiling at 133°C ., its formula being $\text{C}_4\text{H}_5\text{N}$, and, when perfectly pure, possessing a delightful fragrance somewhat resembling that of chloroform.

I have here a few drops of the very first specimen of pyrrol ever prepared in a perfectly pure state, and I believe that it is now the only specimen in the world of the first pure preparation; but, small as this quantity is, it is enough to make many thousands of experiments which show its wonderful property of colouring fir-wood. I have tried repeatedly to estimate the minimum quantity necessary for the reaction; but to express this quantity we should have to use numbers like those used by astronomers to estimate planetary distances. I need hardly say that to make an experiment with so small a quantity of so precious a specimen is a task more fitted for the laboratory than the lecture-table; but I trust I shall succeed in making you all see it. Of course, if I used a pyrrol artificially prepared, I could have made the experiment on a larger scale; but I venture to hope that you would prefer to see this particular specimen. I have here a small slip of fir-wood. I shall just touch its point with pyrrol, and hang it in this glass with the aid of a card. I now touch another slip of wood with hydrochloric acid, and hang it by the side of the other slip, taking care that they do not touch. Now, although pyrrol boils at 133°C ., and is, therefore, by no means a very volatile substance, the second slip (if the experiment be successful) will soon acquire a rich crimson colour. As (although pyrrol can now be made artificially) you will never again see the experiment made with the first specimen ever prepared, I hope you will kindly forgive me for taking up so much of your time with it, but I confess I never see it without thinking of the past history of coal tar; of Runge,

who was the first to see the reaction; and of Anderson, whose investigation of pyrrol marks one of the great eras in organic chemistry.

Runge, I ought to tell you, when he saw this reaction, prophesied that one day other beautiful and useful colours would be made from coal tar; but, unfortunately, he did not live to see its fulfilment; and, equally unfortunately, the peculiarities of pyrrol have hitherto prevented it from being anything more than a chemical curiosity. However, the resources of Science are unlimited, and this reproach will one day be wiped away.

Three years after the discovery of pyrrol—that is to say, in 1837—Pelletier and Walter discovered toluene in the oils produced by the distillation of resin, and this discovery was only secondary in importance to that of benzene. It is scarcely necessary, I am sure, to remind you that the coal-tar colours are not contained, as such, in tar; but it is a remarkable fact that to this day there are many persons, even among those whose employments would lead one to suppose that they have at least some knowledge of organic chemistry, who believe that the colours on the table before me are extracted from coal tar. I even lately heard a person say, "Oh, I have often seen the coal-tar colours in the tar itself; for when a drop of tar falls upon water you see the most beautiful tints as it spreads out." I had some little difficulty in explaining to my friend that the colours he saw were not the coal-tar colours, but arose from the decomposition of light, in exactly the same way as we see in the soap-bubble and the opal.

I have now given you a strictly chronological sketch of the history of the discovery of a few of the principal ingredients of coal tar. It is, of course, only a sketch; but I have endeavoured to make it show the more salient features—the landmarks, as it were, of the more important discoveries which have led to the present wonderful development of this branch of industry; and I only hope that, in my endeavours to give you a sharp and definite outline, I have not trespassed too much on your patience.

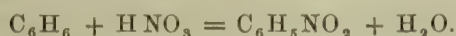
At this point I must somewhat modify my programme; and, paying less attention to chronology, consider the steps by which the substances we have previously spoken of have become utilized. Let us, therefore, return to benzene, or benzole, as the crude article of commerce is usually termed. A partially purified product, containing, I believe, about 30 per cent. of pure benzene, is familiarly known in domestic economy under the name of "benzine-collas," and is used for cleaning gloves and removing grease. Its formula is C_6H_6 , and its vapour is nearly three times heavier than air. I hope to be able to show you this heaviness by an experiment. I heat a small disc of copper over the spirit-lamp. I then place it at the bottom of a beaker, which contains a few folds of paper, to prevent the heat of the disc from causing fracture. I then pour a few drops of the hydrocarbon upon it. The heat will cause it to boil, and thus convert it into vapour. I then pour this vapour, just as if it were a liquid, into a second glass, taking care that no liquid accompanies it. Although apparently empty, you will see that on applying a light it inflames. Now, if the vapour of the benzene had not been very heavy, you will easily perceive that this experiment would have been impossible.

The great German chemist Mitscherlich found that benzene could be prepared in a very pure state from benzoic acid by distilling its lime salt; but it was reserved for Hofmann and his pupil, C. B. Mansfield, to show that the true source for the production of benzene on the large scale was coal tar. Mansfield devoted the remainder of his life to the production of benzene on the large scale. Unhappily, however, his enthusiasm for discovery led to his death; for a small experimental still, with which he was working, catching fire, he endeavoured to remove it in order to prevent the destruction of the building; and while doing so he became covered with the blazing liquid, and perished miserably; thus adding his name, like Gehlen and Scheele, to the sacred list of "Martyrs to Science."

The inflammability of benzene is such that it will even burn on water. There are many substances which possess this property, and even some which burn on mere contact with water. Thus, if I throw a scrap of the metal potassium on water, you see that it instantly inflames. If I now vary the experiment a little, by pouring some benzene on the water, and then throw a scrap of potassium in, you will see that the potassium inflames, and sets the hydrocarbon on fire. This property of benzene and other hydrocarbons to burn on water, and of potassium to inflame on contact with it, has even been proposed for use in naval warfare; I trust, however, we shall not live to see the time when such satanic means of destruction will be resorted to. Benzene boils at 80°C ., or

178° Fahr., and at 0° C., or 32° Fahr., it freezes into a beautiful mass of colourless crystals.

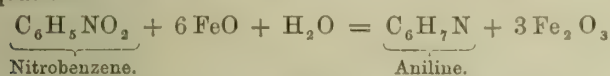
In order to produce colours from benzene, the next step is to convert it into nitrobenzene. This is effected by treating benzene with concentrated nitric acid, in accordance with the equation—



It is, therefore, in chemical parlance nitrobenzene, or benzene in which an atom of H is replaced by nitryl or nitric-peroxide. Nitrobenzene (or, as it is sometimes called in commerce, essence or oil of mirbane) is a heavy oily liquid, of a specific gravity of 1.1866, having a fragrant odour almost exactly like that of bitter almond oil. It is extensively used for perfuming the common kinds of scented soap; but it is somewhat poisonous.

This production of nitrobenzene is only one more step towards the preparation of the first of the coal-tar colours; so you will see that the beautiful colours upon the table are not obtained without much labour; and, indeed, with some of them there are thirty or forty operations to be gone through, some of them requiring very delicate manipulation, before the colours are obtained.

The next step is a most important one; this is the conversion of nitrobenzene into aniline, and it is to the discovery that aniline can be produced in almost any quantities from the benzene of coal tar that we are indebted for an apparently endless number of colours, having not only every tint seen in the rainbow, but many shades never before seen by man. To convert nitrobenzene into aniline, the nitro-compound is treated in large iron cylinders with iron borings and acetic acid. The change takes place in accordance with the equation—



This reaction was discovered by M. Béchamp in the course of a purely scientific research. If he had known the enormous commercial importance it was destined to acquire, and protected it, his patent would have been one of the most valuable ever taken out. Be pleased to remember that this discovery of M. Béchamp's was not the discovery of aniline itself, but of a new mode of preparing it. Aniline was really discovered, as I have said, by Unverdorben in 1826; he obtained it by distilling indigo, and I can well recollect the time when an ounce or two, prepared in this manner, would be preserved in chemical laboratories as precious specimens. Unverdorben called what he had found in this manner—crystalline.

When Runge found traces of aniline in coal tar, he did not know that the substance he had found was the same as the crystalline of Unverdorben; all he knew was that coal-tar oils contained something which coloured fir-wood wetted with hydrochloric acid a deep yellow. He also found that aniline in solution in water turned a dark purple with a solution of chloride of lime. This last reaction is remarkable, as chloride of lime, or bleaching powder, generally destroys colours instead of producing them, as we shall see when we come to magenta. Now Runge concluded from what he had observed that the substance which gave a yellow with fir-wood and hydrochloric acid, and a purple with bleaching liquid, was a new substance, and he called it kyanol. It was reserved for Dr. Hofmann to discover that the crystalline of Unverdorben, the kyanol of Runge, and the aniline of modern chemists, were, in fact, the same substance.

Here is a specimen of pure aniline. It is an oily liquid boiling at 182° C., or 359.6 Fahr. Allow me to repeat myself a little, and to ask you to remember that coal tar itself contains only mere traces of aniline, and that it is never extracted from it directly, but is always prepared from the benzene of coal tar, as yielding infinitely more than could be prepared in any other way.

And now, having given you the history of this wonderfully prolific alkaloid, the parent of the colours you see on the table, and directly or indirectly of many others, we come to the history of the first colour which it yielded that was of any commercial value. Mr. William Perkin had the idea that quinine could be prepared from aniline; but his experiments not succeeding, they drifted into other channels, and the idea struck him that the purple I showed you as being produced when chloride of lime is added to aniline could be fixed, and used as a dye. While at work on the subject, he dissolved aniline in sulphuric acid, and added bichromate of potassium to the solution. In time a dirty-looking precipitate fell down, he poured a little alcohol on the precipitate, a purple dissolved out. He boiled the feather of his quill pen

in the solution, and it became dyed with a purple infinitely more brilliant than had ever been seen before. Mr. Perkin then made this colour on the large scale; it met with an almost unparalleled success, and thus by his own unaided genius he became the founder of the vast industry now known as the Aniline Colour Trade, which, in its turn, has so immensely raised the value of coal tar.

Magenta.—I need hardly say that the revolution in colours produced by this discovery of Mr. Perkin's purple (or mauve, as he termed it) could not fail to set many chemists at work in the hope of discovering other colours from aniline. The next step was made by M. Verguin, who, by boiling aniline with anhydrous tetrachloride of tin, obtained a superb crimson, which as much eclipsed the old crimsons as the mauve eclipsed the old violets. This crimson is now known as magenta. Immediately numerous patents were taken out for new processes for making it; but that of Mr. Medlock, which consisted in treating aniline with arsenic acid, superseded all others. It was sold to a firm of manufacturing chemists, who greatly improved the process of purification, and made an enormous fortune by it. Now, 100 lbs. of coal yield about 5 lbs. of tar; this tar yields about 2 oz. of benzene, which in their turn yield about 1040 grains of aniline (say 2½ oz. avoirdupois), and this aniline gives 207 grains of magenta pure and crystalline. This will dye 8 lbs. of wool a full deep shade, or would print 207 yards of calico of a medium closeness and depth of pattern; so that each grain of magenta will print one yard of calico.

The magenta of commerce is a salt, a hydrochlorate of what is called rosaniline. This rosaniline is a colourless base; I have here a solution of it. I add acetic acid to it, and you see that the colour is instantly developed. The tinctorial or colouring power of magenta is so enormous that if a piece of paper be simply dusted with it, so as to leave an imperceptible trace of the powder on it, it will become dyed if moistened with alcohol. A solution containing only a millionth part of magenta is distinctly red. But although magenta has such great tinctorial power, it is easily destroyed by a minute quantity of solution of bleaching powder. The colour that magenta gives to silk is very brilliant and beautiful, but it requires a very correct taste in dress or decoration so to use it as to avoid vulgarity. By daylight it is a rich crimson, but by gaslight it appears almost scarlet. This difference in shade is easily shown, you see, by the aid of burning magnesium.

Blues from Magenta.—Now although magenta is a finished product, it is also the raw material for the production of various other colours. If boiled with aniline under proper conditions, it forms beautiful blues and violets. The violets made in this manner are falling into disuse; but the blues made from magenta are still produced on an enormous scale. There are a vast number of them of different shades and qualities, but there is one whose properties are so remarkable that I shall show you an experiment with it which illustrates its chief peculiarity. It is what is called an alkaline blue—that is, it is dyed in an alkaline solution. Now, an alkaline solution of this blue is colourless, and the dyed fabric is also almost colourless; but when the wool or silk so dyed is dipped into a weak acid the colour instantly appears. The blue dyed in this manner has the valuable property of not rubbing off—that is, if rubbed upon a white surface, the latter does not become blued. It is proper to state that this blue was one of the many discoveries of Mr. Nicholson.

Greens from Magenta.—By heating magenta in its colourless or basic condition with iodide of methyl, it is first converted into a violet, and finally into a very lovely green, which has the property of appearing more beautiful by gaslight than in the daytime. Several other greens of more or less similar character are now made from methylaniline violet, and by the action of benzyl trichloride on dimethylaniline. The tinctorial power of this green will be seen by dusting a little on paper, and pouring alcohol on it. I now come to the

Dimethylaniline Violet.—By treating aniline with chloride of methyl under pressure we obtain dimethylaniline, and by mixing the latter with sand or common salt and nitrate or chloride of copper and acetic acid a mass is obtained, which is spread on copper trays in layers 3 or 4 inches thick. If these layers are kept in a room at a temperature of from 60° to 90° C. they harden, and assume a metallic appearance. When the maximum amount of violet is formed, which is easily ascertained in practice, the violet is extracted by water. The bluer shades are obtained by the action of chloride of benzyl on the base of the violet. These violets are now universally employed for all the richest shades on wool, cotton, or silk. Here is a piece of silk dyed with dimethylaniline violet. You are all aware that purples and violets appear much redder by artificial light than by daylight. I will now

burn a piece of magnesium ribbon, which yields a light as pure as that of the sun, and you will see how much bluer it appears.

I have no time to enter into the theory of the constitution of these colours, or of the aromatic series, as to do so would require more time than I can devote to the whole of this lecture. Those who desire information on this most interesting subject will do well to study the Supplement to Watts's "Chemical Dictionary," and the *Berichte* of the Chemical Society of Berlin.

Eosine.—The beautiful pink colour called eosine is produced from benzene by a long and somewhat complex process. The colour on silk or wool is a beautiful pink, and it makes the most brilliant of all red inks; but it is, unfortunately, rather fugitive.

Azo-Compounds.—The azo-compounds may be said especially to represent the Present of the coal-tar colours, as it is to them that the attention of modern chemists is particularly directed. It is to the admirable researches of Griess that the great progress in this direction is mainly due. An "azo-compound," in its most modern sense, may be defined as one in which one atom of nitrogen replaces one of hydrogen.

When nitro-benzene is treated at a boiling heat with nitric acid we obtain meta-dinitro-benzene, and this by reduction with iron and hydrochloric acid gives what used to be called phenylene-diamine, but is now known as diamido-benzene; and this substance in solution, when treated with nitrite of sodium and hydrochloric acid, yields triamido-azobenzene, or Bismarck brown. This colour, which is now made on a very large scale, is a valuable and fast colour. The quantities of this coal-tar product now used may be judged from the fact that one firm in three years made 160 tons! I now come to

Chrysoidine.—This colour was discovered by Dr. Witt, in the endeavour to obtain a diamido-azobenzene, as, for excellent reasons, he expected it to prove a valuable colour. Chrysoidine crystallizes beautifully, as you will see by this specimen. It gives a very fine colour on wool, of a beautiful orange yellow shade, such as you see in this "swatch." [The word "swatch" is used by dyers for any piece of silk, wool, or other material used to try the quality of any colour either by dyeing or printing.]

Tropæolines.—The tropæolines are a further development of the azo-compounds, and can be obtained of all shades, from the palest orange to the deepest scarlet. Dr. Witt's tropæoline, OO, is one of the most beautiful of all the members of the series, and appears quite resplendent by the light of burning magnesium.

Naphthaline Colours.—Many beautiful colours are now prepared from naphthaline. I have only time to show you one of them—namely, this naphthaline scarlet, which is, I think, quite sufficient to prove that the once despised naphthaline, so detested by gas managers (from the way in which it stops up their pipes), has now an important place among the colour-yielding products of coal tar.

Diphenylamine Blue.—My friend M. Charles Girard, by heating aniline with hydrochloride of aniline, succeeded in producing a new alkaloid called diphenylamine. By heating it with oxalic acid it yields a superb blue, which, when treated with sulphuric acid, yields a sulphonate having the character of an alkaline or Nicholson blue. Seen by the aid of burning magnesium, its shade is very beautiful.

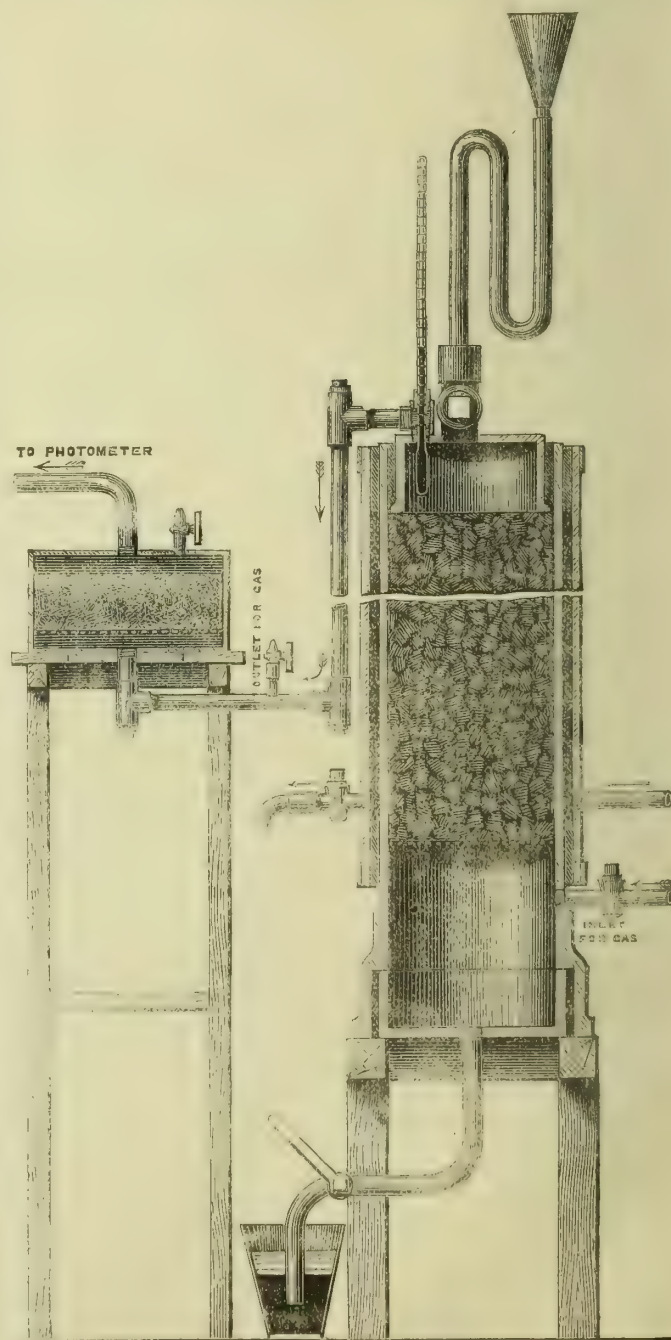
Picric Acid.—Among the many constituents of coal tar is a substance called at various times by the names of phenol, phenic acid, and carbolic acid. It is another of the many gifts to science of the German chemist Runge. It is now so invaluable as a disinfectant and antiseptic that surgeons and physicians would be at their wits end without it. As a dressing after surgical operations, especially on the battle-field, it acts like a charm; and inhaled with steam, in even the worst cases of sore-throat, its effects are truly wonderful. But it is not with its medicinal effects that we have to do this evening. When treated with nitric acid it yields a substance to which numerous names have been given at various times. We will simply call it picric acid. It dyes silk a delicate sulphur yellow, which is very permanent. It is a substance which requires to be used with caution, as its salts are very explosive, as you will see when I heat a little picrate of potassium on a spatula. It has been proposed by some French artillerists to use it in warfare, but it has been rejected as uncertain and treacherous.

Anthracene.—When coal tar is distilled, and the still is at a very high temperature—too high, indeed, for the mercurial thermometer to register—a substance comes over in a very impure state, called anthracene. It remained a mere scientific curiosity until two celebrated German chemists, Graebe and Liebermann, made the brilliant discovery that anthracene

could be converted into alizarine, the principal colouring matter of the madder-root. It is this substance with which the famous Turkey red dye (so well known for its fastness and beauty) has been prepared almost time out of mind. I have here a specimen of cotton dyed with alizarine from coal tar.

The alchemists called the worthless residues contained in their alembics a *caput mortuum*; but here we have the *caput mortuum* of a *caput mortuum*—the residue of a residue—and yet at the bidding of Science the last residues of the distillation of coal tar, known of old by the name of dead oils, yield the raw material for the production of the brilliant colouring matter of a plant.

So much, gentlemen, for such of the colouring matters of coal tar as I have had time to describe. I have done my best to be brief, but I cannot help feeling some alarm lest I should have wearied you. I will, therefore, turn for a moment to a question in which you are all, I believe, deeply interested—namely, the effect of the contact of tar upon the illuminating power of coal gas. The subject has been ably treated by Mr. Bowditch, Mr. Livesey, Mr. Patterson, and others; and I think it has been pretty generally agreed that the contact of tar at ordinary temperatures deteriorates the illuminating power of gas; but I am not aware of any photometric experiments showing the exact amount of deterioration taking place in an apparatus of a given size. My friend Mr. Morton requested me to determine this point, and was kind enough to give me every possible assistance in making the experiments. If they have any value, the merit belongs to him; but for any defects or want of completeness, I take the entire respon-



APPARATUS FOR EFFECTING THE CONTACT OF COAL GAS WITH TAR.

sibility. I may, however, say that the investigation is still proceeding.

In order to make the results strictly comparable, an experimental gasholder was filled before each series of observations. To effect contact of the gas with the tar, an apparatus 7 feet in height and 9 inches in diameter was used, which is accurately represented in the diagram, on a scale of 1 inch to the foot. The tower was filled with clinkers saturated with tar, and the gas was passed through at the rate of 5 feet per hour. The tower was surrounded with a jacket, into which steam could be passed to increase the temperature; but it was not used in the experiments I am about to describe. The temperature of the gas was estimated by an accurate thermometer placed at the exit from the column. The lowest temperature recorded was 50°, the highest 60° Fahr. Before reaching the photometer the gas passed through a purifier containing oxide of iron, to intercept any sulphuretted hydrogen with which it might have become contaminated during its contact with the tar. At the upper part of the column a syphon was placed to enable the tar to be poured into the column without permitting the entrance of air. At the lower part of the column an exit-tube was placed to allow of the escape of the excess of tar. This tube was sealed by dipping into tar covered with water. Precautions were, of course, taken that every trace of air was expelled before the gas was tested.

In the first series of experiments, the gas before being passed over the tar gave, as a mean of 50 closely-agreeing experiments, an illuminating power of 16·24 candles. After passing over the tar at the same rate, the gas gave, as a mean of 100 photometric observations, an illuminating power of 14·39 candles. This indicates a loss equal to 1·85 candles. In a second series of trials, a fresh sample of gas before contact with the tar gave an illuminating power equal to 15·19 candles, and after contact with the tar 13·01 candles; the loss being equal to 2·18 candles. As the difference between the first and second series of experiments is only 0·3 of a candle, it may, with perfect safety, be said that, under the circumstances indicated, the gas is injured to the extent of 2 candles. The photometric observations were made with Mr. Methven's standard light, which I found admirably suited for experiments of this kind.

Allow me to return to the coal tar colours for a moment, as I wish to remove an absurd impression which prevails among some persons that all aniline dyes are poisonous, and contain arsenic. It is true that magenta, as prepared by Medlock's process, contains traces of arsenic, but certainly not enough to do the slightest harm to any one wearing any article dyed with the colour. All the other dyes are perfectly free from arsenic, and Mr. Anthony Nesbit has fed rabbits for weeks together upon food containing most of the dyes I have mentioned to-night, and, strange to say, their general health, if one may judge from their appetite and condition, was not in the slightest degree impaired. It is true that some pigments—that is, paints, not dyes—like orpiment and emerald green, contain large quantities of arsenic. Orpiment should never be used, as it gradually fades, and the deplorable way in which Sir Joshua Reynolds's pictures have deteriorated is partly due to the use of orpiment and carmine; this last colour, although perfectly harmless, becoming grey in the course of time.

Future of Coal Tar.—Permit me, in conclusion, to say a few words on the Future of Coal Tar. It may confidently be said that none of the products of coal tar are useless. A well-known chemist, several years ago, in a work which in many respects showed great cleverness, was unwise enough to reproach chemists for the enormous labour which they had bestowed on what he called so useless a substance as aniline. He, however, lived to see it become one of the most valuable substances in existence. It is true that the leucoline and pyridine series have not as yet been utilized; but to doubt that they will one day yield valuable derivatives would be to neglect all the teachings of our glorious science. Nothing exists in vain, and the chemists who, for the sake of pure science, study the physical and chemical properties of new and as yet useless substances, are preparing the way for the practical man, who will one day be thankful to those pioneers who have smoothed the road, and made the advance into new realms comparatively easy. Although the leucoline series have not yet been utilized, I found a quarter of a century ago that its isomer, chinoline, by alternate treatment with iodide of methyl and oxide or sulphate of silver, yielded superb coloured reactions; and doubtless, by suitable processes, the leucoline series will be made to afford valuable products.

I found also that chinoline treated with iodide of amyl, and then with caustic alkalis, yielded the superb blue colouring matter cyanine. This colour, from its peculiar constitution,

forms quite a new departure in organic chemistry, and recent researches show it to be closely allied to our subject; as, from the observations of Ballo and Dewar, there seems to be little doubt that chinoline at times, and perhaps often, accompanies or replaces leucoline in coal tar.

There are also many other substances which have not yet been utilized, among which I may mention the solid hydrocarbons chrysene, retene, and pyrene. It needs no prophetic eye to see that, with the substances already known, there is room for an absolutely endless number of new combinations; and the Future of Coal Tar will be far more brilliant than the Past or the Present.

To me, gentlemen, coal tar, though "black," is "comely," and if I have failed to impart to you some of my own enthusiasm for it, the fault lies with me, and not with the subject, which I feel is worthy of treatment by a master-hand.

P A P E R S R E A D .

(I.)

EXPERIMENTS ON THE THERMAL POWER OF GAS HEATING APPARATUS.

By Mr. T. TRAVERS, of Cork.

In a paper which I had the privilege of reading before you two years since, your attention was called to the fact that gas cooking and heating stoves did not, as a rule, give the full thermal effect practically available from them. To us this is a matter of importance, as one of the points with which we have to contend is to demonstrate the economy of gaseous fuel. At present this can only be done when gas is consumed under the most favourable circumstances.

Manufacturers of gas cooking and heating apparatus are succeeding very well in making them attractive to the eye. Both in style and finish they are suitable to grace, in many instances, a well-furnished room; but to render them more popular, attention must be paid to the mode of developing the largest amount of heat from the smallest quantity of gas. What I purpose showing is that in the majority of instances this is not obtained, and it is desirable that additional pressure be put on the stove makers, so as to enable us to speak with more confidence to our consumers. As a kindred case in point, you are aware that some years ago gas burners then in use did not give the same amount of light per foot of gas as we now obtain. If the electric light did no other good than to rouse the burner makers to the sense of the injustice they were so long perpetrating on gas makers and gas consumers, by impeding the full development of the illuminating power, it has done good work. In like manner let us spur on the stove manufacturers to that which will certainly prove to be of mutual benefit.

In order to be able to recommend to the gas consumers of Cork the best and most economical apparatus, I made, during last year, some experiments, and from the results of them I think it will be seen that the apparatus in general use are capable of such improvements as will lead to better results. I am fully aware that the effect of any kind of fuel is much greater on theory than in practice. I have, therefore, made the experiments on a plain, practical method, such as may be applied to the doings of every-day life.

Intimately connected with this subject is that of the thermal power of gas of various qualities, and I commenced operations by making some tests under this head. I noticed that the results are not quite in accordance with some I have seen in the journals. The apparatus with which I operated was capable of carbonizing 30 cwt. of coal per day. I was, therefore, able to make a comparative calculation of the cost of the gas from coal of various qualities. The coal was Scotch cannel, Newcastle coal, and coal from South Wales. The points noted were—

The illuminating power.

The evaporating power of the gas.

The net cost of coal per 1000 feet of gas.

Coal.	Illuminating Power.	Water Evaporated.	Gas Consumed.
Cannel	24·0 candles	1 gallon ..	18·50 cubic feet.
"	22·0 " "	1 " ..	19·75 " "
"	20·0 " "	1 " ..	20·50 " "
Newcastle	16·5 " "	1 " ..	21·75 " "
"	14·5 " "	1 " ..	22·00 " "
"	13·5 " "	1 " ..	22·50 " "
South Wales	10·5 " "	1 " ..	28·00 " "
Do. do. and 20 per cent. cannel	14·0 " "	1 " ..	23·50 " "

Of course the thermal theoretical efficiency of the various descriptions of gas is far greater than the results which are given above.

On the average it will be found by the experiments that 16 lbs. of water were evaporated by 1 lb. of gas. Newcastle

coal gas, for example, of sp. gr. .420 has an evaporative value equal to 22 times its weight. From the figures it will also be seen that the thermal power does not increase in the same ratio as the illuminating power, as some people suppose. The calculations I have made of the net cost of coal per 1000 feet of gas prove that a very cheap gas of low illuminating power can be produced for heating purposes, provided we were able permanently to enrich it at the consumers meters when used for illuminating purposes—an experiment worthy of the attention of the inventive portion of the profession.

Taking gas from Newcastle coal at 16 candles as a standard of the average gas at present supplied, and 750 as the thermal units per foot of gas, I made a series of experiments on the gas-stoves from the various makers. I took the stoves as they are delivered in the usual way to purchasers.

Thermal Units per
Cubic Foot of Gas.

No. 1.—Cooking stove fitted with a Bunsen burner formed by a ring of $1\frac{1}{4}$ -inch wrought-iron pipe with jet holes 1 inch apart gave	244
No. 2.—Boiling stove, consisting of single burner 9 inches diameter, made of $\frac{3}{4}$ -inch pipe, jets $\frac{3}{4}$ -inch apart	260
No. 3.—Hotplate, consisting of three rings each 6 inches diameter, jets $\frac{1}{2}$ -inch apart	280
No. 4.—Like the above, rings 4 inches diameter	310
No. 5.—Cooker formed of bars of 1-inch wrought-iron pipe, jets $\frac{1}{2}$ -inch apart	338
No. 6.—Concentric burner, consisting of a double row of rings one inside the other, 6 inches diameter	390
No. 7.—Burner, same construction as above, but 4 inches diameter	408
No. 8.—Solid flame burner	450
No. 9.—Wallace's burner adapted for domestic purposes	580

To the construction of this burner is due the higher return of work than from the others. It is on the principle that jets of fluid escaping from an orifice travel on in their original direction of motion a certain distance before they disperse. In this burner the gas is made to leap across a space, and in doing so it communicates a sort of gaseous friction to the air. Both then move in the same direction, but with a retarded motion; thus they become mixed in a chamber, from which they escape through a wire gauze, and they burn at a point of exit in the shape of solid flame, varying in diameter according to the size of the burner. Here we have a very powerful concentrated heat, developing a very large percentage of the calorific efficiency of the gas.

It is important to ascertain the reason of this. You are aware that in combustion for the purpose of artificial light, we have a very interesting arrangement of nature. The combination of oxygen with hydrogen causes powerful heat, and consequent expansion. Hence the particles of carbon are scattered freely through the heated hydrogen, and thus they remain for some time before their exit; and from their incandescence, diffused in all directions, we obtain beautiful light. But in the Bunsen burner the case is different. The oxygen is introduced in such quantities that there is not time to allow the carbon to radiate its light. It is at once converted into convected heat—that is, the transfer of heated air from one place to another moving in one direction—and thereby we obtain from this lightless flame intense heat. But note the difference—not hotter nor nearly so hot to a body exposed to its radiation, but very much hotter to a body plunged in the flame. It is by attention to this principle of convected heat that, for certain purposes, we obtain the best results from the Bunsen burner, while for other purposes radiated heat is more suitable.

Professor Tyndall very clearly illustrates the difference between the two. With ordinary gas-burners the convected heat generated is 80 per cent.; radiant heat, 16 per cent. In the Bunsen burner 96 per cent. is convected heat, and 4 per cent. radiant. Tyndall has found that radiation from a luminous gas-flame was $2\frac{1}{2}$ times that from a non-luminous flame. Using an apparatus of an exceedingly sensitive precision, furnished with a dial index that noted the degrees of force, not of heat, the degree of force in a luminous flame was 30, and the radiation fell to a force of 12 the moment it became non-luminous. But by introducing solid matter the radiation originating in the hydrogen or non-luminous flame became so intense that a spiral of platinum wire plunged in the former brought up the index to 200. There was thereby

generated an amount of radiant heat more than six times that of the luminous gas-flame, and more than thirty times that of the non-luminous one.

A few months since I had a practical illustration of the advantage for certain work of a luminous over a non-luminous flame, and one which will be found to apply in many similar cases. In a low-lying district we erected a stove from one of the best makers; but the day pressure was not sufficient, and the result was that the Bunsen burner, which formed the heating ring in the stove, frequently fired back, and was thereby a source of annoyance, and so retarded the efficiency of the range that the consumer became dissatisfied. To increase the pressure was out of the question. To meet the case if possible, I converted the non-luminous into a luminous flame, and since then we have had no firing back. The consumer is perfectly satisfied, both with the quality of the cooking and the convenience of the stove; and the consumption of gas is not increased by the alteration, for much of the heat that was before lost by convection is now converted into radiated heat. Bunsen burners, to be used for heat-giving in fire-places, are, to my mind, and for the reasons given above, a mistake; for, unless special arrangements are made, over 90 per cent. passes off in the shape of convected heat.

I think it is clear that there is here a wide field for the exercise of skill and ingenuity for such as are interested in this portion of our business. There is a practice, very strongly to be condemned—viz., the course pursued by some who attempt to fix heating stoves without making provision to carry off the products of combustion; and makers who recommend such ought to be made aware that they are thus displaying an ignorance of a very elementary portion of their business.

I am glad to find, in a paper read by Mr. Fletcher, of Warrington, before the Society of Arts a short time since, that he corroborates the experiments referred to in this paper. This is an illustration of the fact that two persons very often arrive at like results when pursuing the same subject quite independently of each other.

Discussion.

Mr. F. W. HARTLEY (London) said he was somewhat surprised at the low calorific effect obtained by Mr. Travers with a ring burner—only 244 units. Mr. Travers was somewhat hard on makers of stoves who, to a great extent, were forced to make cheap things to suit the public, who, as a rule, were indisposed to pay the prices required for good ones, and, indeed, in many cases, were incapable of using the best. He (Mr. Hartley) had for years been interested in the subject of the use of gas for heating purposes, and could say that the calorific power of London gas had not sensibly changed during the past seven years—indeed, he was sure it had not changed during a much longer time, but said seven years, as his records proved this. About Christmas last he was led, owing to interest re-excited in his mind by being engaged as a juror, both at the Birmingham and Nottingham gas apparatus exhibitions, to repeat old experiments, and make some, to him, new ones. He first sought to ascertain as nearly as possible, in a practical way, the total calorific power of ordinary coal gas, and having at Nottingham realized, with a very excellent water heater, 626 units, he borrowed a similar one from the maker, and from London gas realized in the water 612 thermal units. In addition, he noted the temperature of the casing of the heater and of the air, as well as of surrounding objects. Besides noting the temperature of the effluent gases, he also took means to ascertain their volume. When all these factors were taken into account, the calorific power of the gas was shown as 680. Mr. F. J. Evans a few years ago determined the power as 650 units, while Mr. Harcourt and some others fixed upon 700, which he believed to be very near the truth. The calorific power might be calculated from the composition of the gas; but the question arose, what was its composition? One authority some time since gave such a composition as indicated London gas to be of .396 specific gravity, and its calorific power to be 695, while another more recently gave such a composition as indicated a specific gravity of nearly or quite .500 (for common gas, be it understood), and a calorific power of 797. Both the calculations were subject to a small deduction for the effect of the presence of small percentages of carbonic acid, nitrogen, and oxygen in the gas. The gravity of the gas, as worked out from the last analysis, seemed to indicate that the analysis was wrong. He had found London gas as high as specific gravity .430; but, as far as he had ascertained it, it was generally somewhat lower. If it were not now, unfortunately, a very common practice for vendors generally to put exaggerated statements before the public as

to the merits and powers of the articles to be sold—a practice for which vendors were not altogether to be blamed—he (Mr. Hartley) should be astonished at the audacity, arising, he thought, as much from want of knowledge as anything else, with which some makers gravely stated that their particular speciality developed from 50 to 100 per cent. more heat from coal gas than science showed to be possible. He must confess, however, that he was surprised that a gentleman of high skill and experience in the application of gas for heating purposes should make such a blunder as to state and to believe that he had “got in actual work 1 gallon of water boiled with an expenditure of $1\frac{1}{2}$ cubic feet of gas.” He said “blunder,” for either the calorific values of gases, as determined by scientific men of the highest standing, and given in the best text-books, were fallacious, or Mr. Fletcher, of Warrington, must be wrong. The Manchester gas was richer than London gas, but he (Mr. Hartley) ventured to say with some confidence, it was far from being so much as 100 calorific units greater in power. Assuming for the sake of demonstration, that Manchester gas was of 800 units power, and what followed? One gallon, or 10 lbs. of water, raised through 152° (from 60° to 212° Fahr.) required 1520 units of heat, and if $1\frac{1}{2}$ cubic feet only of gas sufficed, the calorific power of the gas would be equal to 1013 units per cubic foot, or at least 27 per cent. in excess of possibility. He believed Mr. Fletcher’s statement to be in error to a much greater extent, for the water was said to have been boiled. Now as higher temperatures were reached with water, more heat went as it were to waste, the highest calorific power being manifested in ordinary heating when the water was kept under about 100° Fahr., and raised only through about 40° or 50° Fahr., because the water of combustion escaped as steam along with the generated gases at higher temperature, and this higher temperature operated to produce a more rapid draught of air over the vessel that contained the water which was being heated. The following, he said, represented a fair average of the results which he had obtained, and showed the values of the gas per cubic foot in raising water from 60° to 210° Fahr., in a tin kettle placed over a good air burner; the air and walls of the room being at 60° Fahr.:

Water raised 18° F.; Calorific power of gas per cubic foot,			
44°	“	“	450
“	83°	“	440
“	121°	“	412
“	150°	“	403
“	“	“	394

Hence the average power was only 87.55 per cent. of that first indicated, and such must always be the case. Sometimes in cold weather he had only realized from 74 to as low as 61 per cent. He thought it was hopeless to expect to realize in heating water more than 90 per cent. of the actual calorific power of any gas, however much apparatus might be improved. Now, 90 per cent. of 800 was 720, which divided by 152 (the difference between 60° and 212° Fahr.) gave 4.73 lbs. as the possible weight of water which might, by an extremely refined mode, be raised from 60° Fahr. to boiling point; this was equal to 7.09 lbs. instead of 10 lbs. for $1\frac{1}{2}$ cubic feet of gas. Still, taking 90 per cent. as a practically possible maximum, and 700 as the power in units of common gas, there were 630 units, which were capable of raising 4.145 lbs. of water from 60° to 212° Fahr. At the present time, by the agency of the best kettles and burners in use, not more than about 2.66 lbs. of water were so raised in temperature. Most baths which were directly heated by burners below them rendered less than 400 units to the foot of gas burned, though he had found some in which the heat developed in the water had risen as high as 470 units; but, unfortunately, the economy had been accomplished at an enormous sacrifice of time. One bath, which was specially referred to, required about an hour and a quarter to raise 30 gallons of water from 60° to 100° Fahr.; while others, burning gas less effectively from a scientific point of view, did the same work in from 30 to 40 minutes. Water heaters, so called, also gave the highest calorific results when the water was raised only to about 100° Fahr., and through from 40° to about 60° Fahr. The heater which he had mentioned as yielding up to the flowing water 612 units per cubic foot of gas, was used under such favourable conditions as had been mentioned, the outflowing water being 102° Fahr.; but when with the same heater the water was raised to 182° Fahr. from 38° Fahr., the realized heat fell to 471 units. Again, when it was tried with the gas consumption very low, and the water only raised through 11° Fahr., the indicated heating power was 388 units, or about the same as was realized with an ordinary kettle. Truly these tests were very severe, but he mentioned them to show that it was only under certain conditions that the things called water heaters were

greatly superior to other heating apparatuses. In his paper on “Cooking by Gas,” which was read before the Association at the meeting in 1873, he said that, in his opinion, ovens of circulation, if he might call them so, were to be preferred to those which cooked by the heat of radiation. He was still of the same opinion; but in his investigations he had been struck with the beauty of many of the radiating stoves which were now being made, and with the admirable manner in which they did their work. It was not his intention to say one word in their disparagement, for they overbore a stupid prejudice which some of the public had against subjecting food, in the older types of cooker, to the products of combustion; but what he did regret was to see that so many makers should use air burners for radiating heat, in ignorance, it seemed, of the fact that the amount of heat radiated by the non-luminous flame of mixed gas and air was greatly less than that from a luminous flame burning the same quantity of gas. It must be admitted, however, that in cookers the difference was far less than when the burners were in the open, and for the reason that the burner was surmounted by a deflector, which became hot and radiated downwards part of the heat which it received from the burner beneath it; but this benefit was too often dearly purchased, for if the deflector were near enough to the burner to produce the best effect, then if the gas were turned the least degree too high, imperfect combustion ensued, with the evolution of an odour offensive to the nose, and of fumes highly irritating to the respiratory organs. In the course of the experiments which he made he used several small heat-radiating cookers. Some which he bought were fitted with air burners, and one with a circular jet burner. For the last he had an air burner made, and for the others jet burners, so that he could substitute in such a cooker either sort of burner for its opposite. Next he had some vessels of tin plate made, which closely fitted the ovens, and were each about 1 inch deep. These were protected at the bottom and front by a casing of wood, to prevent as much as possible any cooling effect from the air. They were also fitted with tubes, which served for the insertion of a registering thermometer, and also afforded room for the expansion of the measured quantity of water with which each vessel on every occasion was filled. These vessels were placed at the same distance below the burners in all cases, and at a little less distance than the cooking pan was intended to be. To complete the information, he used the vessels both with bright tinned surfaces and with the same surfaces blackened by the best of all blacks—namely, that deposited from gas burned smokily. The differences in heat absorption between bright surfaces and blackened surfaces ranged with the air burners in the proportion of 100 with the bright surface to 250 with the blackened surface, and with the luminous jet burner in the proportion of 100 to 246; while the proportion of heat absorbed by the bright surface heated by the air burner, as compared with the same heated by the jet burner, was as 100 to 131; the ratio with the blackened surface being 100 to 128. Taking the calorific value of the gas at 680, as determined by himself, the average of a number of experiments with blackened vessels gave 7.83 with the air burner, and 9.95 with the jet burner, as the percentages of heat realized in the radiant form. These quantities were almost incredibly small. However, Mr. Fryer and he agreed at Nottingham that it would be well to try certain reflector stoves, and that gentleman made a vessel of tin plate, blackened on its face, measuring 1 foot square, cased in wood, and of a capacity to contain exactly 1 gallon of water. This was placed vertically at a distance of 6 inches from the stoves which were tried. Taking Nottingham gas as capable of yielding 700 thermal units, the results he obtained worked out at 9.3 and 9.64 per cent. only. This by no means represented the effective heat power obtained in use. For in heating water by convection, as an old experiment showed, the top surface might be boiling while the lower part was cold, but the experiment served to show the relation between the kinds of burners. All such experiments gave correctly enough the ratio between certain burners or apparatuses, but by no means indicated their effective value in actual work, such value being greatly higher. The reason for the low indications was quite easy to understand, but it was difficult to devise means whereby to realize working effects. Reverting for a moment to cooking stoves—ovens of convection—he might say that he had sought to find some factor which should be a standard of economy. It was known that in most things with which gaseous or other fuel was used, the proportionate expenditure of fuel diminished as the power for work of the things increased. So it was with gas ovens; the larger they were the less gas per cubic foot of capacity

did they need, if properly constructed. He had observed that the ratio of consumption tended to be proportionate inversely to the cube root of the capacity, and he had little doubt that if all the stoves he tested had differed in no other respect than in size, such rule would be found very near the truth. Thus:—

Cubic Capacity of Oven, Feet.	Gas burned per Hour per Cubic Foot of Capacity.	Gas needed, as calculated by assumed Rule.
19-00	3-56	—
12-00	4-00	4-13
18-00	4-65	4-73
1-66	9-70	8-08

If some such standard could be established for each particular class of stove, it would facilitate the estimation of relative worth, and possibly save some things, which merited approval, from condemnation.

Mr. A. G. VERNON HARCOURT said he hardly knew whether it fell sufficiently within the scope of the paper which had been read, but, seeing the title on the list, he thought he would like to describe a small apparatus for the application of the heating power of gas, which was often wanted, and which ought to be wanted more frequently—namely, the heating of a small conservatory during the winter, in order to keep out the frost. This was a very common need amongst householders in this country, and he was consulted by a friend of his as to how he could most conveniently manage it. He thought it could be most advantageously done with gas, because there would be less trouble; and, after thinking about it, he contrived a small and simple apparatus, which had stood the test successfully of the last two winters, which had been longer and more severe than English winters commonly were. The arrangement consisted of a little cupboard hollowed out lower than the level of the floor of the conservatory to be heated, in which a Bunsen burner was placed. This opened through a grating into the conservatory, so that any heat radiated was not lost, and immediately above the burner was placed an ordinary rain-water pipe, which was carried round the conservatory, and then out through the wall to a chimney, so that the whole of the heat produced by the gas, and the heat radiated from the tube, passed up through the grating into the conservatory, and was not lost. The products of combustion—carbonic acid, steam, nitrogen—along with the excess of air which entered the tube, passed all together round the conservatory, and out through the wall to a chimney carried a certain distance above the roof. The difference of temperature between the heated gas in the first portion of the tube, and the slight difference that still existed between the gas in the chimney and the outer air, was sufficient to secure a movement of the products of combustion throughout the pipe, and the burner drew very well, even on windy days. What he aimed at accomplishing was this—that as nearly as possible all the heat produced in the combustion of the gas should be utilized in the heating of the room. All one needed to secure was, that the whole of the heat produced where the gas was burning, and all the heat that went off in the process of combustion, except the very small quantity necessary to secure a draught, should be utilized. The pipe was very hot at first, but gradually, as in an ordinary air condenser, the temperature sank as the heat was given out in passing through the iron pipe, and the gaseous product as it issued from the chimney was scarcely warm to the hand. Therefore but a very small quantity of heat was lost. Whatever the absolute number of units produced by the combustion of gas, what one wanted to be sure of was that the least possible amount of that heat should escape; and when this had been done, all that was possible had been accomplished. The arrangement he had described was very simple. It was effective, and not costly. The labour was simply *nil*, since it was only necessary to turn on the tap when one wanted to light the burner, and turn it off when not wanted, whilst more or less gas could be burned, according as the temperature required was higher or lower.

Mr. A. H. WOOD (Hastings) said that for ten years past he had warmed a greenhouse in a somewhat similar manner, and for eight or nine years he had a striking-pit in which there was a coil of 2-inch pipe laid horizontally in the bottom of the pit, with 9 or 10 inches of earth above, and under it a jet burning about 1 cubic foot of gas an hour. Nothing but the products of combustion were carried off by a pipe at the end, and this last spring he had taken out several pans of cuttings, every one of which had developed into a very nice plant.

The PRESIDENT said Mr. Harcourt had described a most simple and excellent method of heating greenhouses, such as was very much wanted. There was a wide field for the employment of gas in this direction, and he would only ask him

whether he considered the upright pipe absolutely necessary, or whether it would not be sufficient to stop short without taking the pipe through the wall, trusting to the heat of the gas to produce the necessary draught.

Mr. HARCOURT said it depended upon how far below the level of the conservatory it was possible to get. He had constructed more than one of these arrangements, and in his own house, where he could get down some 12 feet below the floor of the greenhouse without burrowing, and so had a longer pipe above the burner, he did not use the chimney, but simply allowed the products of combustion to issue at the level of the horizontal pipe. In the other case, where he had only a rise of something like 4 feet, he found he had hardly power enough, and therefore had to put on the extra chimney. He had omitted to point out that there was an arrangement at the lowest part of the iron pipe for letting the condensed and rather acid water produced in the combustion of the gas run out. It was necessary that this should be done, or else it would lie in the pipe, and cause corrosion.

Mr. TRAVERS, in reply, said he was glad to find that his paper had led to such important communications as had been made by Mr. Hartley and Mr. Harcourt. Mr. Hartley seemed to doubt the fact of his having obtained only 240 units of heat from a ring burner; but such was the fact, for he had repeated the experiment several times. His object was simply to point out how much below the mark some of the stoves were, and hence the reason why there were so many complaints as to the excessive cost of gas when used for heating purposes. He heartily agreed with Mr. Hartley in his remarks with respect to the efficiency of gas-stoves.

Mr. HARTLEY said it was quite a mistake to suppose he had doubted Mr. Travers's statement; he had only expressed his surprise at the result.

EXHIBITION OF GAS APPARATUS AT COVENTRY.

A small but interesting exhibition of gas cooking and heating apparatus was held last week in the Corn Exchange, Coventry, under the auspices of the Coventry Gas Company. The exhibition was, in the main, similar to those which have of late been held in various parts of the country, and comprised samples of most of the appliances which have been devised for promoting the use of gas for domestic and other purposes. The building selected for the exhibition was exceptionally well suited to the purpose, as the large area available allowed of the exhibits being so arranged as to make an effective display, while sufficient space was at the same time afforded for their convenient examination by the visitors.

The articles to which the projectors of the exhibition desired specially to invite the attention of the inhabitants of Coventry—viz., the cooking and heating stoves—were furnished by the four best known makers; and of their exhibits it is quite unnecessary to speak at length, each firm having already an established reputation. It may, however, be said that down the centre of the building Messrs. Leoni had a very comprehensive show of their kitcheners in various sizes, and these were backed by a good assortment of jacketed gas cookers, exhibited by Messrs. Wright, which are found to be so economical in working; whilst against the walls on either side, Messrs. Billing had an array of their "Sun Dial," reflector, and *repoussé* work stoves, and Messrs. Hassall and Singleton showed some of their boiling stoves and their large Phoenix range. It will thus be seen that a very fair bid was made for the patronage of the visitors.

Most of the usual accompaniments of a gas apparatus exhibition were present in the shape of gas-heated baths, water-heaters, and gas-pressure regulators and burners; Mr. W. Sugg's improvements in the latter direction meeting the visitor on the very threshold, while his gorgeous display of lamps was the first thing to attract notice on entering the building. At the end of the hall three gas-engines—a $\frac{1}{2}$ -horse "Otto," a 2-man "Bisschop," and a $2\frac{1}{2}$ -horse "Leicester"—were in operation. Behind them, on a raised platform, were to be found blocks of the raw material from which gas is obtained; a model of gas-works (kindly lent by Mr. C. Hunt, of Birmingham), showing the process of obtaining it; the instruments employed in testing and registering its purity, illuminating power, and consumption; and, finally—and certainly by no means the least important—samples of the various residual products of its manufacture, and their commercial application in connection with the special branch of industry for which Coventry is famous.

A lady from the National Training School of Cookery at South Kensington was engaged to give at intervals short lectures on cooking, and the adaptability of gas-stoves for the purpose. In addition to this, some of the stoves were actually at work, the results being verified by an expert, and certified by the Gas Company's officials. A good opportunity was thus afforded of testing the capabilities of the exhibits, and of forming an opinion as to their working power.

There is, of necessity, a certain sameness about these exhibitions which renders any lengthy notice of them unnecessary. They are, nevertheless, worthy of being recorded, as they are each a step in advance in the work of extending the use of gas. In the present case, the action taken by the Coventry Gas Company may not result in an immediate increase in the gas consumption, but that it must eventually do so we fully believe; and we hope they may soon have to congratulate themselves on having held this exhibition, for the general success of which much is due to the exertions of their Manager, Mr. W. L. Robinson.

SOCIÉTÉ TECHNIQUE DE L'INDUSTRIE DU GAZ EN FRANCE.—The annual congress of the above Society will be opened in Paris on Monday next, and will probably extend over two or three days. The number of members who have already expressed their intention of being present, and the nature of the communications submitted, induce the belief that the meeting this year will be a particularly interesting one. It is highly probable that permission will be granted by the Paris Gas Company for the members of the Society to visit the new works now in course of erection at Clichy, and if this should be the case, we feel sure that all who avail themselves of it will derive much gratification therefrom.

London: Printed by WALTER KING (at the office of Clayton & Co., 17, Bouverie Street, Fleet Street), and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, June 15, 1880.

would naturally expect him to say a few words on the present position of the agreements between the Government and themselves. They had seen from the public press what had been done in the House of Commons, and they knew that a Select Committee had been appointed, to whom it had been referred to consider the value of those agreements. On this question they, and he believed the other Companies, were in accord; they did not feel it was necessary for them to take any action whatever. They had entered into these agreements, and, as honourable men, they said that if they were carried out they were prepared to perform their part. On the other hand, if it should be decided that the agreements were not to be carried out, then they would be rather pleased, because they felt satisfied, so far as they were concerned, that the amount they had agreed to take was not the full value of the concern they had to sell. Therefore they did not care one iota whether the agreements were to be carried out or not. He believed that the instruction given to counsel before the Committee would be to say that the Water Companies did not desire to offer any remark on the matter one way or the other. They would let the agreements stand for what they were, and leave it to the sound judgment of the men who would have the matter before them to form a proper opinion. As to the other matters before the Committee, one was to obtain a new supply, and the other was to alter the rating powers of the Companies. Both points were vital ones. As regarded the rating powers, it was to be remembered that the public had subscribed £10,000,000 on the faith of Acts of Parliament. The Act of Parliament had specified the manner and form in which the rates were to be levied. The public who subscribed this money were contented to receive no dividend for many years, and for many years more to receive a dividend far less than they ought to have had; and it was only now, when they were beginning to have a fair return, that agitators raised this question, and strove to take from them what had been honestly and legitimately earned. He would not say for a moment that the water-rates were levied in the wisest, fairest, and best manner possible; but he did say that they were levied in the manner in which Parliament said they should be levied. He felt that it was to the interest of the Water Companies to be represented by counsel before the Committee. They would not be there to obstruct in any way, but rather to assist in the solution of this great question. As regarded a new supply for the Metropolis, that was a question on which the Companies also felt that they must be represented by counsel before the Committee, to see that their interests were not interfered with in any way. With regard to the possibility or probability of a new supply, this was a question he did not choose to go into. He had not the slightest doubt that engineers would drop up like mushrooms, and would be ready to supply London with the most beautiful water one could imagine, and bring it from any conceivable distance for an incomprehensibly small sum. All such schemes, however, would have to be sifted before an intelligent Committee, and under the examination of counsel representing the Water Companies, and he did not hesitate for a moment to say they would find it neither possible nor practicable to indicate a source or introduce a service to the Metropolis in a manner that would supersede that of the present Water Companies. All this might have to be inquired into, and the Shareholders must always bear in mind that although the Companies might not now have, and never had a monopoly of the supply of water to their districts, yet Parliament had apportioned districts to the various Water Companies, and it was in consequence of their Acts of Parliament that the Companies had taken their districts, and that the money for the construction of various works had been subscribed. In former times the public generally were glad to have their service from the Water Companies. He felt satisfied that this subject would be fairly considered before the Committee of the House of Commons, and he hoped and believed that a proper decision would be arrived at. With regard to the Company's own Bill, he had told the Shareholders before that this was a matter of very great anxiety to the Board, and it would be remembered that when they set the Bill going nothing certain existed or could be ascertained as to what would be the course of events as to the Water Companies. The Directors felt it was necessary to put themselves in a position which would enable them to construct extra works and obtain an extra supply of water, so that, as time rolled on, they might not find that they ought to supply a certain part of their district, and were without the means of doing so. They therefore felt it necessary to apply to Parliament for power to extend their works. Those works were not absolutely necessary for the moment, because they would take some years to construct; but the Directors' instruction to their Engineer was to give them an idea of the works which would be required so as to make the Company safe for about ten years, and so that they might be thoroughly efficient in all their departments, and not have to go to Parliament for some time. This was the object they had in promoting their Bill. They knew now the course events had taken, and it became a very serious question with the Board as to whether it was for their interest, and that of the water community generally, to proceed with their own Bill. That had been under their earnest consideration for the last few weeks, and they had really found the utmost difficulty in coming to a conclusion as to what was best to be done. They found themselves in this position, that the Home Secretary had said emphatically that he would deal with the question promptly, and that an important Committee had been appointed to examine the whole subject. It had appeared to them that possibly it would not be wise for the Company to proceed with their private Bill, but wait and see the outcome of the inquiry before the Select Committee. This involved a serious consideration, because their accounts showed that they had spent £1300, and he had no doubt that the subsequent expenditure had increased that amount to £2000, and this was a charge which must eventually be dealt with, and paid for out of revenue. It was not a heavy amount, but it was a matter that he ought to explain to the Shareholders, because it was an element in coming to a decision as to the course that should be taken respecting the Bill. The Directors felt that the whole of their energies would be required to protect the interests of the Shareholders and the Water Companies before the Select Committee, and they felt also that an opinion might be expressed that if all the Companies' works were to be bought up, amalgamated, and taken in hand by some authority, the works the Company constructed might be considered unnecessary by the Committee of the House of Commons, or they might say they should be deferred. All these matters had been anxiously considered by the Board, and it was only just before they entered the meeting that they had been re-discussing them, and finally they had come to the determination that it would be to the interest of the Shareholders, and the water community generally, for them to wait and see the result of the inquiry. They had, therefore, decided not to proceed with their Bill this session. Referring next to the question of dividend, he observed that the Directors proposed a large increase. They had paid an increasing dividend every half year since they had conducted the Company's affairs. From the bad times, when they could not afford to pay their law bill, up to now, they had gradually increased their dividend from 2 to 3, 4, 5, and 6 per cent., and now they proposed 7½ per cent., and this was a dividend which they could fairly, rightly, and properly pay. They had discharged extraordinary liabilities during the past half year, and after they had paid the proposed 7½ per cent. dividend they would still have left a balance of something

like £10,000 to carry forward. This sum would be held to meet the extraordinary expenses they would have to pay, some of which would bear rather heavily on them. There was the £2000 expended on their Bill, the withdrawal of which was really not their fault. Then there were the long negotiations which were forced on them in bringing about an agreement for the sale of their undertaking. Those expenses must be considerable, and they must be borne by the Water Companies if the agreements were not adopted, so there were certain items of an extraordinary character which the Company must meet. Next half year the Directors would pay off another £4000, leaving only £4000 to clear off Messrs. Harvey's account. That £4000 represented an increased dividend of 1 per cent. for the half year, so he thought the Shareholders would quite agree with him that although there was a diminished amount of unappropriated profits carried forward—£10,000 as against £18,000—yet he had explained how £8000 had been expended in an extraordinary manner. Then they had also to put against the decrease the approaching cessation of the £4000 per half year to Messrs. Harvey, and the natural increase of their water-rents. It was, therefore, with the utmost confidence that he asked them to endorse the recommendation of the Board to pay a 7½ per cent. dividend. He hoped the statement he had made was satisfactory, and also that the Shareholders would feel that, in recommending the large increase of 1½ per cent. in the dividend, the Directors had not gone beyond what they were justified in doing, but that it was a dividend to which they were fairly entitled, and it was only paid after keeping the plant, machinery, and other matters in thoroughly efficient order. The Company had not increased their water-rates, as the public would make people believe, oppressively or unjustly. They had simply adjusted their water-rates, and those who had been paying infinitely less than they ought to have paid had been made to pay more. He was now in a position to answer the question as to the price they paid for their coal. The contract price for that which they consumed most of was 17s. 9d. per ton for large Welsh, delivered at Hampton, 16s. 6d. for Merthyr, and 11s. 6d. for small. The 17s. 9d. compared with 20s. 3d. in the previous contract; the other prices were about the same. Some of the other tenders were a good deal higher. He ought to have alluded to one other matter, and this was that during the half year the Directors had increased the remuneration of the Secretary from £600 to £800 a year.

Mr. C. M. VIALLS seconded the motion.

Mr. VAN TROMP asked how it was proposed that the Company should be represented before the House of Commons Committee.

The CHAIRMAN said that the Chairmen of the Water Companies had a meeting on the question last week, and they passed a resolution that it was desirable that the Companies should act together in the matter, and it was also resolved that one set of counsel should represent them, each Company being also represented by its Solicitor, and that the Solicitors should act together. In reply to a Shareholder, he added that he wished the item of accrued rents was much larger. It was really the amount due up to last half year, which was now in course of collection, and out of which the Directors would pay the dividend proposed. The total amount was £88,900 for the half year. Every half year they put aside £4000 for bad debts.

The motion was then put, and carried unanimously.

The CHAIRMAN next moved the payment of the dividends recommended in the report.

Alderman FINNIS seconded the motion, and it was also carried unanimously.

Mr. VAN TROMP moved a vote of thanks to the Chairman and Directors, and warmly eulogized their services, and the Chairman for the lucid and perfectly impartial statement he had made.

Mr. BRADFIELD seconded the motion, and it was carried unanimously.

The CHAIRMAN expressed the acknowledgments of his colleagues and himself, and said he only hoped their efforts would be as successful in the future as they had been in the past. They knew that the prospects of the Company were exceedingly good, and, as he had said before, if they were let alone they would give the best water at the lowest price, and pay the largest dividend.

The proceedings then terminated.

PROPOSED PURCHASE OF THE NEWCASTLE-UNDER-LYME GAS-WORKS BY THE CORPORATION.

A Special Meeting of the Newcastle Town Council was held on the 3rd inst.—the MAYOR (Mr. J. Gallimore) in the chair—to consider a minute of the Gas-Works Purchase Sub-Committee, to the effect that there should be reported to the Lighting Committee their opinion that it was desirable that the Town Council should exercise the powers possessed under the Newcastle-under-Lyme Gas Act, 1877, with reference to the purchase of the Newcastle Gaslight Company's undertaking. A meeting of the Sub-Committee was held on the 13th ult., and the resolution was submitted to a meeting of the Lighting Committee held on the 28th, at which it was decided to adopt the report of the Sub-Committee, and to recommend the Town Council to take the necessary steps to effect the purchase.

Mr. W. O. BRIGGS moved that the minute of the Lighting Committee recommending the purchase by the Corporation of the Newcastle-under-Lyme Gaslight Company's undertaking be confirmed. In doing so, he remarked that this was one of the most important matters which had ever come before the Town Council for consideration, and which the Corporation had engaged in. It would no doubt be within the recollection of the Council that under the Act obtained by the Corporation in 1877, powers were granted them to purchase the undertaking of the Newcastle Gaslight Company, and a time was specified during which notice of the intended purchase must be given to the Gas Company. This term would expire on the 1st day of August next. In November last the Town Council appointed a Sub-Committee to consider and inquire into the question of whether it was advisable for the Corporation to exercise these powers and purchase the gas-works. The Gas-Works Purchase Committee, having been duly constituted, proceeded to inquire from other Corporations and Local Authorities who had purchased gas-works the terms upon which such purchases had been made, and the results which had followed the transfers. In pursuance of the instructions given, a series of questions were submitted to the Corporations and Local Authorities thus applied to, and he thought he could not do better than avail himself of this opportunity of thanking the various Authorities for the great courtesy and readiness with which they had afforded full and complete information on the subject. The information thus supplied received the serious consideration of the Committee, and they were struck with the fact that the results all pointed in one direction—viz., that the purchase of gas-works had invariably issued in considerable advantages accruing to those Boards which had succeeded in negotiating the transfers. In every case there had been advantage in two respects—in the first place to the consumers, by reason of the tendency to a reduction in the price of gas when the works were under the management of the Local Authority; and in the next place to the ratepayers, by securing a balance of profit available for carrying out works of public improvement, thereby affording considerable relief to the rates. After considering the question very carefully,

the Committee could see no reason why the purchase of the gas-works in Newcastle should not prove as remunerative and advantageous—or at least secure to the borough some measure of the advantages which had been proved to result from the purchase of gas-works in other towns. Of course in Newcastle there were some points of difference which would follow upon different conditions as to the consumption of gas. For instance, so far as the statistics obtained by the Committee had shown, it would appear that the people of Newcastle were exceedingly economical in their consumption of gas; for while in Birmingham the consumption was 6000 feet of gas per head per annum, in Newcastle it was only 2500 feet per head. This might be an extreme comparison because of the large works in Birmingham, in which gas was extensively used for the purposes of manufacture; still there were other towns, of greater similarity to Newcastle, where the consumption of gas was much higher per head of the population than it was in this borough. The Committee, however, had based their calculations upon the present consumption of gas, which might be taken at a rough estimate as under 50 million cubic feet; and upon this calculation, and assuming that the charges upon capital account were not too great, they saw no reason why the gas-works might not, in the hands of the Corporation, prove remunerative, and of considerable advantage both to the consumers and the ratepayers. Of course it must be remembered that a good deal would hinge upon the price paid by the Corporation for the undertaking; but in the event of the Gas Company asking more than might be considered a fair and reasonable price, the Council ought not to hesitate to go to arbitration under the powers contained in the Act. At present the Gas Company declined to fix a price or state any figures until they had received official notice, under the corporate seal, of the intention of the Council to purchase the gas-works. The Committee had not, however, been working in the dark in this matter, but had obtained copies of certain statements which the law required the Gas Company to lodge at the office of the Clerk of the Peace for the county, and upon the figures contained in those statements the Committee had based their calculations as to what would be a reasonable price for the works. Assuming that the Council and the Gas Company could agree upon the price, the matter would be very simple indeed, and a transfer of the undertaking might be readily effected; but if they could not agree as to the terms, then the Council had power under the Act to submit the question of price to arbitration. The Committee had taken some pains to ascertain what were the principles upon which such arbitrations as these were conducted, and they found that the main evidence by which the arbitrator was guided in making his award was that given by professional experts as to the structural value of the works, plant, and mains. In fact, the whole works would be measured up by competent persons, and a valuation would be made. This seemed to be the fairest way of dealing with the case; but there was the element of expense surrounding a reference to arbitration, which the Corporation would no doubt, if possible, avoid. In fact, he thought it might be taken for granted that an appeal to arbitration would only be resorted to in case the Council considered the price demanded by the Company was an unreasonable one. The share capital of the Company, up to three years ago, stood at £20,000, with a mortgage loan of £5250. Since that time, however, the Company had issued new capital to the extent of £6000. This issue was made in December, 1877. The new capital now being called up was being used for the purpose of providing new mains, and the construction of a new gasholder and tank, so that the total capital, including the loan, now stood at £31,250; and the simple question which arose was—What shall the Corporation pay for the transfer of the undertaking? The usual mode of calculation had been reckoned at so many years purchase of the dividends, and from the returns the Committee had received, the prices appeared to have varied from 21 to 27 years purchase. But it would be delusive to suppose that the 21 years purchase would be the cheaper one, because it all depended upon whether the capital had been judiciously and economically expended, and this could best be tested by the cost per 1000 feet to pay the charges upon capital account. The cheapest works provided the largest quantity of gas at the least capital. This being the case, it became a question for the Council to consider whether the capital of the Newcastle Gas Company had been wisely and judiciously expended. Now the original Directors of the Company erected their first works at too great an elevation to supply the lower parts of the town with gas, and then the works had to be taken down and rebuilt where they stood at the present time. This being so, it was natural to conclude that unless the cost of the original works was written off the capital account, when the principle of valuation was applied the undertaking would prove to be overburdened with capital to that extent. It was a mistake, therefore, to suppose that the number of years purchase of the dividends was the best and only test to apply in order to arrive at the fair and reasonable price to be paid for the works. He trusted that the negotiations would be conducted in a conciliatory spirit, and without any acrimonious feeling. It was a business transaction requiring calculation, much careful thought, and full and fair consideration, and this he had no doubt it would receive. The Directors of the Gas Company were men of business; they were acting as trustees for their Shareholders, and would naturally try to obtain as good a price for their undertaking as possible. On the other hand, the Town Council were trustees for the ratepayers, and would see that too large a sum was not given for the gas-works; and in this respect they would be protected by the arbitration clause in the Act. He was of opinion that the lighting of the town ought to be in the hands of the Corporation, and he trusted that when the gas-works were transferred to the Town Council the undertaking would prove advantageous to the ratepayers and to the consumers.

Alderman BAYLEY, in seconding the motion, concurred generally in the remarks made by Mr. Briggs. He considered it was only right that the Corporation should have possession of the gas-works. He did not, he said, anticipate that any very large profits would be made out of the concern; but no matter how small the profits might be, he was of opinion that it would be to the advantage of the ratepayers and the consumers if the gas-works were in the hands of the Corporation. With regard to the delay which had taken place in the consideration of the gas-works purchase question, he thought the great cause of the delay was the excitement created some time ago by the electric light. It was thought that the electric light would supersede gas, and therefore the Council hesitated to enter into negotiations for the purchase of the gas-works; but this idea had now died away, and the only point on which the Council need have any anxiety was as to the attitude the Gas Company would assume in the matter. He saw no reason, however, to suppose that the Council and the Company would not be able to come to terms, and he really entertained a hope that the latter would accept a fair and reasonable price for their undertaking, without putting the town to the trouble and expense of referring the matter to arbitration.

Alderman LEECH congratulated the Council upon the satisfactory way in which they had discharged the duty of collecting information upon this important question. He quite agreed with Mr. Briggs that this was one of the most important matters the Council had been called upon to deal with, and that it required very careful consideration at their hands. The proposal of the Lighting Committee involved two questions—one of principle and one of evidence. In the first place they had to consider whether

it was right that they, as a Corporation, should undertake the duty of lighting the town. To his mind it was as much the duty of a municipality to take charge of the lighting of its district as it was to look after the highways and sanitary condition of the district. Therefore on the question of principle he felt bound to support the recommendation of the Committee. Then came the question of whether it was expedient for the Town Council to undertake the lighting of the borough—whether it was desirable for the Council to expend a large sum of the ratepayers' money in purchasing the undertaking of the Gas Company. Well, they were aware that at Stafford, Stoke, Burslem, Longton, and other places, the Corporations had purchased the gas-works, and it was a very singular thing that in every case where a municipality had purchased gas-works the undertaking had turned out very successful indeed. Besides paying the working expenses and the annual instalments for the repayment of capital borrowed, they had all been able to hand over a sum of money to the borough fund account. He saw nothing exceptional in the case of Newcastle which was at all likely to prevent the gas-works from being successfully carried on by the Corporation. As had been pointed out by Mr. Briggs, if the Town Council purchased the gas-works, they would probably be able to benefit the consumers by improving the quality and reducing the price of gas, and at the same time benefit the ratepayers generally by carrying forward to the borough fund a sum which would be used for the reduction of the rates. With regard to the electric light, he thought that gas had not yet had its day, and that the Council need be under no apprehension. From the evidence which had been collected with such care by the Sub-Committee, he was of opinion that the Council would do wisely to purchase the gas-works, and therefore he should support the motion.

Alderman MILLER advised the Council to be careful how they committed themselves to so important a measure as that proposed by the Lighting Committee. He was of opinion that the gas-works could be conducted much more economically as a private enterprise than they could be in the hands of the Corporation, and he also pointed out that as Newcastle was not a manufacturing town the Gas Company had to rely mainly upon private consumers. The matter was one which ought to be well considered before any particular line of action was decided upon.

Mr. BRIGGS remarked that the Gas Company were not allowed by law to pay a dividend of more than 10 per cent. He thought that gas-works conducted by a corporation might be more economically managed than if the works were conducted by a company who were not allowed to pay more than 10 per cent. With regard to Newcastle being a residential and not a manufacturing town, he thought this was something in their favour, as the undertaking would be less of a speculative one, and not so liable to be affected by depression of trade.

Alderman LEECH said he had just been informed that at a meeting of the Burslem Town Council the previous day the Gas-Works Committee placed £2000, out of their profits for the past year, at the disposal of the Council for the reduction of the rates.

The MAYOR said he was quite in favour of the proposal to purchase the gas-works. He did not quite agree with Alderman Bayley that the electric light had completely died away, because science was ever advancing, and the light might be so developed as to cause it to rise again. He was of opinion that for public places the electric light was really the light of the future. Still, notwithstanding this, he thought that the purchase of the gas-works by the Corporation would be a grand thing for the town.

The motion was carried unanimously.

Mr. BRIGGS said there was a second motion which followed as a corollary upon the first. He begged to move—"That in pursuance of the powers and provisions of the Newcastle-under-Lyme Corporation Act, 1877, this Council, by writing under their common seal, to be addressed and sent to the Secretary of the Newcastle-under-Lyme Gaslight Company, require the said Gaslight Company to sell their undertaking to the Corporation of this borough."

Alderman LEECH seconded the motion, and it was carried unanimously. The proceedings then terminated.

METROPOLIS GAS SUPPLY.

METROPOLITAN BOARD OF WORKS.

At the Meeting of the Board on Friday last, the Parliamentary Committee submitted a report, which was adopted, in reference to the Bill being promoted in the present session of Parliament, by the Corporation of the City of London, to amend the law relative to the testing of the gas supplied by the Chartered, South Metropolitan, and Commercial Gas Companies, and to the forfeitures to which the Companies are subject. The Committee state that, on its being resolved by the Board not to proceed with the Bill, as was originally intended, in conjunction with the Corporation, a letter was written to the Board of Trade, suggesting that as the Corporation had given notice of a Bill, and as the defects which it was sought to remedy had been pointed out by the Metropolitan Gas Referees, the Board of Trade might probably wish to obtain the concurrence of the three Gas Companies concerned, to the necessary amendments of their Acts of Parliament, so that the law respecting the testing of the gas and the forfeitures to be incurred for defective gas might be uniform throughout their districts. The Board of Trade, upon receiving this request, entered into communication with the Corporation and the Companies. They also consulted the Referees as to the best method of remedying the defects complained of, and amended the Bill of the Corporation in various particulars. They had since taken the opinion of all the parties concerned upon the Bill as amended; and as it appeared to carry out the object which was desired by the Corporation and the Board, and was, in the main, in accordance with the views expressed by the Board, the Committee, acting on behalf of the Board, had, with the other parties, agreed to the amended Bill, which would probably now be passed as an unopposed Bill.

WEST OF SCOTLAND GAS MANAGERS ASSOCIATION.

(Continued from p. 881.)

Mr. W. BRODIE (Paisley) read the following paper on

GASHOLDER CONSTRUCTION.

The paper which I have the pleasure to read to you on gasholder construction is one of very great interest to every gas manager and to all those who have an interest in gas-works. No one will be disposed to dispute the fact that this is an age of progress, and that engineering has been kept in the front during its onward march. The ponderous land engines for our manufactures—the large, heavy locomotives for our railways—the magnificent steamboats with their powerful engines—give us overwhelming evidence of the advance that has been made; and when we compare the present size of gasholders with those that were made little more than half a century ago, we find the progress of this branch of engineering has at least kept pace with the others mentioned.

The first gasholders were made either square or rectangular in shape. There was a square one near Paisley about 20 years ago; and there are two rectangular ones working at present at Messrs. Henry Monteith and Co.'s extensive works at Blantyre. They are inside a house; and at many gas-works at present the houses that used to contain gasholders are

being used for storing coals, &c. Although houses are not now used in this country to protect holders from the weather, still they are used for this purpose in Canada, on account of the severe winters they have there.

About the year 1814 scientific men were of opinion that holders should not be made larger than to contain 6000 cubic feet; and, as an evidence of the great progress that has been made, there is one being constructed at present about 580 times that size. At first holders were made of heavy materials, and counterbalanced to reduce the pressure; but about 34 years ago they were made of No. 18 sheets, which size suited very well, and saved counterbalance weights. Governors not having then come into general use, the holders had to be made light to regulate the pressure in the street-mains; but seeing that governors have now come to be generally used, gasholders should not be made of less than No. 16 sheets, if under 40 feet; if 40 and up to 100 feet, less than 14; above 100 up to 160 feet, No. 12 should be used. The first and last courses of crown, and top and bottom courses of side sheets, should always be two numbers on the Birmingham gauge heavier than the rest of the sheets; and holders about 160 feet should have for these $\frac{1}{2}$ -inch plate. As there is no considerable tensile strain on the crown sheets, it is a mistake to continue on large holders the thin sheets up to the crown plate. When you put a course of heavy plates next it you greatly increase the area where the light sheets commence, and consequently it will bear a much greater strain.

A very important thing is the rise of the crown, which should have neither too much nor too little rise. There was one near Glasgow lately which was a curiosity—it was about 30 feet in diameter, and had a rise of about 10 feet—the proper rise is 16 inches for the size. The person who made it was unaccustomed to the work. If made with too little rise, the water sometimes lodges; and I have seen holders that were very low at the crown plate, while the rest of the crown was up to the proper height. The water lay on the top of the crown plate and the first course of crown sheets. One is apt to think that the tension-rods are at fault in a case like this, but the joists are not properly cambered, as they have too much circle at the edge of the crown plate, and when bolted to the crown plate they carry it down in spite of the tension-rods. The best proportion for the rise of a crown is 17-32nds of an inch for every foot diameter of holder. I disapprove of the crown sheets being riveted to the purlins. There is always a slight hollow at the rivets, which keeps that part alternately wet and dry, and causes the plates to oxidize. Sheets for sides should be about 4 feet by 2 feet, and those on the crown about 5 feet long. Purlins should always be about 5 feet separate from each other, placed about 6 inches above the outside tail of each course of plates. The outer curb does for the outside course.

Holders up to 70 feet should have flat iron joists, and above that T-iron, to prevent them warping. There should always be one main joist at each column and one between, with minor joists between each of the main ones, these being about half the length of the main ones; and the purlins to which they are attached should be increased in size to carry them safely.

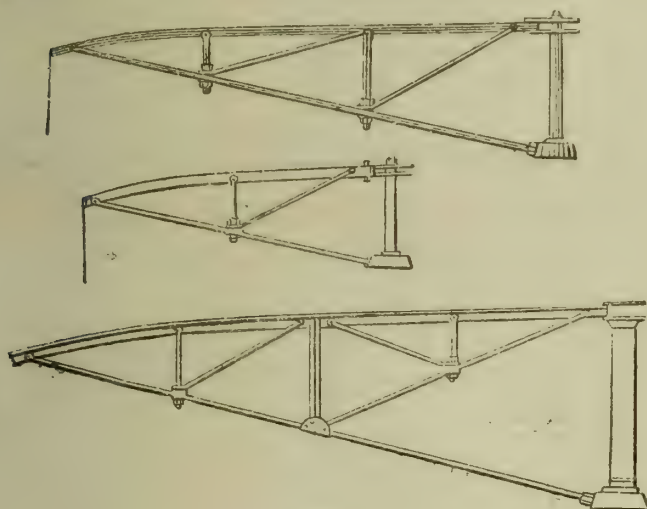


FIG. 1.

The detailed drawings, Fig. 1, give the members a better idea how different sizes should be trussed, than can be described in this paper. A 40-feet holder should have one T stiffening bar, with struts and rods at each column. One of 50 feet and upwards should have them both at the columns and at the centre between them. This is necessary because the sides of a holder are just like a piece of paper on edge, and will surely buckle if not supported; and it is just as important to have rest stones under every T-bar, because, if intermediate stones are wanting, the whole part from the centre of the crown to the outside between the columns will subside, T-bar and all, when the holder is resting. The rivets for 16, 14, and 12 sheets should be $\frac{1}{2}$ -inch diameter, placed 1-inch centres; and those for other parts—if 5-16th inch at $1\frac{1}{4}$ inch, $\frac{3}{8}$ -inch at $1\frac{1}{2}$ inch, 7-16th inch at $1\frac{3}{4}$ inch, and $\frac{1}{2}$ -inch at $1\frac{1}{2}$ -inch centres. Centre pillars should be at least three times the length of the rise of the crown, so that the tension-rods will be able easily to keep up the crown.

When telescopic holders were first made, the cup was formed of two single-iron bars, a flat plate joining them; but Messrs. Pigott and Co., of Birmingham—first-class makers—make them of plate iron, the one plate forming both side plate and dip, and dispensing with angle or the channel iron. Channel iron is generally adopted in Scotland, and I believe makes, all things considered, the best job. If you will look at the detailed drawings, Figs. 2, 3, 4, and 5, you will see the different modes. I think the flat channel bars are preferable to the others—not that the others will not do, but because the channel bars are very strong, and being flat they must cup evenly all round. The outer shell has sometimes channel and sometimes bulb T-iron guide-bars to keep the inner shell in proper position. Either way will do; but I prefer the T-bars, which press against the half-round cope on the cup of the upper lift. The inside lift may have a little play and still work well; but this will not be so if fitted with the channel bars and pulleys, unless great care is taken, as there is little room between the dip plate of the cup of the inner lift and the sides of the outer lift. The channel bars must be very shallow, and if the holder has any play the pulleys will come out of the channel, ride, and so prevent the holder from working satisfactorily. I have made them both ways, and got them to work well; but the one with pulleys and channel bars must be made to the exact size. A very important thing in making a telescopic holder is to have each lift at the top and bottom exactly to its circle. If the cups are

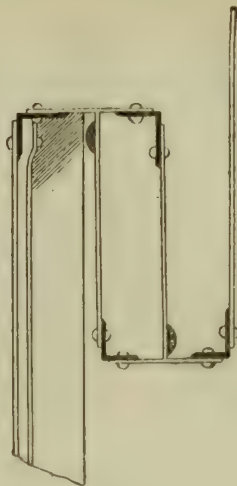


FIG. 2.



FIG. 3.

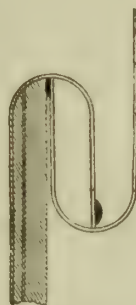


FIG. 4.

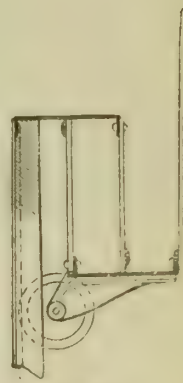


FIG. 5.

made a little oval, they will not work well, being so strong that very great friction will take place while cupping. All the rollers should be put on to keep them exactly round, and although the tank is made slightly oval, the brackets ought to be made to suit it. The water traps and pipes in a tank should be carefully put in and tested with water before the tank is filled.

In built tanks the stand-pipes outside the holder are sometimes recessed to the extent of their full diameter into the side wall of the tank. This is a very unsatisfactory way of constructing them, because you weaken the circle at the very place it should be strongest—namely, on the inside. Although the walls are strengthened on the outside at this part, still it is not equal to one having no recess at all. I know a case where one (near Glasgow) was built up half way when it collapsed at the recess, and had to be built again from the foundation. The better way is to take the pipe through at the bottom, and have the stand-pipes outside the wall;

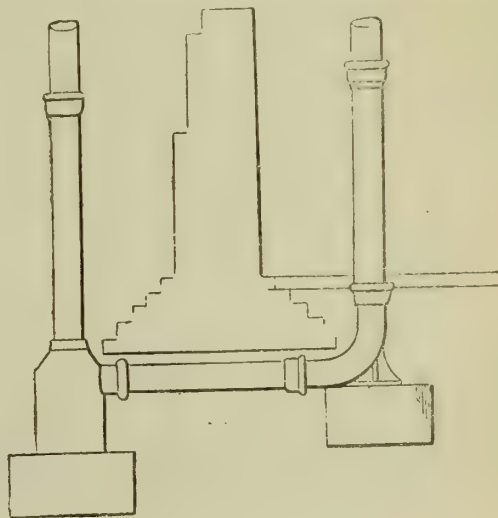


FIG. 6.

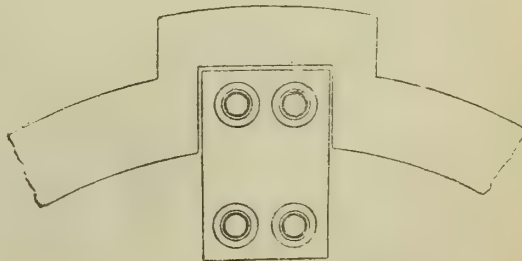


FIG. 7.

and if you look at the detailed drawings, Figs. 6 and 7, you will see clearly what is meant. Tanks for large gasholders should have at least 1 foot between the sides and the tank wall, and the smaller ones should have

either 9 in. or 6 in. between the sides and the wall. If the runs are sunk into the walls to their own depth, 6 in. will do; but if they project into the tank, then the tank must be 9 in. larger all round than the holders. Guide-pulleys less than 9 in. diameter do not suit well for the bottom pulleys; and if the tank is only 6 in. larger all round than the holder, you must either sink the runs or make the brackets to project into the inside of the holder. Before you can do so the sheet must be cut. This is troublesome and objectionable. In placing the runs in some tanks one very important thing has been lost sight of, and the result has been that some holders have come out of their position and broken the columns. It is quite common to have the runs in the tank forward and those on the columns back, thus breaking the continuous line of run that ought to exist from the top of the column to the bottom of the tank. If the runs are not in a line, stops should be put at the top of the tank runs to prevent the bottom pulleys from getting out of the runs. If the tank is completely full of water, and no stops, there is great risk of an accident through the pulleys getting out of their proper position. Where an accident occurred lately from that cause, the intermediate runs have been carried up about one foot higher than the cope of the tank, to prevent the same from happening again. By looking at the detailed drawings, Figs. 8, 9, 10, and 11, you will see the whole thing at a glance.

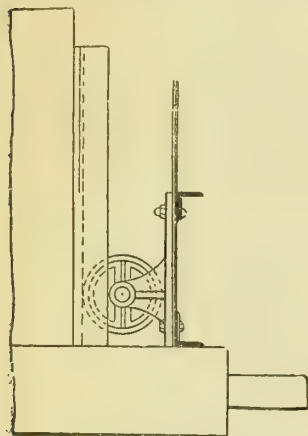


FIG. 8.

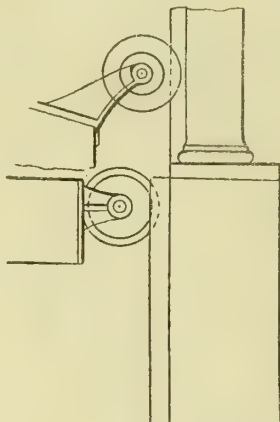


FIG. 9.

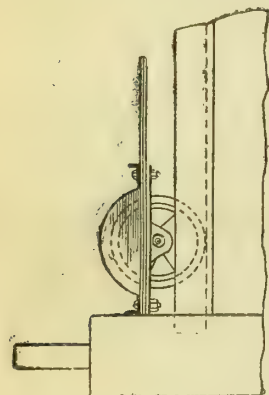


FIG. 10.

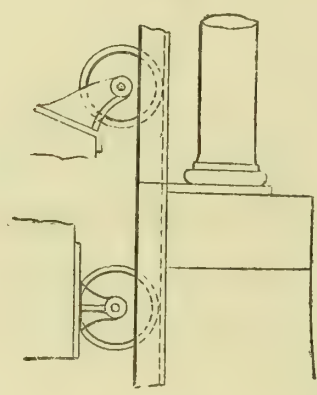


FIG. 11.

In no case should guide-rods with straps and bushes be used to guide holders, because they are very troublesome. Holders above 40 feet should have two bottom rings, with the joinings of the lower breaking band with the upper one; and where there is only one bottom ring, the clasps should be made long, with six rivets on each side of the joining.

It would be very difficult to give you a "constant" for the number of columns that ought to be in a holder of a given size. Holders 80 feet in diameter and upwards, if divided by 10, would give the number that would suit. Holders 60 feet in diameter should have 7 columns; 40 feet in diameter, 5; and 30 feet in diameter, 4. It is better always to have one more than one less than the number named. The soles of the columns are most important parts; and, while it is difficult to lay down exact data to go by in every case, an 18-inch diameter column will have a suitable sole if made double the diameter—say, 36 inches square. Smaller columns should be a little more, and larger ones a little less in the size of the square than twice their respective diameters. Girders are sometimes made, as you are all aware, of cast iron; but malleable iron is much preferred, and is safer than cast iron, which is so very treacherous, and so easily affected by differences of temperature. For small holders, a T-bar at the top and bottom, with flat diagonal straps and rosettes where they intersect each other, makes a first-class job. For large holders they are better with two angle-iron bars at the bottom, one on each side, and the same at the top, with straps and rosettes as described, or with neat cast-iron ornamental plates placed between the angles, as shown on the detailed drawing, fig. 12.

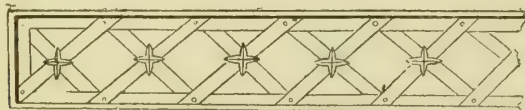


FIG. 12.

Holders are now fitted in some cases with two sets of girders—one at the middle, and the other at the top of the columns; and this certainly gives the framing a fine appearance, besides adding greatly to the strength. Holders of 100 feet in diameter and upwards should have a pier built in the tank to support the centre pillar while the holder is resting at the bottom. If this is done the trussing can be lighter. I have said nothing about untrussed crowns, nor do I intend to do so further than to state that I approve of the trussed ones, because, though the trussing is saved, you must have additional staging so as to keep the crown in position before it is filled. There are greater obstructions in getting the crown rivetted where the wood staging comes in than with a trussed crown, because the iron is less bulky than the wood.

In commenting on gasholders, many people have called them unsightly articles; but that only shows that they are bad judges. I have now been 34 years connected with their manufacture, and so far as I could see they are things of beauty, and are monuments of the skill and perseverance of gas engineers. Some persons are very anxious to dispense with them altogether, but I am afraid they will trouble them a long time yet. You may attempt to press the gas into smaller vessels, but extra pressure simply means stronger vessels, greater leakage, and the risk of a stoppage. Your old friend the holder is ever ready, and will never desert you. When the lightness of holders and their great size are taken into account, it is certainly a wonder that they are made so sweet to the eye. It is not like a ship or a boiler, the plates of which are heavy and rigid, and will stand as they are set; it is very different with working light iron, which is so liable to buckle. Five hundred mechanics may come to the workshop door seeking employment, and not one of them be competent to take the twist out of a sheet, or, in other words, to flatten it.

In regard to painting, all the malleable iron at least should receive one coat of good paint before leaving the contractors, and one during erection. The bottom course of sheets, the cups, and the sheets connected with them, should receive an extra coat.

In conclusion, I know that in reading this paper it contains little that is new to some of you, but there are others among you who know less, and if they derive any benefit I shall be very glad. In a paper of this sort it would be impossible to thoroughly exhaust the subject; but my object has been to draw your attention to the most important parts. Some people interested in gas-works know very little about gasholders. We were erecting one, and a director asked the manager when the bottom was going to be put into the holder. That manager has now gone to that "undiscovered country, from whose bourne no traveller returns;" and when I take a retrospective glance for 30 years or so, I feel sad in recalling to my mind so many of my dearest and kindest friends, gas managers, who have gone to their rest, and whose memories I shall ever revere.

Discussion.

The PRESIDENT: I am sure we have all listened with great pleasure to this paper. As I anticipated, it has been of a thoroughly practical description.

Mr. LEECH: What is the difference between a low-crowned holder and a high-crowned one? The holder that Mr. Brodie speaks of gave complete satisfaction to the parties who bought it. Another holder was put up alongside it, which did not give the same satisfaction.

Mr. STEWART: We are all indebted to Mr. Brodie for his paper, as the gasholder is an important part of our apparatus, and requires to be carefully constructed. I understand that some of the large holders are now being built altogether of steel. In this way they will not weigh so heavy as iron holders. I propose a vote of thanks to Mr. Brodie.

Mr. BRODIE: I have to thank you for the patient hearing you have given me, and Mr. Stewart for the compliment he has paid me. In reference to Mr. Leech's remark, I only mentioned the particular holder because it is different from those generally made. I have no doubt it was as good and as tight a working holder as could be had. A hat six feet high might fit a man of the ordinary size as well as one of six inches, but still it would not be nice to look at.

Mr. STEWART: But there is another point, and that is that a high-crowned holder would contain an amount of gas which could not be got for use, and its height would also catch the wind more than a low-crowned holder, and thus make it unsteady.

Mr. ROBB: This paper is one of the most valuable contributions we have had for a long time. The facts that Mr. Brodie has given us will be exceedingly valuable to small managers who are obliged to do engineering work themselves.

There was no time to further discuss the paper.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

So far as all descriptions of round coal are concerned, trade in this district is in a very depressed condition. For both the better classes for house-fire purposes and the common sorts for steam and forge purposes there is less demand, and a considerable number of the pits are not running more than about three days a week. Although there has been no alteration on the list rates this month, prices are weak, with a downward tendency, and where sellers have to push for orders it is difficult to say what prices are being taken. For best house coal at the pit's mouth not more than about 7s. 6d. to 8s. per ton is being obtained as a rule; seconds average about 6s. to 6s. 6d.; and common round coals 4s. 9d. to 5s. 3d. per ton. In the gas coal trade extremely low prices are ruling, and I hear that the Manchester Corporation, who have now settled for a portion of their requirements, have secured contracts for delivery over five years, and at prices below those which they have previously been paying; screened gas coal being delivered at the works in Manchester at under 8s. per ton. I also hear that other contracts in this district have been concluded for long forward deliveries. These extended contracts are regarded with considerable surprise in the trade, as many of the principal Lancashire firms are declining to quote beyond next season's supplies. Cannel is generally steady in price, sellers not being willing, as a rule, to take anything under last year's rates. Engine classes of fuel meet with a fair demand, and are without material change so far as prices are concerned, the small production of slack enabling colliery proprietors to be firm at late rates. Good burgy at the pit's mouth is quoted at 3s. 9d. to 4s. 3d., and good slack at 3s. 6d. to 3s. 9d. per ton.

There is very little inquiry for coal for shipment, and for steam coal, delivered at the High Level, Liverpool, or at Garston, sellers are not able to command much more than 6s. per ton.

Coke is still quoted at about 10s. to 13s. per ton at the ovens, but there is only a very limited demand.

In the iron trade there is no improvement, and local makers are offering at very low figures, without, however, securing much new business. For Lancashire pig iron, delivered into the Manchester district, makers are now willing to take 47s. 6d. per ton, less 2½ per cent., but there is so little being sold that a further considerable reduction of the output is in contemplation. For Lancashire bars, delivered into the Manchester district, prices now range as low as £6 5s. to £6 10s. per ton.

THE SOUTH STAFFORDSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The coal trade is the subject of much discussion at the present time in this district. Though for several qualities there exists a fair demand, nevertheless there is a great want of unanimity amongst sellers. The complaints of underselling which were rife prior to the drop are again raised, and much mischief is caused by a few of the minor local colliery owners offering the cheaper sorts at rates below those quoted by the leading producers. Instances of this practice are most numerous with the owners of some of the shallow pits, and whose coals are mostly suited to ironmaking purposes. The great diminution in the number of furnaces in blast having caused a falling off in the demand for ironmaking coal, as well as for

qualities used in the forge, is the only assignable reason; though it may be also accounted for by the fact that local colliery owners are eager to keep the supply in their own hands, and prefer to sell at reduced rates rather than share the trade with the Cannock Chase masters. In forge coal, the difference made is as much as 1s. 6d. per ton. In other respects things are looking in much the same condition as they were prior to the reduction, which it may be stated has not caused any perceptible change in the demand, though an increased business was confidently looked for. There are those who hold that a further reduction will yet be made, notwithstanding the unusually low figures now quoted; but this, it may fairly be said, will not take place at present, if indeed at all. Only a slight difference marks the present prices with those of a year ago, when they were considered to be as low as it was possible to bring them. For all the better qualities the call continues good, and most of the deep collieries are working full time. The Directors of the Cannock and Huntingdon Colliery Company, Limited, have just issued a report to the Shareholders in which it is set forth that operations will in all probability be so far completed as to have reached deep coal by June, 1883, and a further increase of capital to the amount of £20,000 is advised.

The strike which has existed amongst the miners in the Rowley district has been brought to a close, and nearly all the men have returned to work. The result was brought about by means of a conference between masters and men, at which it was agreed that a reduction of 8d. per ton on cobbles and 1d. on coal should be made. The terms as now arranged are—Cobbles, 10d. per ton; coal, 1s.; slack, 4d. Considerable discussion is taking place amongst colliery proprietors in this district on the terms of the Employers Liability Bill, and at a meeting of the South Staffordshire Institute of Mining Engineers, held during the past week, a resolution was passed to give it strenuous opposition.

Little business was done in the iron markets during the week, and but a limited number of sellers and buyers were in attendance. The inquiries from abroad were few, and such parcels as changed hands were small, and unimportant. Perhaps the principal buyers were speculators who have customers in view. Marked bars are firm at 48; good medium, 46 10s; though there is plenty of good merchant iron to be had at 46. Common pigs are offered as low as £1 17s. 6d., and better sorts at £2 5s. All-mine hot-air pigs stand at 44, and part-mine at 48. Girder and boiler-plate buyers are numerous, and prices are firm; but hoops, nail-roads, and angles are a slow sale. Galvanizers sheets are in good request, and prices are very firm. Manufacturers of finished iron continue to work full time, though the number of blast furnaces continues to decrease. It is indeed questionable if there are more than half the number of furnaces going at the present time that were in work at the end of January last. In accordance with the resolution passed by the South Staffordshire and the East Worcestershire blast-furnace proprietors, the men have received notice of 10 per cent. reduction.

THE YORKSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The iron trade is somewhat quieter than it was a short time ago, but many of the works are kept fairly going. The foundries where gas and water pipes are produced are doing about an average business, but there is not over much demand for colliery and other castings, owing to the quiet state of trade. On the other hand, the district furnaces are in full blast, and are for the most part supplied with ore from North Lincolnshire and other places, but little being raised in the district.

Fully an average tonnage of gas coal is being raised and forwarded to various places where the owners have contracts. It is satisfactory to state that the South Yorkshire coalowners have fared very well with regard to the gas coal contracts recently placed. In addition to the 40,000 tons secured by Messrs. Newton, Chambers, and Co., of the Nottingham contract, 7000 tons have been placed with Messrs. Wells, Birch, Ryde, and Co., the owners of the Hoyland Silkstone Collieries, who raise a large tonnage of gas coal. The Darley Main Colliery Company have 5000, Barrow 5000, Edmund's Main 5000, Cooper's 3000, and the Barnsley Silkstone 3000 tons, making a total of 68,000 tons out of the 100,000 tons required.

House coal continues remarkably quiet, whilst prices are lower than they have been for several years past. The rate at which Silkstones have been supplied to consumers in London—21s. per ton—will not allow the owners to receive more than 7s. to 7s. 6d. per ton at the pits. The tonnage to London and the South has of late been very moderate, the coal-owners contending that the rate, which amounts to 8s. 3d. per ton, including City dues, prevents them competing with seaborne coal. Several unsuccessful attempts have been made to induce the Directors of the Great Northern Railway Company to lower the tariff; but it is rumoured that the matter is being again considered, and there is some chance of a re-arrangement being come to. The quantity passing over the other lines to Lincolnshire, the Eastern Counties, and various West Riding towns, is only limited.

The steam coal trade is about the only branch where anything like activity is being displayed. A very fair quantity is being forwarded to Grimsby, where the owners enjoy extra facilities. There is also a good deal sent to Hull for exportation to the Baltic and other parts. The chief feature in connection with this branch of trade is the projected Hull and Barnsley Railway, the promoters of which pledge themselves to carry coal from South Yorkshire, and place it on board at 2s. 7d. per ton; the rate from South Yorkshire at the present time being 3s. 1d., and from Normanton or the West Riding 2s. 2d. per ton. The Bill is, however, being severely opposed.

Makers of coke are, notwithstanding the great increase in the output brought about by the erection of new ovens, doing a good business. Some important contracts have been placed in North Lincolnshire, where of late a large number of blast furnaces have been called into requisition.

The various railway companies who have contracts at the district collieries are taking a good deal of locomotive coal. To what extent the local collieries have participated in the contracts for supplying the Midland Railway, or what are the prices, has not transpired; but it may be stated that some collieries which tendered at a low figure have had their tenders returned.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The gas coal trade of the county of Durham has gone on upon an ordinary summer's average shipment over the past fortnight. The best collieries are shipping to the Continent, and are completing the ordinary contracts coastwise. They alter very little in the quantities they put into the open market. The outputs, as a rule, had been contracted for early in the year. They have few coals at any time to sell at the best pits. Second-class gas coals are not changed in value, and the demand is moderate. The inquiry for coke has improved. A contract was made for 15,000 tons of coke last week. Some new contracts were under negotiation. Prices are a little stronger than they have been, and there is an improvement in the business doing for steam coals. They are about 6d. per ton lower than they were. Manufacturing coals stand better in the

shipping market. There is an increase in the cargoes which are sent overseas to the Baltic, and to the Continent generally.

The tonnage to hand has been pretty abundant, and rates have been low. The shippers still command the market. Handy little sailing vessels have loaded gas coals for the Channel ports, and to inland and the eastern counties. Very little extra business has been done by steamers loading coal for London, over and above the regular gas companies boats which ply weekly to the Thames. What steamers have been freighted to London have had to do so at low rates. The Irish gas-works seem to have made up their supplies for the moment. No more sailing ships were chartered thence with gas coals last week.

The iron trade of the North is, if anything, a little better. The improvement is hardly perceptible. At the same time, however, it seems to have touched the bottom, and is beginning to work upwards again. The demand for chemicals is very quiet. The effect of over-speculation in the early part of the year is still keenly felt in this trade. The price of every description of chemicals is low. Lead is about 10s. a ton down from last quotations. The demand for copper shows an improvement. The timber trade is dull. Speculators find it impossible to force prices up in the trade, and the business that is transacted is for immediate use. The shipments of best fire-bricks and fire-clay goods continue. There is a falling away in the exportation of second-class sorts.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The annual general meeting of the Falkirk Joint Stock Gas Company, Limited, was held on the 1st inst.—Mr. T. Kier, of Linns, Chairman of the Directors, presiding. The Secretary, Mr. A. Allan, read the annual report and balance-sheet, which showed the Company's affairs to be in a very satisfactory condition. In consequence, however, of a large recent expenditure in extensions and upon new apparatus, the Directors did not deem it advisable to recommend a higher dividend than 5 per cent. on the preference shares and 4 per cent. on the ordinary stock. On the motion of the Chairman, seconded by Mr. W. Learmouth, Edinburgh, the report was unanimously adopted, and a dividend was declared in terms of the recommendation of the Directors.

The annual general meeting of the Shareholders of the Stonehouse Gaslight Company was held last Wednesday—Mr. W. Craig in the chair. A report was submitted by the Clerk, which stated that the works and street-mains were in a fair state of repair. The yield through the station-meter was considered satisfactory, being 8000 cubic feet of gas per ton of coal, at an average price of 14s. per ton; but the consumers meters did not show the same results, their indications being only 6000 cubic feet per ton of coal carbonized, thus making a loss of 25 per cent. These results, however, were very much more satisfactory than in former years. [Stonehouse, it should be mentioned, is in a mining district in the Middle Ward of Lanarkshire.] The price of gas was continued the same as last year—namely, 6s. 8d. per 1000 cubic feet. It was resolved to declare a dividend of 5 per cent. on the past year's transactions. Important extensions are about to be made to the works.

At the annual general meeting of the Shareholders of the Kinross and Milnathort Gaslight Company, held last Wednesday, it was resolved to declare a dividend at the rate of 5 per cent., and to appropriate a large portion of the surplus funds in the reduction of the debt existing on the Company's works. Mr. G. Laing was unanimously re-elected Secretary and Treasurer to the Company.

After careful inquiry, the Commissioners of Northern Lighthouses have, with the sanction of the Board of Trade, decided to adopt Keith's patent mineral oil gas-works in connection with the driving of two large gas-engines to work the new fog signals at Langness, Isle of Man; and Messrs. Stevenson, Edinburgh, the Engineers to the Lighthouse Board, have just completed the final arrangements with the inventor and patentee, Mr. J. Keith, of Edinburgh and Arbroath, to proceed with the work immediately. The work is being specially constructed by Mr. Keith for the purpose, at a cost of £1000.

The usual quarterly meeting of the Clyde Lighthouse Trustees was held last Wednesday, and from the minutes which were submitted on that occasion by the Committee of Management and Finance, it appeared that as the illuminated buoy on Rosneath Patch had been highly satisfactory, it was suggested that it deserved consideration whether it should not only be continued at Rosneath, but that similar buoys should be placed at Garvel Point in lieu of the lightship there, and also at Skelmorlie Bank. Estimates had been obtained for these extra gas buoys, and also for the erection of gas-works. Inquiry was to be made as to obtaining a convenient site for gas-works at Port Glasgow, and the consideration of the estimates was meantime delayed.

It has been resolved to form a special water supply district for the parish of Barry, including Carnoustie, Forfarshire. Mr. J. F. Bateman, C.E., London, has reported favourably on what is known as the Brax water scheme, and Mr. J. Falconer King, City Analyst, Edinburgh, has reported in favour of the quality of the water. Mr. A. McCulloch, C.E., Dundee, has been appointed the Engineer to carry out the scheme.

The Local Authority of Dalsert have concluded arrangements with the Bothwell Local Authority for a supply of water at 3d. per 1000 gallons. Contracts for the necessary pipes and for the laying of the same have been made, and operations will be commenced immediately.

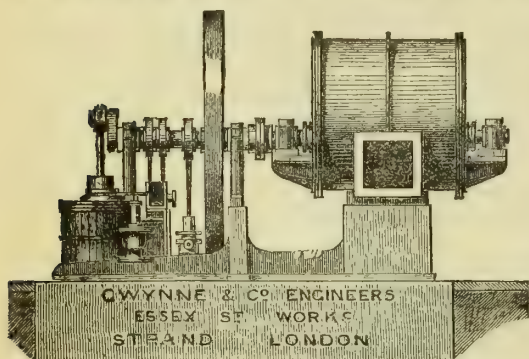
There was an advance in the price of pig iron from day to day in the Glasgow market up till last Thursday, when, amidst considerable excitement, a large amount of business was done up to 47s. 6d. cash per ton. From that point a very rapid reaction set in, and on Friday afternoon the close was sellers at 46s., and buyers at 45s. 10d. cash and one month—7d. per ton better than on the preceding Friday. An advance of 1s. per ton has been announced in the price of one or two brands of makers iron, but the values in the market are practically unaltered.

The coal market is exceedingly dull, and prices are very low.

TODMORDEN GAS COMPANY.—The tenth annual meeting of this Company was held on the 31st ult.—A. Ormerod, Esq. J.P., in the chair. The accounts of the Company for the past year were presented, as also the Auditor's report. The accounts showed the total receipts for the year to have been £6928 17s. 1d. Bad debts were written off amounting to £140; £100 was set aside as the nucleus of a depreciation account, and there remained as profit £2379 18s. 7d. Out of this sum the Directors recommended the payment of a dividend of 9 per cent. on the consolidated stock (£18,775), and 7 per cent. on the amount called up of the £10 share capital. These dividends, with £68 16s. for interest due on share capital paid in advance, would absorb £2020 1s. 5d., leaving a balance of £359 17s. 2d., which the Directors recommended should be carried to the reserve-fund account. The Company's works and distributing plant were reported to be in good working condition, and more than equal to the present requirements. The capital and liabilities of the Company (including the year's profit) were estimated in the balance-sheet at £34,719 14s. 1d. The various recommendations of the Directors were agreed to, and the three retiring Directors (Messrs. Halstead, Barker, and Ashworth) and one of the Auditors (Mr. C. Lord) were re-elected.

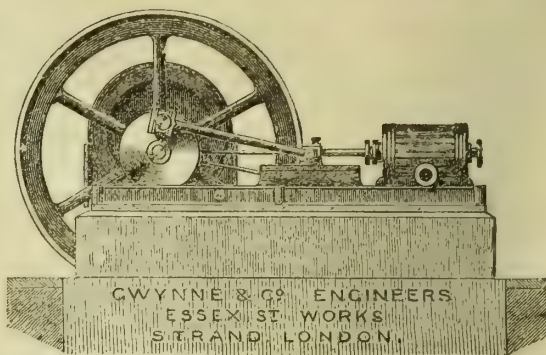
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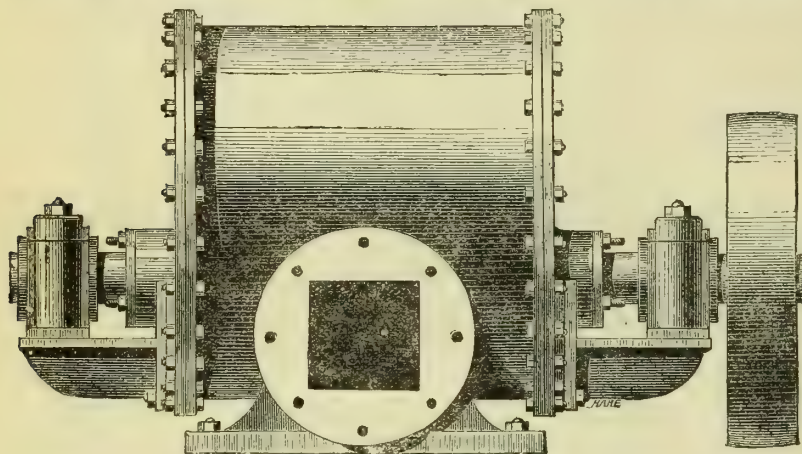
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WANTED, Readers of the NEW Edition, "Cooking & Heating by Gas;" on Burners, &c. Copies, by post, Threepence, direct from the Author, **MAGNUS OHREN, Assoc. M.I.C.E., Gas-Works, SYDENHAM.**

TO ENGINEERS AND MANAGERS.

WANTED, by a steady Man, a permanent Situation as BRICKLAYER and RETORT-SETTER. Seven years good reference. Apply to T. B. H., 24, Cheapside, SITTINGBOURNE.

WANTED, by the Advertiser, a Young Man aged 25. and Married, a Situation as **MANAGER** of a small Gas-Works. Applicant has a thorough knowledge of the Manufacture and Distribution of Gas in all its branches. Has had several years experience as Manager of a Works (make 15 millions). Has no objection to go Abroad. Satisfactory reasons for change. Address No. 663, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SITUATION wanted as Collector and METER INSPECTOR or any similar capacity in a Country Gas-Works, by an experienced man. Good testimonials. Address W., care of Mr. Burgess, 5, Denmark Street, CAMBERWELL, S.E.

HOLLYWOOD GAS COMPANY, LIMITED.

WANTED, a Manager for the above Works. He will be required, besides taking the general management of the Works under the Chairman and Directors, to take the in lications of the Meters. He must be competent to Superintend the Setting of Retorts, Laying of Mains, &c. Security will be required for the due discharge of the duties of the situation. Salary not less than £90 a year, with house, fire, and light. Applications, with testimonials as to character, ability, and experience, to be forwarded to the Chairman of Directors on or before the 28th inst.

THOMAS HUNTER, Secretary.

Hollywood, Belfast, June 10, 1880.

WANTED, Plans and Tenders for the Erection of Gas-Works to supply about 2200 cubic feet per 24 hours. Address **GRAHAM, MAXWELL, and FAIRLIE, SILLOTH.**

WANTED, the following Second-hand PLANT:

A **SCRUBBER**, about 12 ft. high, 3 ft. 6 in. wide, with Water Tank and Distributing Apparatus, and 6-in. Connections and Four-Way Valve.

A **PURIFIER**, about 9 ft. by 6 ft., and 4 ft. deep, with Sieves, Lift, 6-in. Connection, and Four-Way Valve. Price, &c., to be addressed to **GEO. WHITMAN, Company's Office, Aspley Guise, near Woburn.**

GAS SHARES FOR SALE—Ten £5 SHARES of the Hawick Gas Company, guaranteed dividend 10 per cent., payable yearly on the 26th of May. Address offers to No. 666, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A Second-hand Square STATION-METER, to pass 40,000 cubic feet per hour. Erected about 12 years. Made by Messrs. J. and J. Braddock, Oldham. Now in use at the Plymouth Gas-Works. To be removed to make place for a larger sized Meter. To be sold a bargain.

For price and particulars apply to **W. W. ANDREWS, 238, Kingsland Road, LONDON.**

FOR SALE.

GASHOLDER Sheets and Framing, 40 ft. diameter by 16 ft. deep; capacity about 17,000 cubic feet. In excellent condition. Will stand well to be Re-erected.

Iron Roof, 65 ft. long by 27 ft. span. Inside walls in good condition.

Hydraulic Main, Cast Iron, 22 in. deep by 20 in. wide and about 61 ft. long.

Apply to Subscriber, Montrose Gas-Works.

June 12, 1880.

ROBERT RENTON, Manager.

THE Redcar Gas Company have for Immediate Sale in excellent condition the complete **PLANT** of a discontinued Gas-Works capable of making up to 20 millions, any portion will be sold separately, comprising:—Gasholder, four Purifiers with Centre Valve and Connections, Scrubber, Condensers, Station Meter, Governors, Inlet and Outlet Pipes, Retort Fittings, Hydraulic Mains, &c.

Further particulars may be had on application to the undersigned.

M. FLIGG, Secretary.

THE Gloucester Gas Company, ceasing to manufacture gas at their old works, will have the undermentioned APPARATUS for Sale about the beginning of August, viz:—

About 150 feet of D-shape Wrought-Iron Hydraulic Main, size 19 in. by 19 in. Also about 38 ft. of D-shaped Wrought-Iron Hydraulic Main, size 20 in. by 20 in. Angular Condenser, consisting of six Vertical Pipes, 24 in. diameter, 19 ft. high, with three 12-in. Slide-Valves and 12-in. Connections.

Scrubber (round), 5 ft. by 20 ft., with three 12-in. Slide-Valves, and 12-in. Connections.

Exhauster (Jones) to pass about 15,000 feet per hour.

Exhauster (Beales) to pass about 25,000 feet per hour.

Two Vertical Steam-Engines, each about 6-horse power with Pulleys, and Shafting used for driving the above.

Boiler 14 ft. 6 in. by 3 ft. 6 in., with Centre Tube, and four Galloway Patent Tubes.

4-horse power Horizontal Steam-Engine.

Three 4-in. Pumps, with cranked Shafting and a pair of Mitre Wheels.

Two Purifiers, 16 ft. by 8 ft., with six 12-in. Slide-Valves and 12-in. Connections.

Gasholder, Double Lift, with Cast-Iron Tank, capacity 37,000 feet.

Gasholder, Double Lift, capacity 100,000 feet.

Gasholder, Double Lift, capacity 240,000 feet.

One 12-in. Governor, by Wright, London, with 12-in. Valves, Bye-Pass, and Connections.

Two 12-in. four-way faced Valves, by Cockey.

For further information, &c., apply to the undersigned, **R. MORLAND, Engineer.**

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THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 22, 1880.

Circular to Gas Companies.

CONTINUING our notice of the proceedings at the recent meeting of the British Association of Gas Managers, we have to-day to deal with the first five papers read—the sixth, that by Mr. G. E. Stevenson, on the question of publishing comparative working statistics, we commented upon in last week's "Circular," and have nothing further at present to add to the remarks we then made.

Mr. Travers's paper on the Thermal Power of Gas Cooking Stoves, published last week, was chiefly noticeable, apart from the painstaking of the author which was manifested in its preparation, for the surprising way in which it exhibited the inefficiency of much of the apparatus that is sold at the present day for the utilization of gas as fuel for cooking and heating. Mr. Travers was commendably careful in preparing the gas which he used for his first experiments, in order to get a comparison between the heating power of gas from various kinds of coal, of different value as regards illuminating power; but the special requirements of the case did not apparently warrant the more exhaustive analysis which would have helped to distinguish the samples with greater relevance to the purpose for which they were required. And we are not sure that the heating power of gases of different specific gravity can be fairly tested with the same burner. Mr. Travers was only able to get the low result of 244 units per cubic foot with a ring atmospheric burner, of the kind so generally supplied with the usual cooking-stoves, while with a higher form of burner he obtained 580 units out of the same quantity of gas of equal power. Mr. F. W. Hartley subsequently stated that he had himself obtained 626 units with Nottingham gas, which was a result with which he appeared tolerably well satisfied. Now, comparing Mr. Travers's highest result with his lowest, it will be observed that the unfortunate user of the worst burner would have to pay nearly two and a half times as much as the happy possessor of the better apparatus for the same amount of work; and would, consequently, be a less enthusiastic believer in gas cookers generally. It speaks well for the advantages of gas for cooking and heating, that even when so heavily handicapped with wasteful appliances, got up by manufacturers, whose sole aim has been to provide a showy article at a low price, it should still have made such headway as it has. It is, however, quite certain that rubbishy stoves and heating

burners, not always low priced, have done an incalculable amount of harm in hindering the rapid extension of gas for other than lighting purposes; people who have once been deceived in this way having been made incredulous of benefits derivable from its use.

Mr. Travers touched upon a subject which has attracted a considerable amount of attention, and upon which the last word has yet to be spoken, when he hinted at the practicability of making gas of good heating power, but of low illuminating value, to be used for both purposes, subject to carburetting when intended for the latter application. The gas referred to can be easily produced, but the carburetter is not as yet in existence, although it is not an impossibility, and we may yet live to see it in the power of the consumer to regulate the illuminating value of his gas as easily as he now can its quantity.

In the discussion that followed the reading of the paper, Mr. Hartley gave some exceedingly interesting facts respecting the heating power of gas, which he had ascertained from his own experiments; and the careful manner in which Mr. Hartley is known to make his observations lent additional value to his remarks. The very simple apparatus described by Mr. Vernon Harcourt, as constructed under his directions, for keeping frost out of greenhouses, by the heat of the products of combustion of a small gas-flame, was a fitting addition to the information given on the subject of the paper by the author, Mr. Hartley, and others, and we are convinced that heating apparatus of this kind needs only to be known to be appreciated, and the principle involved may, with every chance of success, be applied in very much larger apparatus than Mr. Harcourt described.

Mr. Harrison Veevers's paper on Testing Gas Coals and Cannels, which appears in another part of this week's issue, was substantially an account of the author's examinations of various descriptions of the raw material which he had had submitted for his own use at Dukinfield, and the actual results were consequently chiefly of local interest, although the importance of the subject in its general application was evidenced by the long discussion which followed the reading of the paper, and which was confined almost entirely to the method of testing adopted by the author, without much reference to the examples treated thereby. Some exception was taken, and, as it appears to us, with considerable force, to the author's plan of testing the illuminating power of the gas at certain intervals, in connection with the quantity given off from the retorts between the same periods of time. While acknowledging the fact that much valuable information respecting the quality of the gas being made at the precise moment when the photometrical observations are taken may be obtained in this way, it is evident that a mean of such observations, even if the varying quantities of gas produced between the regular intervals before mentioned be also taken into account, cannot give a reliable average value for the gas so produced when stored in bulk. Mr. Veevers contends that his method is independent of a gasholder, and can therefore be used when other methods which involve the use of the latter cumbersome apparatus are unavailable. But this contention does not touch the main question, which is whether any method of testing the gas obtained from a given weight of coal, other than in bulk, is competent to give data really worth having. Testing gas, in the sense commonly understood in the profession, consists in obtaining definite results of the nature of such as are arrived at in actual working, from the material examined. This is a very different thing from the process known to chemists as analysis, which means the disintegration of a compound into its component elements; or, sometimes, when the analysis is not required to be exhaustive, into the forms of those elements. This is almost invariably effected by means altogether different from any treatment which the material may receive for its practical and economical separation into the same elements. Hence the practice has become very general for gas managers to "test" their coal, as a means of estimating its value supplementary or preferably to the stricter analysis which goes to show, not what the gas maker can get out of it, but of what it is fundamentally composed. But it is plain that the former method of examining coal depends for its value simply and solely on the closeness with which its conditions conform to those of actual working. If any great discrepancy should exist between the testing apparatus and the working arrangements, any results obtained by the operation of the former must be to that extent inapplicable as a gauge for the latter. In ordinary working, the gas from many retorts in all stages of carbonization, some newly charged and others nearly worked

off, is intimately mixed in every stage of its passage to the holder, and is there allowed to stand long enough for the attainment of equality in constitution, in which state it is eventually consumed. With these considerations in view, it is difficult to see how any method of testing which ignores the holder can be anything more than curious for comparison among its own results, and for the lessons it may thereby indirectly teach. Thus, Mr. Veevers's method may be taken as a means of estimating the effects of heat in retorts, quite as well as for its ostensible purpose; indeed, considerable evidence of this was offered by the author himself, in his explanation of the two first examples given in the table of illustrations which accompanied the paper. Conspicuous proof was certainly afforded, by the results given in this table, of the permanent necessity for ascertaining the temperature of gas-retorts generally—but more especially experimental retorts—in order that a definite idea may be formed of the true practical value of the coal carbonized therein. The method of measuring the temperature as subsequently described by Mr. Sugg, by plunging blocks of cast iron, previously heated in the retorts, into water, and noting the rise of temperature of the water, is capable of determining this particular point with sufficient accuracy for all practical purposes, and is very easy of application. Again, if the advantages of high heats and short charges had needed further confirmation, it might be found in Mr. Veevers's experiments, wherein this lesson also appears to lie on the surface. Mr. Hunter, of Stalybridge, is of opinion that the illuminating power of the gas evolved at the end of the second hour from retorts filled with a six-hour charge, is a good average indication of the quality of the whole. This probably means that at this time the coal is thoroughly and equably heated, and has attained its maximum expansion, so that the major portion of its volatile constituents are then being given off, the most volatile hydrocarbons having already gone. This observation is interesting, so far as it goes; but much must depend on the heat of the retort, which, however, is indicated to some extent by the condition stated by Mr. Hunter—that it should be capable of working off a six-hour charge.

A good number of speakers joined in the discussion, but a general impression might be gathered from the statements made, that methods of testing primarily intended to guide individuals as to the results they should expect in practice, are apt to imitate the defects as well as the advantages of practical work, and to that extent may not be strictly comparable one with another. For instance, a bad experimental apparatus for making gas might be actually excelled by some full-sized works, while considerations which need not be detailed might render nugatory the results of others. Hence it might be inferred that nothing short of ultimate analysis, conducted by a trustworthy chemist, is at all reliable, and that having obtained a certain statement of this kind, it should be left to practical men to approach it as nearly as they can. But, unfortunately, the illuminating power of a coal or cannel is only to be satisfactorily determined by actual inspection, and for this purpose the gas must be produced and consumed in the prescribed manner. Perhaps, after all, some generally acceptable results might be secured by a modification of the method advocated by Mr. Carr and other speakers, wherein the value of the gas produced in experimental retorts at a stated temperature—say, 2000° Fahr.—should be determined with reference to both quantity and illuminating power, and the residual products should also be valued, not omitting a record of the impurities in the gas and the percentage of ash in the coke. Then if—and it is, of course, a very large “if”—the apparatus employed is in perfect order, and all possible care be taken in the manipulation, no such glaring discrepancies as we now meet with in the recorded tests of the same description of coal should be possible, or, if occurring, it would only be in such circumscribed limits as would render discovery of the disturbing cause much easier of attainment.

The use of gaseous fuel for heating gas-retorts was, perhaps, the most practical subject which occupied the attention of the late meeting, and the manner in which it was brought forward by Mr. F. Livesey and Mr. G. E. Stevenson in their respective papers, and subsequently treated by the various speakers who took part in the discussion, left nothing to be desired. Unless appearances are very deceptive, this is a matter which has now taken firm hold of the gas engineers of the United Kingdom, and the day cannot be distant when the reproach of being so far behind their continental brethren in this respect will no longer apply to them in the same degree as at present. Mr. Livesey's communication was particularly

interesting, as it described some experiments on a working scale which have been carried on at the South Metropolitan Gas-Works, and which go to show that the first principles of the Siemens furnace having been clearly understood, it is comparatively easy to construct modified furnaces in accordance therewith, which shall meet the peculiar requirements of almost any kind of retort-setting. In fact, when once the besetting causes of failure have been carefully guarded against—and this is by no means difficult—it is quite as easy to construct a gas generator as an ordinary furnace. While Mr. Livesey recounted how he had succeeded by working on independent lines, profiting, of course, by the example of those investigators who have preceded him, Mr. Stevenson gave a narrative of how Herr Liegel, who was one of the earliest workers in this field, constructs the newest generators which bear his name. Mr. Livesey explained how easily the desired effect may be produced, and Mr. Stevenson showed one of the most perfect appliances now used for the same purpose; and thus the beginning and the end of effort were placed before the meeting in instructive juxtaposition.

The central principle of gas generator furnaces—the combustion of fuel to carbonic oxide, and the subsequent ignition of this inflammable gas in the retort furnace—needs no further explanation than has been already given in these columns and elsewhere; but there appeared to be some difficulty, on the part of several of the speakers, in comprehending the reasons why it has been found advantageous in practice to produce and consume this particular compound of carbon and oxygen, instead of burning the fuel directly to carbonic acid in the usual way; more particularly as it is well known that the production of the latter compound is attended with the evolution of higher thermal power from the fuel employed than the former. This is partly to be accounted for by the fact mentioned by Mr. Stevenson, that such an excess of air must, in practice, be brought into contact with any kind of solid fuel, in order that no part of its bulk may escape exposure to oxygen, that the resulting heat is enormously diluted by the means adopted to cause its development; whereas two gases such as carbonic oxide and air may be made to combine in proportions almost confined to the requirements of theory, and this great advantage more than balances the higher value possible, but never really obtained in the other case. But in addition to this circumstance, which may be called a practical drawback, conceivably removable by improvements in appliances for the use of solid fuel, the local intensity of the combustion of carbonic oxide—that is to say, the temperature which it immediately imparts to the products of its combustion with atmospheric air—is really higher than that given in the direct formation of carbonic acid, for the reason that the bulk of its combustion products is less, and their temperature is correspondingly increased. Another reason for the advantages found to accrue from the use of gaseous fuel, in retort-settings especially, is found in the fact that the heating flame itself is actually in contact with the retorts, and practically envelopes them in a sphere of the most intense ignition, and this continuously; there being no necessity for periodically exposing the interior of the setting to cold air, as with the direct-acting furnace, and thus the utmost regularity in working is readily attainable.

There was much to be learnt by the direct comparison of Mr. Livesey's designs with Herr Liegel's arrangement. In the first place, in all furnaces which generate carbonic oxide there must be a region where the air is first admitted, in which the ignition is extremely violent; so much so as to fuse any brickwork thereabout, unless it be highly refractory, or unless special means be provided for reducing the temperature. Again, the slag or clinker which is formed in the generator must be got rid of; and these two considerations are treated together in all generators, but not by any means in the same way. Herr Liegel faces this difficulty of the fusing of the brickwork by using specially made blocks of the most refractory material obtainable, and then utilizes the intense heat for fusing the clinker, in order that it may run out of the generator; so that, provided he can get his blocks to stand, the high temperature of the primary ignition is rather an advantage to his system than otherwise. It is, however, evident that some nicety of management is required to effect the regular fusion of the clinker, and yet avoid destruction of the brickwork. It is only fair to Herr Liegel to say that he claims that there is no difficulty in doing this; but Dr. Siemens, the eminent introducer of these furnaces, himself acknowledged having met with considerable trouble in the attempt, eventually abandoning it in favour of the plan adopted in Mr. Livesey's furnaces, which consists in admitting water or steam with the air, in such quantities that the ignition temperature is lowered

by the abstraction of the heat necessary to decompose the water, the effect being that while the brickwork is protected, the clinker does not form masses by partial fusion, but is readily removable in small pieces, and the excess of heat, transported from the place where it is not required by the aqueous vapour which it reduces to its elements, is reproduced in the proper place when the resultant hydrogen is burnt with the carbon gas in the retort-setting. Herr Liegel makes a point of "stepping" the brickwork in the interior of the generator, in order to stop the air from creeping up by the walls instead of permeating the mass of fuel; while Mr. Livesey, having commenced with stepping, proposes to discard it in future, as he finds that the interior soon became smooth with ordinary wear; this is, of course, similar to what is observable in ordinary furnaces, but it somewhat demolishes Herr Liegel's claims in this particular respect.

One of Mr. Livesey's arrangements, as to which he appeared somewhat sanguine, was an ingenious construction of a generator within an ordinary setting, instead of separate and apart from the retort-stack, as usual. Saving of room in the retort-house, and utilization directly of the radiant heat of combustion, were the chief advantages claimed for this innovation, which, moreover, promises, with some modifications, to be peculiarly suitable for retort-houses which have no stage, and where the separate generator with its serving tunnel would be deemed unsuitable. Yet it must not be overlooked that space in the coke-hole is only obtained at the cost of space in the retort-setting—room that would otherwise be filled by a retort having to be occupied by a furnace; and as to radiation, there is not much from a separate generator when properly built and jacketed with a non-conducting layer, as used by Dr. Schilling. So that the question of putting the generator within or without the setting would appear to resolve itself into a matter of comparative value of space, granting, however, that this is sometimes of paramount importance.

It was of very great advantage to those present at the meeting, in order to a full comprehension of the whole question, that they were able to hear Dr. C. W. Siemens himself describe the course of his early researches into this system of heating, with which his name is so indissolubly connected. It may be quite true that the forms of apparatus which represent to us the latest developments of the practice of heating retorts, are merely reproductions of designs tried long since by Dr. Siemens, and rejected by him as imperfect; but while acknowledging this, and confessing that more perfect arrangements for regenerative heating on a large scale have long existed, it is still open for us to say that simple appliances of the kind we have mentioned are perhaps better suited to the comparatively small requirements of gas-works, and that, without robbing Dr. Siemens of any portion of the honour which is so conspicuously his due, great credit must be given to those who seek merely to embody the principles which he discovered, in simple forms intended for a special and restricted application.

Mr. Barker's paper on Gasholders was in many respects a model for communications of this nature. Clearly written, forcibly yet temperately argued, and well illustrated, it could not but claim a considerate hearing from any one who might fail to agree with the conclusions to which it arrived. The construction of gasholders, of the dimensions now becoming so common, is replete with problems concerning strength and stability which tax the highest constructive ability in their solution, and no time could be more appropriate than the present for raising the question whether it is convenient, or even safe, to go on increasing the size of these already huge structures, without searching inquiry into the conditions necessary to be observed for their safety, in order that it may be ascertained whether the method of construction which has been successful hitherto with holders of moderate capacity, will be also sufficiently trustworthy if almost indefinitely extended. This is an inquiry which Mr. Barker answered in the negative, at least to the extent of affirming that a totally different design is preferable, in which contention he was not followed by a single supporter when his remarks were subsequently discussed; and we are compelled to say that further reflection has not convinced us of the soundness of his proposals. Mr. Barker confined his remarks entirely to large holders, in which we shall follow him, for one reason that there is nothing novel in the application of a central guiding pillar for small holders; while in the case of larger holders enclosed in houses, in which the central pillar has been adopted, there are really no questions of stability involved.

It is only when we have to consider the case of a large

holder of considerable height, freely exposed to stress of weather on all sides, that the conditions under which stability is to be ensured become of paramount importance. Let us take, for example, the case of a gasholder 200 feet in diameter and 100 feet high, in two lifts. The first condition necessary for its efficient working—that of the level of the holder, with particular reference to the hydraulic cup—would appear very difficult of fulfilment when the adjusting base is so small as that afforded by a central column. If a holder could always be adjusted exactly as it rests on its ground supports, this objection would have less weight; but experience proves the contrary. And with a number of roller-paths around the holder in the usual way, the absolute perpendicular of the guides and the simultaneous bearing of all the rollers is of infinitely less importance than when a fourth or a fifth of their number are alone to be trusted in a close group. The force which might at any time have to be transmitted through a very few rollers on Mr. Barker's plan, would in such a case be enormous, and the failure of one of them would probably be attended with terrible consequences. Consider also the tremendous crushing effect which would be produced on the casing of the column at its lower portion when a heavy gale was rocking the holder. Would not the iron plates loosen and fail long before the force which would overturn the column could be reached? Setting aside the question of providing a proper foundation for the column—although, except in rare cases, it would be no easy matter to pile thousands of tons of ballast in a cylinder of moderate area, and keep it free from all risk of settlement—and ignoring also the difficulty of painting and keeping the inner sides of the annular holder in proper order, which Mr. G. Anderson urged with reason, the great and it may be said insuperable objections to trusting the transmission of tremendous forces through a very few points, to a single cantilever, still remain, after due consideration has been accorded to everything which Mr. Barker was able to bring forward in support of his theory.

There is not much to be said for Mr. Barker's proposal respecting the connecting girders between gasholder guide-columns being laid on horizontally instead of vertically, as is the general practice. If these girders are to be considered as struts, they are certainly best fixed in that position in which they will be most rigid; and if they are ties, then again they should not be made liable to sag. But these portions of a gasholder framing are really struts, and should only be designed to keep the upright guides in place. The ties should most decidedly be diagonal. This will be seen at once by supposing the case of a holder framing consisting of columns tied together with girders only at the top. In the event of pressure being exerted on any one column, it can only be relieved by a strain being put upon the rest, just at the point where they are all weakest—viz., at the farthest distance from their bases; whereas if the same thing were to happen to a ring of columns tied down by diagonal rods, the strain would be relieved by them at once in the best possible way. Hence the soundness of Mr. G. Livesey's principle of bracing the new holder which he is constructing at the South Metropolitan works in the Old Kent Road. Whether Mr. Livesey is quite warranted in calling his system of framing an exterior column, is not altogether clear; but there can be no doubt that he is justified in discarding the false column which ought to be a cantilever, and the false girder-tie which should be a strut, and in elevating the diagonal bracing into its proper place.

One word as to wind pressure. Mr. Livesey is probably right in his statement that half the holders in the kingdom ought to have been blown down, if the wind sometimes blows with anything like a pressure of 50 lbs. per square foot. But it is quite possible that from the generally low position of holders, also frequently sheltered by buildings, a holder of narrow margin of stability may never have been subjected to such fearful blasts of wind, which moreover are generally very circumscribed in their field of greatest effort. There is doubtless much truth in Mr. Livesey's opinion that the *vis inertiae* of a gasholder has something to do with its practical immunity from instant destruction by a hurricane; but it must be remembered that a holder always bears pretty firmly against about half of its guides, and it is conceivable that if the thrice-repeated gusts, of which sailors speak, were to fall in with a holder's period of oscillation, the result might be easily foreseen; and although this has perhaps never yet happened, there is no certainty that it never will.

The Municipality of Brussels, who have the control of the gas supply of the city, recently received an offer from a large

financial Company for a concession of the gas undertaking. It appears that the outlay on the works up to the end of 1879 had been about 12,200,000 frs. (£492,000), and it was proposed to give the Municipality 15,000,000 frs. (£600,000) for the entire concern, being a premium of rather over £100,000 on the sum actually expended on the works, which were to revert to the city at the end of the concession. The public thoroughfares were to be lighted gratuitously on the most improved systems, on the single condition that such systems had been tried for three consecutive years in some place of equal importance and similar general arrangement to Brussels. For a period of six years the Municipality were to receive annually a sum of 600,000 frs. (£24,000), which added to the interest on the 15,000,000 frs. paid for the concession would make a sum equivalent to the profit on the last year's working. At the expiration of the six years the Municipality were to share the profits. Finally, it was proposed that the consumers should pay for their gas at the rate of 18 instead of 20 centimes per cubic mètre, which would be equal to a reduction from 4s. 8d. to 4s. 2d. per 1000 cubic feet. The whole question came before the Brussels Communal Council on the 25th ult., when, after some discussion, it was decided by 21 votes to 4 that there were no grounds to justify the Council in pursuing the negotiations for the transfer of their gas undertaking.

The report of the Metropolitan Board of Works for 1879, recently issued, is wonderfully reticent concerning the proceedings of the Board respecting the installation and maintenance of the electric light upon the Victoria Embankment and Waterloo Bridge. The number of Jablochhoff lamps in use is stated, and the arrangements by which they are worked are detailed, but no hint of any kind is to be found of what the Board think of it all, or what their future proceedings in the matter are likely to be. It is stated that the experiments—which, by the way, are rather extended, in point of time, for “experiments”—have been undertaken by the Board with Metropolitan funds for the general Metropolitan advantage; but have the Board quite satisfied themselves that this extra illumination of the localities named is in all respects desirable? and if so, is the system which they have patronized the best that can be obtained? We are not aware that the Board have attempted to try the expediency of any of the improved systems of gas lighting in the thoroughfares over which they hold the necessary control. While not grudging the Jablochhoff lamps their makeshift position on the Victoria Embankment—for variety is pleasing, and the twinkling carbons give, within brief intervals, every degree of illumination, from noonday blaze to soft twilight mystery—it would only be fair for the Board to try the new gas-lamps for a season; that is, if their steadiness and warmth of colour do not prove to be insuperable obstacles to their adoption.

Considerable importance was recently given by some English and French papers to the fact that the Paris *Salon* was to be lighted by electricity, and the asserted superiority of this light over gas for the illumination of paintings was accepted unquestioned by those who were too indifferent or too prejudiced to inquire very closely into the matter. We find, however, that a class of persons who must be admitted to have some slight knowledge of what is a good and what a bad light for a picture—the artists themselves—have protested against the use of the electric light at the *Salon*, this being stated to be the most unfavourable kind of illumination for effectively showing off their productions. The protest, however, comes rather too late. The agreement entered into with the Jablochhoff Company for the supply of the electric light has been carried out, and this system will, we suppose, remain in use until the end of the season, artistic protests notwithstanding. Again, when sober-minded, right-thinking people ventured to express a doubt as to the permanent adoption of the electric light by those shopkeepers in Paris who had been so ready to take it up as a novel and attractive, not to say startling kind of advertisement, their remarks were received by the worshippers of the rising luminary with all the impertinent contempt usually manifested towards opponents by converts to a new faith. Yet what do we find? The *Figaro*, whose office in the Rue Drout, was one of the first buildings to be illuminated exteriorly by means of the electric light, has positively abandoned that system, and substituted for it two gas-lamps similar to those used by the Paris Gas Company in the Rue du Quatre Septembre, where, by the way, only half the original number of burners are now lighted, and yet the general illumination of the thoroughfare is, we learn, if anything, a trifle better than that of the neighbouring Avenue de l'Opéra, where the electric light still reigns supreme!

Water and Sanitary Notes.

THE end of Sir William Harcourt's inquiry into the London Water Supply is at present lost in the “dim distance.” The Select Committee sat on Tuesday last, and again on Friday, resuming to-day. Mr. E. J. Smith has been under examination by the Chairman of the Committee during the two days which have thus transpired, and how much longer he is likely to remain so is not quite evident. Immediately after Mr. Smith we may look for Mr. Allen Stoneham, the Government Auditor, and Lieut.-Col. Bolton, the Water Examiner. Sir W. Harcourt's examination of Mr. Smith will, of course, be followed by interrogatories from various members of the Committee, and from the imposing array of learned Counsel. It is a noticeable feature in the arrangements, that while all the other Companies are associated together, so as to be represented by one set of Counsel, the Kent Company has Counsel of its own. This may perhaps arise from the fact that this Company differs from the rest in having a supply to which Dr. Frankland awards his approval. In the examination to which Mr. Smith was subjected by Sir W. Harcourt, there was a manifest difference between the Chairman and the witness in the mode of estimating the value of the water undertakings. In dealing with the prospective value, the difference is very marked. The Chairman offers a calculation based on an average of the last few years, while Mr. Smith looks chiefly to the future, and estimates what the increase in the income is likely to be, without tying himself absolutely to a past average. Throughout the entire estimate, embracing the present and prospective values of the several undertakings, it is palpable that Mr. Smith includes a variety of considerations which Sir William Harcourt is disposed to lay aside, though possibly the right honourable gentleman may change some of his views on this point before the inquiry terminates. Mr. Smith avowed, as the basis of his recent negotiations, a conviction of the impracticability of competition with the London Water Companies. Competition, according to his view, was not absolutely impossible, but he looked upon it as a “practical impossibility.” Concerning the efficiency of the present supply, Mr. Smith considered it to be so large that if the constant service were made general there would be no need to increase the total quantity for the next ten or fifteen years.

The manner in which this important subject is being dealt with is somewhat singular. It is as though a defendant in an action were exalted to a place on the Bench, and left his interests solely in the hands of his witnesses, without any Counsel to conduct his case. The conditional agreements made between Sir Richard Cross and the Water Companies are the subject of investigation, but there is nobody to see that the case is fully presented to the Committee. If the Water Companies would undertake to advocate these agreements, the fight would be maintained on terms of equality; but the Companies are merely watching the progress of affairs, so as to protect themselves against harm, without seeking to obtain the acceptance of the agreements. There is, indeed, a mysterious visitor in the person of Sir Theodore Martin, K.C.B., whose presence is due to a request from the Home Secretary. Perhaps this distinguished gentleman will act as “next friend” to the purchase scheme, and at all events will be in a position to write a history of the affair. If power is wanting on one side, there is plenty of it on the other, and we may expect that both the Corporation and the Metropolitan Board will fight against the terms of purchase. Mr. Smith, who is rather to be pitied under the circumstances, informed the Committee that he appeared before them *en amateur*, wholly at his own cost, so far as he could see at present, and that he had not the advantage of the assistance generally rendered in such cases. He appeared in obedience to an order of the House of Commons, and he was “only too happy” to give such information as he possessed on the subject under investigation, in obedience to that order. Mr. Smith also intimated that he was in some little difficulty as to the detailed reports of Lieut.-Col. Bolton with respect to the state of the Companies works. He had received three of the reports, but there had arisen a question as to who was to pay for these productions, in consequence of which the other five reports had never reached his hands, and he had been compelled to rely on the verbal statements of Lieut.-Col. Bolton. “Do I rightly understand “you,” inquired Sir W. Harcourt, “that in transactions of “such magnitude as this, the capital question of the condition of the works and the plant was dealt with only “by oral communication?” The witness could only plead that he found the oral reports very useful. It must be

owned that the provisional agreements are left in a very forlorn condition, and it seems as if Lieut.-Col. Bolton himself had fallen into a dilemma. The sudden change of Government has caused a general bewilderment. Possibly Sir W. Harcourt was somewhat amused at the *naïveté* with which Mr. Smith described his admonition to the Water Companies, that they might get something from the Conservatives, but could not count on getting anything from "the other party." "Of course," added he, "I used the argument exactly as any other purchaser uses an argument, for the purpose of depreciating the value of the article he is purchasing." "How far the argument is good, or how far the argument is bad," continued the witness, "is a distinct thing; but it undoubtedly, so far as I used it, aided me in getting each of these eight Companies to agree." The Chairman proceeded to speak of "complicated considerations"—a phrase which came in very appropriately.

A letter which appeared in the City Article of *The Times* yesterday criticized the evidence of Mr. Smith as affording proof that too high a price had been proposed for the purchase of the Water Companies undertakings. The writer has an idea, founded on what he states to be "a general feeling," that in the case of some of the Companies the terms of the provisional agreements will be recommended by the Committee for acceptance, while in the case of others the Companies will have the choice of consenting to a reduction in the terms, or of submission to arbitration of that part of their claim which refers to prospective profits. But it is acknowledged that the Committee will have a difficulty to contend with in taking upon themselves the responsibility of advising a submission of any of the Companies claims to arbitration, in the face of the specific statement made by Mr. Smith that in all cases the amount of purchase-money which he has provisionally agreed to give is below that which would be obtained if the value of the property were determined by arbitration. The *Standard*, in a short leading article on Saturday, also referred to the evidence of Mr. Smith as proving that "the public were fully justified in denouncing as 'extravagant the terms proposed in the Government Bill for the purchase of the interests of the Water Companies.'" The *Standard* article remarks that Mr. Smith "seems to have gone to work upon a somewhat singular principle." That is to say, "instead of taking the past earnings of the Companies as the basis of his estimates, he appears to have based them on their future prospects and their unexhausted 'privileges.'" Mr. Smith, no doubt, has looked ahead, and if the prospects of the Companies had been bad instead of good, his mode of proceeding would have been approved by the critics who now object to it. Of course, the number of years purchase which the Government scheme proposed to give to the Water Companies depends very much on the basis adopted. Sir W. Harcourt looks backward as resolutely as Mr. Smith looks forward, and considerable disparity is the result.

Mr. Jones, of the Strand district, artlessly inquired at the meeting of the Metropolitan Board last Friday, what were the instructions given to the Counsel representing the Board before the Committee of the House of Commons, with reference to the London Water Supply. This gentleman appears to be afraid that the Parliamentary Committee of the Board will enthusiastically rush into an "undue waste of" the ratepayers money in the purchase of the water supply. Like other orators elsewhere, Mr. Jones was ruled to be out of order, and thereupon gave notice of a motion for the next meeting. Possibly Mr. Jones has never had the misfortune to employ Counsel on his own behalf, and is therefore unconscious of the imprudence of proclaiming his instructions to them from the housetop. On the other hand, is Mr. Jones really afraid that there is a strong party at the Metropolitan Board determined to have the water supply at any price? Is there likely to be "competition" for the purchase? This is an age of surprises, and we need be astonished at nothing. But Mr. Jones may be altogether wrong, and may be the victim of unnecessary fears.

A parliamentary return obtained at the instance of Sir Charles Dilke has just been printed opportunely for the use of the Select Committee on the London Water Supply. It contains a weighty array of figures, and professes to be the "financial statement on which the calculations are based of payments to be made to the London Water Companies under the proposed Metropolis Water-Works Purchase Bill, and additional revenue required to provide for prospective increase and calculation of income up to 1893 inclusive, &c." Such is the endorsement; but Mr. E. J. Smith, who ought to know something about the "calculations," only acknowledges a sixth part of the return. The rest he "knows nothing

"about." Mr. Allen Stoneham, however, is responsible for the remainder, which is doubtless correct so far as it goes, though the title seems rather inexact, considering the circumstances.

Lieut.-Col. Bolton's annual report, to which we made some reference last week, is a seasonable contribution to the water controversy, though we do not understand why a report addressed to the President of the Local Government Board on Jan. 31 last, should fail to make its appearance in print until the month of June, especially when all information of an official character with reference to the water supply is so peculiarly valuable. The report speaks directly and distinctly on the present proposal to transfer the Water Supply of the Metropolis to a public authority, and gives reasons why such an idea should be carried out. Lieut.-Col. Bolton guards himself by saying that, in his remarks on this subject, "it is assumed that it is the intention to make the best of the existing sources of supply to the Metropolis, and to improve them as much as possible, without, at any rate for the present, contemplating the projects which have from time to time been submitted for a supply from other channels." Supposing the transfer to take place, constant supply should be made imperative on the community. The economy to be effected by the unification of the works is shown in some detail, and it is suggested that a practical "standard of quality" should be established. This, indeed, seems to be recommended, even if the supply remains in the hands of the Companies. Lieut.-Col. Bolton, we observe, has been somewhat unfairly attacked by the *Daily Telegraph* in respect to this report, our contemporary scarcely taking sufficient pains to understand the document.

As a set-off to the annual report of Lieut.-Col. Bolton, we have the "Annual Summary" of the Registrar-General, in reference to the vital statistics of London and other large cities during the year 1879. This document contains the usual analyses and report by Dr. Frankland with respect to the London Water Supply, and on this subject the Registrar-General expresses a hope that a satisfactory measure will be passed by the Legislature, which will take that supply "out of the domain of profitable speculation, and transfer it to some public authority." Despite the customary criticisms by Dr. Frankland as to the quality of the water supply, the report of the Registrar-General begins by saying, "A considerable improvement has taken place in the health of London in recent years." The average annual mortality per 1000 inhabitants was 24.1 in the thirty years 1841-70, whereas in the nine years 1871-79 it fell to 22.9, showing a decrease of five per cent. In 1879 the death-rate was 23.3, being nearly the same as that of the previous year. We also read: "A satisfactory sign of the good effects of a purer water supply is found in the decline of the death-rate by cholera from 4.67 to 10,000 living in the thirty years 1841-70 to 0.39 in the nine years 1871-79." The deaths from the eight principal diseases of the zymotic class have also fallen from 52 to 39 per 10,000 living, and last year they were down as low as 35. Adopting the views of Dr. Frankland, the Registrar-General urges the general introduction of deep-well water into London, as a substitute for the present river supply. It is argued that a sufficient quantity could be obtained from such a source, "pure spring water being everywhere abundant in the Thames Basin." Scientific opinion, nevertheless, is not all on the side of Dr. Frankland in this matter.

The President of the Local Government Board has been enlightened on the subject of sanitary legislation by a deputation from the Social Science Association, consisting of four well-known gentlemen. The deputation urged the importance of certain amendments which they considered requisite to be made in the sanitary statutes. There were four leading suggestions, one very desirable proposal being that no new building should be occupied as a dwelling-house until an official certificate was given that the premises were properly drained and duly supplied with water. Another proposal had reference to the peril to the public health which arose from the growth of suburban districts outside the boundaries of towns having urban powers.

The Society of Arts has once more held its Annual Conference on the Progress of Public Health, the chair being occupied by the Right Hon. J. Stansfeld. The proceedings occupied two days, and six resolutions were passed. For the present we must postpone our consideration of the details, which comprehend a variety of considerations. A system of local inspection, dealing with the sanitary condition of dwelling-houses, was one of the novelties proposed, such inspection to be followed by the issuing of a certificate, varying in its character according to the state of the dwelling.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE SCIENTIFIC USE OF COAL GAS.

SIR,—Will Mr. Sugg kindly explain more fully what arrangements he would adopt so as to obtain the "non-actinic reading light" alluded to in his lecture at Hull on the 20th of May last, and reported in the *Journal* of the 25th ult.? I would wish to use an Argand burner.

Liverpool, June 13, 1880.

ALEX. M'IVOR.

THE BRITISH ASSOCIATION OF GAS MANAGERS.

SIR,—I have observed with much pleasure your able advocacy of changes which, in the opinion of many of its members, are likely to advance the interests and add to the importance of the Association. As a member of some years standing, I have noticed with regret that many excellent suggestions, emanating from succeeding Presidents, or during the course of our discussions, have fallen to the ground, not perhaps from lack of persistency so much as from the want of efficient machinery to bring them to maturity. It may have been a misfortune rather than otherwise to the Association that its rules were some years ago amended in a spirit of such absolute democracy as not to permit of the re-election of any President to a second year of office; but I think you have hit the greater blot in ascribing the paucity of progressive legislation to the entire absence of consultative meetings for nearly ten months in every year.

The suggestion that there should be a class of associates is of no recent origin. It has formed the subject of discussion amongst the members for some time past, and, I believe I am correct in saying, has been debated also at successive Committee meetings. That it would relieve the Committee of a difficulty of not unfrequent occurrence when having to deal with applications for membership from persons who cannot be described as either managers or engineers, but whose future may be said to be dedicated to gas manufacture, there can be little doubt, although it is to be expected that, under any circumstances, occasions will arise to test their ingenuity and judgment. It is doubtful also whether there is not something very inconsistent in the idea of an associate of an association—the latter term signifying equality for all purposes, except that of governance. But underlying all these proposals and discussions there is the undoubted desire for an enlargement of the scope of the Association, and therefore the question which I trust the Committee will seriously take into consideration at an early date is, whether the time has not arrived for a new departure; whether sufficient progress has not been made to justify the commencement of a new era. By the Institution of Gas Engineers, with its members or fellows, associates, graduates or students, and honorary members, the present work of the Association might be carried on, not only without the slightest interruption, but with greatly increased success, since it would be the means of attracting to itself a much more numerous body than is at present possible, while it could not but most materially raise the status of the profession. Into such a corporation all of the present members would have the right to enter, upon the same footing in all respects as that which they now enjoy, although to future candidates for admission fresh regulations would, as a matter of course, have to be applied.

Although, with regard to the other valuable suggestions that have been made, much could be done by the Association as at present constituted; yet, rightly or wrongly, I look upon such a reconstruction as that which I have ventured to propose for the consideration of my fellow-members as the only one capable of providing really efficient machinery for carrying into effect their known wishes, and for satisfying the natural and growing aspirations of the profession at large.

June 18, 1880.

FORWARD.

SIR,—Referring to Mr. Livesey's remarks at the meeting on Wednesday, the 9th inst., in connection with large makes of gas, I know of two gas-works where the quantities of gas made per ton of coal are 11,400 and 11,200 cubic feet respectively, and the quantities sold 10,500 and 10,200 cubic feet. In one case the illuminating power is 18 candles, and in the other 16 candles. The quantity of cannell used in one case is 3 per cent., and in the other about 12 per cent. In neither case are the retorts burnt out in the time specified by Mr. Livesey.

June 16, 1880.

A PROVINCIAL GAS MANAGER.

Legal Intelligence.

HIGH COURT OF JUSTICE—COMMON PLEAS DIVISION.

THURSDAY, JUNE 10.

(Before Lord Chief Justice COLERIDGE and a Special Jury.)

JOHNSON AND OTHERS v. THE GASLIGHT AND COKE COMPANY.

HANNAH JOHNSON v. THE GASLIGHT AND COKE COMPANY.

MR. WILLOUGHBY, MR. SIMS, and MR. WHITAKER appeared for the plaintiffs; and the ATTORNEY-GENERAL, MR. MORGAN HOWARD, Q.C., and MR. TYRRELL PAINE for the defendants.

MR. WILLOUGHBY said the action was brought to recover compensation for the plaintiffs and their children, who had been injuriously affected by a large escape of gas from a main-pipe belonging to the defendants into the house No. 50, Ellesmere Road, Old Ford, on the morning of Dec. 17, 1878. The plaintiff was a fish salesman in Billingsgate Market, and in consequence of the injuries he sustained he was prevented from attending to his business for three months; there were also expenses incurred in removing from the premises and for medical attendance to himself and family, and also the injury to his business which he suffered in consequence. The main-pipe in question was laid down in the year 1864, and it had been ascertained that in 1869 an explosion had taken place in the same road as the present, in consequence of which the pipes were examined and repaired. It was, doubtless, not only the duty of the Company to lay down their pipes in any road in which they had power to do so, but also to take reasonable and proper care of those pipes during the time they were in the road, so that the inhabitants might not be injuriously affected by anything that might proceed from those pipes; and the Company certainly had the opportunity of doing so in the years 1869 and 1870, when, in consequence of some defect, it was necessary

to make an examination, and it was discovered that the pipe had sunk in the roadway. It also appeared that in 1873 the then tenant of the house had a service laid on from the main, and the Company had again the opportunity of seeing the state and condition of the pipe. In 1874 the use of gas was discontinued, and the service-pipe was thereupon disconnected. The main-pipe was at that time plugged, and the service-pipe capped, so that no gas should enter the house, and subsequently the whole service-pipe was disconnected. Nothing more was heard of the matter until the 17th of December, 1878, when, undoubtedly, a large escape of gas went into the plaintiff's premises, and the supposition was that it percolated, not through the service-pipe itself, but went round it, and so into the house. Of course, immediately after that matter took place, it was looked into by the officers of the Company, and the pipe was found to be fractured, and something was done in the way of repairing it; but it was not until 1879 that the whole main was looked at, and then the cause of the fracture was made apparent—viz., the improper soil which had been used to support the pipe. Instead of using proper gravel for the purpose, shifting sand of a treacherous description had been employed, and the pipe had therefore broken down. A new pipe was subsequently inserted in place of the piece which was fractured, and, in addition, a quantity of gravel and ballast was used to restate the road. There ought not, however, to have been the treacherous shifting soil on which the pipe was laid, but a proper substratum; and if that had been done, probably no explosion would have occurred. The contention of the defendants was that some time or other some one had made a drain from the house to the sewer, which went down the centre of the road, and that in doing so the earth had been disturbed and replaced so improperly that the result was prejudicial to the gas-pipes, and hence it was no fault of theirs. He (Mr. Willoughby), however, submitted that this would not exonerate the Gas Company, although it might give them a cause of action against the parties who made the drain. In the first place, the drain from No. 50, Ellesmere Road to the main sewer lay in a different direction from where the soil under the pipe was; one was longitudinal, and the other was transverse. Again, the drain was made about the year 1866, and if there had been any subsidence of the soil, the Company having opened the ground in 1869, in 1873, and in 1874, had ample opportunity of seeing the state and condition of the soil; and it was their bounden duty not only to look after the state of their pipes, but also to look after the soil which was under those pipes, and when the previous explosion took place they ought to have put in fresh earth so as to prevent the same thing happening again. One of the principal things a gas company should see to was that the soil which supported their pipes was in a proper state, but if they used a quantity of sand and rubbish, that was not a proper support, and what had happened on the present occasion was what might have been expected. Evidence would be produced to show that the pipe was not at all in a good condition, and that it ought to have been removed long ago, and therefore the Company had been guilty of negligence in this respect.

The following evidence was then called:—

MR. JAMES JOHNSON, the plaintiff, examined by MR. SIMS, said that he went to bed on the night of Dec. 16, 1878, in his usual health, and the next thing he remembered was one of the Company's servants leading him up out of the street.

LORD COLERIDGE said he took it for granted that there was no doubt about the gas escaping into the house.

MR. PAINE said it was not denied that the plaintiff was more or less affected. It was, therefore, a question of liability, and also of damages.

WITNESS (continuing) said he was ill for some time afterwards. After the explosion he went to his father's, and believed he stayed there, but could not remember. He left the house under medical advice, and during the time he was away he was attended by the doctor. It was five weeks before he was able to go to the market, but he was not fit to do anything for three months. At the time of the accident he estimated his profits at £10 per week, but during the time he was absent he lost one-half or one-third of his business, and he had not recovered his customers since. He was still under the doctor, and the shock to his system made all his nerves shake. He should think he had lost £400 or £500 altogether. Some of his furniture was moved into his father's house, but not all. The windows and doors were out, and everything was exposed to the air.

LORD COLERIDGE said he presumed £500 would put the plaintiff into cash again.

WITNESS said it would, including what he had paid to the doctor for attending to himself and family.

In cross-examination by the ATTORNEY-GENERAL, witness said he did not keep any books, his being a ready-money business. He had no banking account, and did not pay any income-tax. Could not say for how long he had been making £10 a week, and had no vouchers to support his statement. When he went back to business he could only do one day's work in one week, and perhaps two days another week, for three months. The doctor's expenses were £25; but they were not yet paid. He had been nursed by his mother while he was ill, and £40 was charged for that and medical attendance. [Witness was cross-examined at some length in reference to the monetary part of his claim, during which he stated that sometimes he made £20 a week and sometimes not £5.] He had not much recollection of the accident, because the gas rendered him insensible. Had been in the habit of consulting the doctor once or twice a week ever since the explosion. Had an interview with his solicitor on the 19th of December—two days after the accident—and instructed him to issue a writ against the Company. Did not know at that time how the accident occurred, but thought he deserved compensation.

MRS. HANNAH JOHNSON, examined by MR. WILLOUGHBY, said she was the plaintiff in the second action, and was a widow, Mr. James Johnson being her brother-in-law. On the morning of the 17th of December she was awake by hearing groans proceeding from the bottom of the house, and on going down she found her sister-in-law had crawled to the door partly unconscious. As she turned round to go downstairs she was "knocked aback" by the smell of gas, and immediately rushed to the street and yard door, and opened them to let a draught through the house. Mr. Johnson was found at the bottom of the stairs insensible, and a neighbour assisted in getting him into the passage. An officer from the Gas Company, who called to find out where the escape came from, advised them to get out of the house by all means, which was done. She did not complain of her state of health, except that she had a very bad cold from having to go out so much.

Cross-examined by MR. PAINE: Mr. Bird was the gentleman who ordered them to leave the house, and they went at once. Two other gentlemen—Mr. Newall and Mr. Carter—also called, and said the windows ought not to be shut, and they were opened accordingly.

Re-examined by MR. WILLOUGHBY: Witness was suing the Company not only on her own behalf, but on that of her eldest daughter, who had been injured in her health for some little time. She had also suffered herself through loss of business—tassel-making—caused by finding her brother-in-law very near death.

By LORD COLERIDGE: Her daughter Alice had also been very ill through the effects of the gas, but she was getting better.

Miss H. JOHNSON, examined by MR. WILLOUGHBY, said she was daughter

of the last witness, and was in the house at the time the gas escaped into it. Felt a pain in her head and chest, but went to business and had to return home again, where she remained three days. Suffered from chest-ache for two or three weeks after, and had a nasty taste in the mouth, which lasted for a long time; it was like the taste of bad onions.

Cross-examined by Mr. PAINE: Was quite well at present.

Mrs. S. Johnson, examined by Mr. WHITAKER, said she was the wife of the plaintiff in the first action. Remembered the morning of the 17th of December, because she thought her husband was dying. Was very bad herself, but was able to call her sister-in-law. Was attended by Dr. Taynton, and suffered in the chest and head, and also from bad appetite, which lasted over a week.

Cross-examined by Mr. PAINE: Was now quite well herself, but her husband had not been well since. Remembered two gentlemen calling, but they did not complain to her of the windows not being open; that was to her sister-in-law.

Dr. W. Taynton, examined by Mr. WILLOUGHBY, said he was called on the morning of Dec. 17, 1878, to see Mr. Johnson. Found him sitting on a chair near an open window on the first floor in an insensible condition, caused from the inhalation of gas. Also saw Mrs. Johnson, but she was not so bad; she was dizzy, but could speak. Had attended Mr. Johnson ever since; he had been suffering from a very weak heart, and his breathing was still very bad. He was confined to his house for five weeks, and it was three months before he was able to attend properly to business. Up to the present time he was suffering from extreme nervousness, and had become much thinner since the accident. The wife was also under the care of witness for about a month, and likewise the children, but they had not suffered to the same extent. Had also attended Mrs. Hannah Johnson and her family, who were suffering from the same cause.

Cross-examined by the ATTORNEY-GENERAL: Had not seen a case of gas poisoning before or since. Had never examined plaintiff before the accident, but said that he had now a weak heart, which he thought might have been produced by inhaling gas, although he did not say it was so. Should certainly treat gas as a volatile body. Whether the effect would pass off quickly would depend upon how long a patient had been exposed to it. Was not aware plaintiff was out on the 18th or 19th of December, and did not think he was able to walk out. Could not say why he paid the lawyer the compliment of a visit, but he did not call on the doctor. Did not keep account or record of the case, because he was under the impression it would be settled. Had not made any entry of his charges, which were 3s. 6d. a visit, and had made about 70 visits altogether during the three months. Had not been paid one farthing up to the present time. The total of the bill for visiting the whole family for the three months was £25, but could not say what was the amount up to the present time. [A lengthy cross-examination took place as to a discrepancy in the figures between the account as originally rendered and a copy which was produced in evidence, but no point of interest was involved.]

Dr. W. Abbott, examined by Mr. WILLOUGHBY, said he was a member of the London College of Physicians. At Christmas, 1878, was called in to have a consultation with Dr. Taynton with reference to the plaintiff and members of his family. Had studied the effects of gas poisoning. The immediate symptoms in the present case were detailed by the plaintiff, and they were such as would arise from inhaling coal gas. Plaintiff complained of severe headache, frequent nausea, a peculiar taste in his mouth, which he compared to that of onions; also languor and drowsiness, and an inability to sustain any continued exertion. Had noticed the personal appearance of the plaintiff, who presented a drowsy look. His face was pale and sallow; he flushed from the least exertion; his muscles were weak and flabby, and he showed a general evidence of want of tone in the system, the heart's action was feeble, with occasional palpitation, and the respiration was frequent and rather laboured. The feebleness of the heart might have been a previous thing. Had seen the plaintiff eight or ten times since the accident. Saw him in March last year, in company with the Medical Officer of the Company, Dr. Hastings, when he was considerably improved, but was not in a healthy condition. There was not much the matter with him at the present time. The remainder of the family had suffered in the same way, but not to so great an extent. The longer a person breathed a poisonous atmosphere the more seriously he was likely to be affected by it; the lungs would be more charged with the gas, and of course there would be a greater difficulty in carrying it off.

Lord COLERIDGE: I do not follow that quite. I thought the lungs would deal, for good or for evil, with what was in them.

Witness: So they will to a certain extent; but it would be absorbed into the system.

Lord COLERIDGE: What is in the lungs is either burnt up at once or is discharged?

Witness: It becomes absorbed in the coats of the blood-vessels, and the linings of the membranes of the lungs.

In answer to a final question by Mr. WILLOUGHBY, witness said the total amount of his claim would be 15 guineas.

Cross-examined by Mr. PAINE, witness said that the immediate effects of gas poisoning would pass off in 24 to 36 hours, but then there were the secondary consequences. He had never analyzed the Company's gas, but there would be a great deal of sulphuretted hydrogen in it. If the poisoning were purely by carbonic oxide, the patient would recover very shortly as a rule, but the effects of sulphuretted hydrogen would not be so soon thrown off.

At this stage the witness protested against the learned Counsel being prompted by Dr. Tidy, the Chemist of the Company.

Lord COLERIDGE said that in cases like the present Counsel must be dependent upon scientific men for their instructions, but he would take care the witness was properly protected.

Cross-examination resumed: Sulphuretted hydrogen could be detected, apart from chemical examination, by taste and smell. Hydrocyanic acid was more volatile than carbonic oxide. It was a fact that when a patient had inhaled coal gas he would recover quickly if he had not inhaled it for any length of time. Even if a person had a powerful heart, the result of inhaling coal gas would be to weaken its action, although not, perhaps, for a long time. He believed the plaintiffs were breathing the coal gas for 12 hours.

Lord COLERIDGE: Did you ever see or hear, or read of, or dream of a case of heart disease produced by inhaling coal gas for a few hours?

Witness: No, my lord.

Henry Lacey, a licensed porter, examined by Mr. SIMS, said he was passing the house on the morning in question, when Mrs. Johnson opened the street door and he saw Mr. Johnson in an insensible condition. At that time there was a strong smell of gas in the house. He then went to Dr. Taynton, and afterwards called at the Gas Company's office and gave information. He subsequently saw the Company's men repairing the pipe in the road by putting on clamps.

Mr. Matthew Jones, examined by Mr. SIMS, said he passed along the Ellesmere Road four or five times a day. About a week before the explosion there was a very strong smell of gas in the road, and he had called at the Gas Company's office and mentioned the circumstance.

In cross-examination by Mr. PAINE, witness said he gave information

at the office in King Edward Road, and pointed out a gentleman in court as the person he had spoken to. The gentleman alluded to, however, denied the statement.

Mr. Henry Jackson, examined by Mr. WILLOUGHBY.

I am a Civil Engineer, and an Architect and Surveyor, residing at Holbeach, in Lincolnshire. I was in the Ellesmere Road with the Company's servants on the morning of the explosion. I went into the house and examined more particularly betwixt the basement and the ground-floor; it was at the time very fully charged with the gas.

Mr. PAINE said he would admit that the gas came up from the basement of the house.

Examination resumed: I saw the men opening the ground, but could not see much of the main, because the hole was so small. Later, on Feb. 15, 1879, I saw the whole length of the main, which was made of English cast iron in lengths of about 9 feet. I inspected the main with Mr. Emmett and another gentleman. We found that it had been broken in two places, and repaired by what are termed slip-joints; but the main appeared to me to be already too much deteriorated from the effects of the ammonia and the sulphur. The ground all along each side was very strong with ammonia, and we took samples of it. The soil on which the pipes were laid was very rotten; the sand had been excavated, and no doubt sold for its value, and the cutting had been filled up with debris from anywhere, and that would naturally settle down, if it was not properly consolidated by punning with water or ramming. The main was laid about 2 feet 6 inches from the surface of the road; I did not observe any water-pipes there. There is a main sewer going down the road at a depth of about 10 or 11 feet. [Witness produced various plans showing the position of the pipes and how they were connected with the main, and was examined with reference to the same.]

Lord COLERIDGE said that as he understood the case the substance of the difference was that the drain was driven under the main at a time when the defendants did not know of it, and by persons for whom they were not responsible; and that in consequence of the supports being interfered with, the main cracked and the gas came out.

Mr. PAINE added that the Company did not know that the ground had settled.

Examination resumed: I saw a portion of the old main removed, and a 6-feet length inserted, which was a great improvement.

Cross-examined by Mr. PAINE: I have erected gas-works, but the actual laying down of mains has not formed part of my practice; still I can speak with some authority. In my judgment the main in question was so rotten that it was percolated, or pretty well so, from the action of the sulphide of ammonium. The lifetime of a main depends upon the purity of the gas. I cannot say whether the piece of pipe produced was taken from the main which was broken, but should say it was not. Assuming it to be the same, however, it is not in bad condition. I do not know when the main sewer of which I have spoken was laid, nor when the connection was made between the house and the sewer. I do not suggest that the Gas Company placed the rubbish in the road; that would be done by the party who put in the drain. One portion of the pipe which was deflected was close to where I was told there had previously been an explosion, which had driven the pavement up into the street, but I am not personally acquainted with that matter.

By Lord COLERIDGE: I ascertained the condition of the pipes by the appearance of the piece that was taken out when the new piece was inserted. We could see the action of the salts very materially, as it had been worn quite thin; it was also deteriorated very much outside as well, it being rusty and eaten away. I did not take a portion of pipe up and examine it; I simply looked at the section as it lay on the ground. I had examined the whole length prior to that, and, in company with Mr. Emmett, had gone into the trench to examine the slip joints. Of course I could only see the externals of the main as far as it was bared.

FRIDAY, JUNE 11.

Mr. William Woodward, examined by Mr. WILLOUGHBY.

On Feb. 25, 1879, I went to the Ellesmere Road with Mr. Jackson and Mr. Emmett, for the purpose of inspecting the mains opposite the plaintiff's house. Immediately in front of the house I noticed that a 9-foot main had been cut, and a portion taken out and a new piece inserted with a slip-joint, but I did not see the piece which had been removed. I went into the trench and walked from end to end of the road, and found the pipes were in a fairly good condition.

Mr. WILLOUGHBY: Did you also notice the road or substratum on which the gas-pipes were laid?

Lord COLERIDGE: There was no cross-examination as to that. It was an admitted fact that the pipes were laid in insufficiently rammed rubbish, and were thereby let down and broken, and an escape of gas caused. One of your witnesses on yesterday said it was not for a moment suggested that the Company did it; but your case, as you opened it, is that, notwithstanding, the Company are liable, and I have been thinking for some time that unless you insist on other things, it is coming much more to a question of law than of fact.

Mr. MORGAN HOWARD said that, as he understood, what his lordship had pointed out was no doubt conceded as to the part where the fracture was, but he did not know that the admissions went farther than that.

Lord COLERIDGE: We are trying who is liable for the undoubted escape of gas at a particular place. At this place it is an admitted fact that the pipe was lying in insufficiently rammed rubbish, and in consequence it bent down and broke, and a quantity of gas escaped. It is a question who is liable.

Mr. WILLOUGHBY said he went farther than that.

Lord COLERIDGE said that as to the rest of the case he should not stop the learned Counsel, but as to this particular part he should do so. The rubbish might be taken as an admitted fact.

Examination resumed: The condition of the road was bad from end to end, and the pipe had sunk in many places. I put a level on it several times, and found it was not level.

Lord COLERIDGE asked Mr. Willoughby what they had to do with anything that did not produce the mischief?

Mr. WILLOUGHBY said it was the duty of the Company to look after their pipes from one end to the other.

Lord COLERIDGE: Granted; but you cannot bring an action against them because they do not perform their duty unless you suffer from such neglect. The question is, what happened at the point where you say they did not do their duty, and you suffered? Whatever you have to say about that is most material; but, supposing it had been a mile away, it would have had nothing to do with the matter.

Mr. WILLOUGHBY said it only went to show that there ought to have been an examination of the pipes.

Lord COLERIDGE: At present I have no evidence as to the pipes. It is not that the pipes were bad, but the bed in which they were laid was bad, and the pipe had sunk in many places. (To witness:) You say that the bed was insufficient?

Witness: Yes, my lord. The earth under the pipe had not been removed; it was simply laid down.

Examination resumed: I made a model plan of the pipes as they would

have been before breakage, and after breakage and repairs. I agree with Mr. Jackson generally in what he has stated.

The witness was not cross-examined.

Lord COLERIDGE said he did not know what to make of the case, because some of the things which Mr. Jackson said were not questioned at all, while as to the particular point on which he was questioned, the last witness could not confirm him because he did not see the pipe. After some further remarks with reference to the rubbish which had been used to fill up the holes from which the sand had been taken, the learned judge reiterated his opinion that the question of liability appeared to be one of law.

Mr. WILLOUGHBY said he did not accede altogether to his lordship's view, but he would like to call the District Surveyor, who really superintended the operations.

Mr. George Emmett, examined by Mr. WILLOUGHBY.

I went with last witness and Mr. Jackson to look at the place where the accident happened. I saw the ground along the trench, and it was very bad earth indeed to lay pipes in. The pipes should be laid in a good bottom, so as to keep them level, and prevent any settlement.

Mr. WILLOUGHBY drew the attention of the Court to the Metropolis Gas Act, 23 & 24 Vict., cap. 125, which stated that when a gas-pipe was in position, there was to be a certain amount of clay used to form the bed.

Examination continued: In old roads the bottom is solid, and they very rarely require anything; but if it be loose underneath it ought to be properly rammed or gravelled.

Mr. MORGAN HOWARD (interrupting), said the section merely used the expression "well and sufficiently bedded," but it did not say what materials were to be used, nor how the work was to be done.

Lord COLERIDGE read the clause, adding that it did not say much about the matter. The old roads when they were solid required no foundation, but they required gravel or some bed to lie in.

Cross-examined: The gravel was all dug out when I went there. I produce some earth taken from where the escape had been, and in my opinion it is very bad stuff. I saw that a new piece of pipe had been put in, but I did not see the piece which had been taken out. With regard to the other portion of the pipes, I could not complain of them, although they were very unlevel from one side of the road to the other.

Cross-examined by Mr. MORGAN HOWARD: I have been concerned in laying both gas and water pipes in Bermondsey, under the different Companies, and in Lambeth as well. I have frequently seen the soil give way in new roads under the pipes. I know nothing of the history of this particular roadway, nor of what was done with reference to the sewer, the house drains, or anything of that sort. I do not know what should be done in this case to remedy the want of support or subsidence of the soil.

A number of interrogatories and the replies thereto by the Company on the subject of the escape of gas and repairs of the pipes were then put in and read, as likewise the reports of the officials engaged in the work.

Mr. Samuel Snooks, a master mason, examined by Mr. WILLOUGHBY, said that the paving was laid down in the Ellesmere Road at the latter end of 1866, at which time the drains were all complete.

Mr. Charles O'Brien, examined by Mr. WILLOUGHBY, said he was a fish salesman in Billingsgate Market, and had been in the habit of employing the plaintiff upon commission. He did a good business so far as witness knew. After the accident, he did not attend to business for some time, and when he returned he appeared very ill.

Mr. William Henry Gathercole, examined by Mr. WILLOUGHBY.

I am Surveyor to the parish, and have to keep the Ellesmere Road in order. I was not in office when the main sewer was laid down. It is customary to give notice to the gas and water companies when any repairs are going to be done to the sewers, in order that whatever is disturbed—whether paving or macadam—may be replaced at the expense of those who make the drain, and that the gas and water companies may see that the replacing of the roads is done in the proper manner. Nothing more than ordinary repairs have been done to the drains in the Ellesmere Road during the three years I have been in office.

Cross-examined by Mr. MORGAN HOWARD: The road has been in a fair state of preservation during the time I have known it.

Mr. WILLOUGHBY said this was the case for the plaintiffs.

Mr. MORGAN HOWARD said he would take his lordship's view as to what course should be pursued. It was now common ground between the parties that the sewer was made in 1866—two years after the pipes were laid by the Gas Company. It was also common ground that in the operations which were carried on with reference to sewerage excavations the ground was made and materials removed. He was in a position to lay before the Court a body of evidence of what the Company had done since 1864, but he thought the question resolved itself into whether they were responsible for the acts of third parties.

Mr. WILLOUGHBY said he did not admit it was the act of a third party. A witness had stated that the sand had been removed, but he could not say by whom.

Lord COLERIDGE said he should be very much surprised if the jury did not see what was perfectly plain—viz., that the natural effect of the evidence was that this was done at the time the sewer was made, and by persons over whom the defendants had no control. He would, however, consult with Justice Grove on the question.

Mr. WILLOUGHBY quoted the case of *Hipkins v. The Birmingham and Staffordshire Gas Company*, in which the Company were sued for damages for polluting water. In that case there had been mining operations underneath a gasholder-tank, which sank in consequence, causing a leakage and fouling the water. The Company set up the defence that it was the act of other persons; but the Court of Exchequer held that the Company had not exonerated themselves from the presumption of negligence, because they had not shown that they might not have constructed their tank in a different position, where the danger from the excavation might not have existed, or that they might not have prevented the injury by the use of other mercantile means.

Lord COLERIDGE: I did not know of that case, but I have been thinking that I should have been disposed to have held, irrespective of it, that the duty of the Company was absolute. (To Mr. Howard:) You may have a remedy against those persons who laid down your pipes, but when your pipe has been laid, the plaintiff has his first remedy against you.

Mr. MORGAN HOWARD said he ventured to think otherwise.

His LORDSHIP then retired to consult with Justice Grove. On his return he said that his learned brother confirmed his view. The defendants were dealing with a matter which might be noxious and cause damage, and it was their duty to take every reasonable care to prevent the escape of it, so as to prevent damage. So far as appeared, there was evidence that the sewer was made, and that the Company had notice of it, and might have seen that the ramming, or whatever it was that did the damage, was properly done. There was no fault of the defendants—nothing done actively that was wrong—but unless they could show that they had no power to interfere, and that they were absolutely in the power of the sewer authorities, there was very cogent evidence to go to the jury that all proper care was not taken.

Mr. MORGAN HOWARD: Then I understand your lordship at present to rule that it is a question of negligence or no negligence.

Lord COLERIDGE: I think so.

Mr. MORGAN HOWARD said, so far as he had read the evidence, there was nothing to show the Company had notice of the operations of the sewer authority.

Lord COLERIDGE said that "notice" did not mean a piece of paper. It meant knowledge, and that was a question of fact to be left to the jury. The operation of the sewer-laying was a long business, and the Company must have known of it.

A conversation ensued in reference to the general condition of the main, which Mr. Jackson had stated to be deteriorated, and which Mr. Willoughby said he should rely on. The learned judge, however, pointed out that the witnesses Woodward and Emmett, who were practical men, had described it as being in good condition.

Mr. WILLOUGHBY then said he relied on five distinct acts of negligence—not having a proper pipe; not laying it properly, and then from time to time looking after it; not having proper inspection of it from time to time; not having it put in order after receiving distinct notice that there was an escape of gas; and breaking up the streets, and so letting the gas into the man's house.

Lord COLERIDGE said the point he should leave to the jury was whether the Company, in 1866, when the sewer was made, or the drains connected with the sewer, under the pipe, did all that was reasonably to be expected from skilful men with a treacherous substance in hand to prevent the escape of it, and to see that the pipes were properly relaid and properly supported. If not, there was evidence of negligence which would make the Company *prima facie* liable to the plaintiffs; for how much was a very different question.

Mr. MORGAN HOWARD, on behalf of the defendants, said the object in view was to ascertain what was the cause of the explosion, and how it came about in the first instance. The case seemed to have resolved itself into the year 1866, and it was due to the defendants to say that they were keeping nothing back, but really offering evidence, in opposition even to their own interests, to show what was the actual state of things at that or at any other time. Witnesses would be called who would prove that no act had been done, and that no act had omitted to be done, which could have brought these people into the trouble which they met with on Dec. 17, 1878; and that everything was done which could reasonably have been done to make the pipes safe and to prevent any gas escaping, because to call it an explosion was giving it a wrong term. It was an escape of gas which penetrated through soft earth into the house, and led to the unfortunate results they had heard about. It would be shown that in 1866—two years after the pipe had been thoroughly well laid, and in a well-bedded place, with all the precautions that could be taken in the matter—some sewers or drains were constructed, and cross drains laid down by Mr. Hall, who had houses there, and that in consequence of some of the excavations being imperfectly filled up, there probably was a subsidence. That this was the time the mischief was done there could not be a doubt, and this was the defence which would be made. It was a very strange thing to say—as his learned friend almost ventured to do—that a Gas Company which had some 1500 miles of gas-pipes to attend to should keep such a rigid and vigilant guard over those pipes as that no escape of gas should possibly take place, and that there should be no subsidence of the soil on those 1500 miles of piping, but that practically the Company should become insurers of the public safety. If this were the case Parliament would be called upon to interfere, because it would be impossible to prevent the happening of occasional accidents from one cause or another. In the present instance there was no escape into the service-pipe, but the plaintiffs case was that an escape took place, and that the gas permeated round the pipe and through the ground, and so into the house; and this might well be the case when a fracture of a gas-pipe took place, and undoubtedly there was a fracture here, but the cause of the escape of gas was not through the act of the Gas Company. Their main had been thoroughly well tested in 1864. The person who caused the mischief came upon the scene two years later; he laid his drains down for the purposes of sewerage, and probably he unsettled the earth. After a lapse of some years there was a slight sinking of the soil, and then the pipe gave way and the gas escaped; and this was how the Gas Companies were said to be liable. As a matter of fact, the Company were not aware of the mischief which was being done in making the cross drain. There were no complaints of escapes of gas at that time; and, in fact, everything Mr. Hall did was as well done as could be. It would be shown by scientific evidence that there was an unconquerable difficulty in compactly and firmly bedding earth together so as to prevent, under some circumstances, an escape of gas. No doubt his lordship would tell the jury that the Company were only bound to take all reasonable care, and that they could not be expected to go beyond that. They had to lay their pipes in the earth, and then they must trust to the inherent qualities of the soil to protect them. They could not control nature, but they were subject to those slight accidents which might take place where they were dealing with a volatile substance like gas. In October, 1869, and February, 1870, there had been repairs for slight escapes opposite Nos. 60 and 72 in the same street. Those defects were immediately and effectively put right, because not until the accident took place in 1878—some years afterwards—was there the slightest pretence for saying the gas was escaping or that there was anything wrong. One witness had been called who stated that only a week before the explosion he had called at the gas office, and had given notice to Mr. Carter of an escape of gas at this spot but Mr. Carter would tell the jury this was not true. He should also show that the main had been properly plugged. His learned friend had thrown some doubt upon the matter, but it would be proved that there was no foundation for the suggestion. With regard to the piece of pipe which had been produced, when the witness was asked to look at it and say if it was not in good condition, he did not venture to say it was not, but sheltered himself under the statement that it was not the piece which had been taken away from the place; but it would be shown conclusively that it was the same. It had been taken by the representatives of the Gas Company, and kept ever since, and was produced at the present time to show the real state of the facts. If this was the pipe, it was still more clear than it was before that there was no inherent bad quality in it; and the only objection to the piece of pipe was from the result produced from an act outside the Gas Company, and for which it was hoped the jury would say they were not responsible. With regard to the plaintiff himself, he (Mr. Morgan Howard) submitted that the statements put forward were extravagant, both as to the illness and the consequences which were supposed to have arisen from it. The jury had heard the evidence, and it would be for them to say how much they gave credence to. If the plaintiff was a ruined man, he was very quickly ruined by a very simple cause. He was ruined on Dec. 17, 1878, but not sufficiently ruined in health to prevent him from going two days afterwards to his solicitors, and instructing them to bring an action, without taking any of those preliminary steps which were fair and reasonable—especially with a Company like the defendants—for the purpose of seeing whether there was a just cause of complaint, and a reasonable way of meeting

SUPPLEMENT

TO THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XXXV.

LONDON, JUNE 22, 1880.

No. 893.

BRITISH ASSOCIATION OF GAS MANAGERS.

SEVENTEENTH ANNUAL MEETING.

PAPERS READ.

(II.)

ON TESTING CANNEL AND COAL.

By Mr. HARRISON VEEVERS, of Dukinfield.

Eight years ago Mr. Paterson, the Engineer of the Warrington Gas-Works, and Past-President of this Association, treated the members to a paper "On the Lithology of Gas Coals," pointing out the characteristics of various coals, and giving tables of several analyses which he had made. He did not, however, describe any method of testing for quantity and quality. This paper is intended, to a certain extent, to be a sequel to that essay, and will in the first place describe a simple apparatus for use in small works where the cost of elaborate plant cannot be afforded, and where appeals to an analytical chemist would, for a similar reason, be prohibitory. In the second place, a few notes will be given on scientific testing.

A manager who purchases a cannel or a coal on the recommendation of a testimonial from a professed analyst, finds himself occasionally with inferior results when the bulk is used in the works. The writer recalls a case where a coal was tested by a reliable authority from a sample sent by a colliery proprietor, and a testimonial given that it had yielded over 10,700 feet per ton of 18-candle gas, fairly free from sulphur. The coal when delivered in bulk was not even worth its cost of cartage; it was grossly charged with sulphur, glistening with pyrites, and white with salts of lime. Fortunately no contract had been entered into, and the supply was stopped. This is a sample case of what has occurred in the experience of most gas engineers. The fault rests not with the analyst in such cases, but with the proprietor or agent who supplies samples superior to bulk. Reference will be made presently to the necessity for proper sampling.

In a small works and for ordinary use, where the illuminating power and yield of gas per ton are the main considerations, the following apparatus will be found inexpensive and efficient:—On the top of one of the ascension-pipes from a retort in use in the works are fixed two 4-inch valves—one to allow the gas to pass into the hydraulic main, and the other into the experimental apparatus. This consists of a 4-inch connection-pipe, a receptacle for tar and ammoniacal liquor, a condenser (consisting of a series of 4-inch street main-pipes), a purifier 6 feet square (which may be procured second-hand), an 80-light wet meter, a Kirkham and Sugg's improved jet photometer, a thermometer, and a 4-inch pipe (with valve) to conduct the gas into the main-pipe of the works between the hydraulic and the exhauster.

It will be observed that no mention is made of a holder and tank. It is their absence which causes this method of testing to be so economical in the cost of apparatus, and the author contends that the results arrived at are as reliable comparatively one coal with another, and with the practical results given when the bulk is operated upon, as though a holder had been provided.

When it is required to make a test, the valve to the hydraulic is closed, and that to the apparatus is opened. The stoker then charges the retort with exactly one-tenth of a ton of the material to be tested. The indications of the meter and photometer are taken every quarter of an hour for six

hours, then the retort is discharged, the coke extracted, slaked with as little water as possible, and weighed. The quantities of gas, of tar, and of liquor are ascertained and multiplied by 10, so as to give the rates per ton. The illuminating power is ascertained by multiplying the average of each hour by the number of feet made in that hour; these added together and divided by the total number of feet made in the six hours gives the illuminating power. A specimen page of the book for entering the observations is given in this paper, and will illustrate the method of procedure. (See Table No. 2 appended.)

The following important facts will be ascertained:—1. The yield of gas per ton, in feet. 2. The illuminating power. 3. The quantity of coke and its appearance. 4. The amount of tar and ammoniacal liquor. 5. The length of time the material should be carbonized. Of course other information could be ascertained, such as the amount of sulphur, the specific gravity, &c.; but as the object of the tests was primarily to ascertain the quantity and quality of gas from the sample, these matters were not considered.

Of the above, the fifth—that is, the length of time the material should be carbonized—is very instructive. It is a matter of much greater importance than is generally considered, and attention was very properly drawn to it by Mr. William Carr in his Inaugural Presidential Address to the members of the Manchester District Institution of Gas Engineers on the 28th of February last. In Table No. 1, accompanying this paper, are many instructive cases where a cannel or a coal has given off the whole of its gas before the end of the fifth hour, whilst in one case 950 feet, in another 960, and in another 1020 feet were made in the sixth hour. The loss to stock by not recharging at the end of the fourth or fifth hour may be very readily calculated. In the cases Nos. 1 and 2 in Table No. 1, experiments were made on two similar samples of cannel—the first at an ordinary temperature, the second with a keener heat. In the case of No. 2, only 50 feet per ton of non-illuminating gas were added to stock during two hours; whereas had the charge been only a four-hour one, 8050 feet per ton of 26-candle gas would have been added to the gasholder stock, at the same cost of fuel, labour, interest, and wear and tear. By the increase in temperature in the furnaces, it will be observed that No. 2 yielded 700 feet per ton of 3-candle better gas than No. 1. An inspection of the table will convince a practical man of the importance of high heats and short-time charges, and that thereby the gain to revenue will far exceed the cost of renewals of retorts.

An interesting subject in the method of testing as above described is not only that the quantities of gas given off hourly vary, but also the illuminating powers. It is almost invariably the case that the greatest light power is yielded by the gas expelled at the end of the first hour and during the second one. Frequently the gas given off in the sixth hour is so poor in quality that the photometer cannot indicate the value, although the amount of gas generated may be over the rate of 1000 feet per ton.

In Table No. 1 the results of tests for quantity and quality by other operators are given to show the practical value of the author's method of testing. It will be observed that the author has not attempted to enter into the more elaborate and scientific methods of analyzing samples of coal, coke, and gas, as it requires a more technical education, and a greater

amount of time and manipulative skill than is possessed by the majority of the profession. When it is required that a coal should be tested, it is necessary to be very careful in the sampling. The author invariably took the one-tenth of a ton to be operated upon from the material on its arrival at the works, and without any selection, except when the trial had a speciality. Particulars as to the coal under test were carefully withheld from *employés* who might have an interest in the result. As much care is needful in sampling for professional analysis, an average sample of about 20 lbs. weight is essential for a reliable test.

As it is desirable that there should be a uniform method of stating the results of testing coal, coke, and gas, the author submits Table No. 3, kindly supplied to him by Mr. John Collins, F.C.S., F.G.S., of Bolton. This form gives as much information as is required, and no more. One item of information given is interesting, as showing the amount of moisture conveyed by gas, and the author calls attention to this fact as deserving consideration. What would be the effect on the illuminating quality by its removal? and whether a cheap and simple method could not be adopted for desiccating gas, and so preventing the freezing of the water in gas supplied to railway signals, &c.? The average quantity of water conveyed by coal gas at a temperature of 60° Fahr. is about 250 grains per 100 cubic feet of gas, or more familiarly one gallon of water is carried forward by each 30,000 cubic feet of gas.

TABLE No. 2.

Sample of Page for Recording Tests of Gas Coal.

Name of coal or canal . . Bridgewater canal (selected pieces).
" pit Water Gate.
" proprietor . . . Bridgewater Trustees.
Date of trial Aug. 15, 1878.

Hour.	Meter Indication.	Make each Quarter Hour.	Make Hourly.	Pressure on Jet Photometer.	Candles.	Hourly Average Candles.	Thermo-meter.
8.45	086080	—	—	—	—	—	—
9.0	134	54	—	94	7	—	64°
9.15	186	52	—	94	7	—	—
9.30	242	56	—	64	13½	—	—
9.45	303	61	223	35	24½	13	—
10.0	358	55	—	33	25	—	65°
10.15	421	63	—	34	24½	—	—
10.30	488	67	—	36	24	—	—
10.45	556	68	253	40	22½	24	—
11.0	627	71	—	42	21½	—	—
11.15	698	71	—	45	20½	—	—
11.30	770	72	—	48	19½	—	—
11.45	839	69	293	51	18½	20	—
12.0	904	65	—	52	18	—	—
12.15	965	61	—	56	16½	—	—
12.30	087016	51	—	59	15½	—	66°
12.45	059	43	220	62	14	16	—
1.0	095	36	—	66	13	—	—
1.15	123	28	—	67	12½	—	—
1.30	145	22	—	69	12	—	—
1.45	162	17	103	71	11	12	—
2.0	174	12	—	71	11	—	67°
2.15	183	9	—	73	10½	—	—
2.30	190	7	—	75	10	—	—
2.45	194	4	32	—	—	8	—

TABLE No. 2.—(Continued.)

Hourly Make.	Illuminating Power.	Total.
223	× 13 =	2899
253	× 24 =	6072
283	× 20 =	5660
220	× 16 =	3520
103	× 12 =	1236
32	× 8 =	256
1114)		19,643
10		1763
		average illuminating quality.
11,140	make of gas per ton.	
Weight of coke	1 cwt. 1 qr. 14 lbs., or 13 cwt. 3 qrs. per ton	
Tar and water	3¼ gallons, or 32½ gallons per ton.	

TABLE No. 3.

Form (A) for Showing Results of Analyses of Gas from Mains.
By Mr. JOHN COLLINS, F.C.S., F.G.S., of Bolton.

Samples taken.			Barometer.	Temperature.	100 Cubic Feet of Gas yield in Grains.						
Date.	Where.	Hour.			Water.	Carbonic Acid.	Carbonic Oxide.	Sulphur.	Ammonia.	Illuminating Power.	Mean Pressure.
1878 May 15.	Offices	5.0	29.8	60°	259	1.73	4.21	14.92	0.47	17.9	11/10

Form (B) for Showing Results of Analyses of Gas from Samples of Gas Coals.

By Mr. JOHN COLLINS, F.C.S., F.G.S., of Bolton.

Description of Sample.	Specific Gravity.	Percentage of				Cubic Feet of Gas per Ton.	Illuminating Power.	Coke		
		Fixed Carbon.	Volatiles.	Sulphur.	Ash in Coal.			Per Ton.	Ash.	Sulphur.
Bridgewater Cannel . .	1.275	66.31	33.69	1.27	2.64	10260	20.16	Cwt. q. lbs. 12 3 8	4.8	1.21

Discussion.

Mr. R. HUNTER (Stalybridge) said his experience was somewhat different to Mr. Veevers's. He found on referring to the tabulated results (Table No. 1), and taking the first on the list, namely, the Wigan Coal and Iron Company's cannel, the quality of the gas given off during the second hour of the test was stated as 28½ candles, and during the third hour as 23½ candles, and the average quality for the whole as 18½ candles, and he found in every case on the list a similar result. Now, these results did not agree with his experience, and he thought they were rather misleading. He would have expected a better average. He had made repeated experiments with a small apparatus capable of carbonizing 2 cwt. of coal at a charge, and he found almost invariably that the quality of gas given off at the end of the second hour was the average quality of the whole. This was not the result of one experiment only, but of many dozens, and he had verified it in this way. He had a small holder capable of containing about 30,000 cubic feet of gas, and when he was able to test a coal for a week in succession, he allowed the whole of the gas to go into the holder, and tested it when he was certain it contained only the gas from that particular coal, and was not mixed with any other. Observations of half-hour and quarter-hour tests were taken during the trial and averaged, and in almost every case he found the illuminating power to agree with the average of the gas given off during the second and third hours of the charge. About 25 per cent. of the gas was given off during the first three-quarters of an hour, 50 per cent. during the next two hours, and the remaining 25 per cent. during the finish of the charge, which might be two or three hours. The gas made during the last three hours tended simply to dilute the gas made during the first three-quarters of an hour, and striking off these, and taking the average of the others, it would be found that it gave a fair average of the whole gas made from any particular charge, and this almost invariably agreed with the gas passing off at the end of the second hour.

Mr. T. B. BALL (New Wortley) said, although the paper gave the quantity of gas produced, and the illuminating power, there were other items which should enter into any calculation of the value of a given coal besides these; and they might perhaps counteract any additional value the coal might seem to possess, as far as its illuminating power was concerned. The value of a coal might be estimated at so much per ton; but if there was taken into account the quantity of tar and ammoniacal liquor the coal would produce, a very different result might be arrived at; because, certainly in the Leeds district, some coals would produce twice as much ammoniacal liquor as others, and as the tendency of this product was to advance in value, it formed an essential factor in any estimate of the value of different samples of coal. With regard to the value of the gas given off in the latter part of a charge, it seemed to him they not only obtained a very small yield of gas during the latter part of the charge, but what was yielded seemed to deteriorate that which had been given off in the first instance, and might perhaps lead to an erroneous conclusion as to the value of any special coal. If they were careful to take the charge out as soon as the better part of the gas was given off, it would perhaps pay considerably more than leaving it in so long, and letting the small portion of gas, which came off last, mix with that given off at the beginning. Of course, it was impossible, looking for a short time at so many tests as had been appended to the paper, to pick out particular instances; but it seemed to him that the residual products must be taken into account, for if gas managers were to meet the competition of the electric light, they must depend more on their residual products, and hence, in order to sell gas as cheaply as possible, they would have to use those coals which would give the best results, and the most valuable residual products.

Mr. A. EDWARDS (Taunton) said some coals, although very rich, took a very large quantity of heat in getting the gas

out of them. People should bear this in mind when purchasing coal by advertised testings. He had in his mind a coal which they constantly used in his district, which would produce in ordinary working 5000 feet per mouthpiece. It was a rich coal, and was supplied at a very low rate; but comparing it with other coals which cost more money, it was not so valuable. Using another coal, which would produce about 10,000 feet per ton of 17-candle gas, he could get 25 per cent. more work out of the retorts in the same time. This was an important consideration when gas managers were hard up for gas in winter.

Mr. R. O. PATERSON (Cheltenham) said he was not quite clear upon one point of Mr. Veevers's paper. He should agree with him as far as his arrangement for distilling the coal went, which appeared to consist of a double pipe on the ascension-pipe; and in charging the retort in the ordinary way, he passed the gas from the retort by a bye-pass arrangement to a special condensing, purifying, and measuring apparatus. This appeared to him quite intelligible; but when he came to test the illuminating value of the gas by a series of observations on the jet photometer, and added up those readings and averaged them, he was afraid the test was hardly reliable. As to the quantity of gas produced, he saw no reason why it should not be perfectly correct as a practical test, but on the question of quality he did not think it was satisfactory. The jet photometer was by no means a reliable instrument for estimating the illuminating value of gas under any circumstances, and least of all if gas from cannel coal was being tested; for, in the first instance, gas of 30 to 40 candle power might be obtained, and in the latter part of the charge only 10 or 15 candle gas. But he thought the object of Mr. Veevers in his paper was to give a reply to the advertised tests of certain coals. These tests were presumably made in the laboratory, under very favourable conditions; and managers knew it was difficult in practical working to come up to laboratory tests. Mr. Veevers had given practical tests, and as a justification for them, and as a proof of their correctness, he stated the temperature of the gas at the meter at which it was measured, from which he probably meant to infer that they had thus obtained a satisfactory test, because he had shown that he had cooled the gas down to a proper temperature before measuring it. This, so far as it went, was quite correct, but if coal was to be tested for its true value, there must be some other conditions fixed in order to make it perfectly satisfactory. It must be known what was the temperature of distillation. By Mr. Veevers's arrangement, supposing in a setting of seven retorts a bottom one was shut off, and the coal was tested by it, a less favourable result would be obtained than if the middle retort in the setting was taken, simply because the middle retort would be hotter than a bottom one. It was, therefore, quite as much a question of the temperature of distillation as of the temperature at which the gas was measured, the former being the more important of the two.

Mr. W. CARR (Halifax) said that some short time ago there was a warm discussion in one of the Associations, which was afterwards continued in the correspondence columns of the JOURNAL, and there was much difference of opinion expressed about the testing of coals. He thought that if members would only bring their views with regard to this matter forward at such meetings as the present one, instead of stoutly asserting to each other, as they did, that certain results were impossible, it would be infinitely better. One gentleman in one part of the country obtained one result, and another in another part said it was impossible that such a result could be obtained by any reasonable process, and so there was a great diversity of opinion existing upon this subject of coal analysis—more perhaps than upon any other. To his (Mr. Carr's) mind, what was wanted was a satisfactory system of testing—a system which could be universal in its application; but this was a very difficult thing to obtain. He, like the last speaker, did not consider the method as now brought forward in any way a satisfactory one. In the first place, he would take exception to the retort itself, which he assumed was one in an ordinary setting of retorts, subject to all the variations of temperature that such settings were subjected to from time to time. To obtain anything like a satisfactory result, it would require very careful watching and timing. Again, he did not care for the jet photometer that was used. It was not reliable at all; and, besides, to test gas as it passed by any given point was altogether unsatisfactory. The only reliable test he could accept was by getting the whole of the gas from a sample of coal into a holder, and then testing it after its mixture had been completed. For instance, in sample No. 2, in Table No. 1 appended to the paper, there were

50 feet of gas of negative quality, having no illuminating power whatsoever, given off in the fifth hour. There was stated the average illuminating power over the whole time; but they had no idea of what the effect of this negative quality gas would be when distributed through the luminous gas which preceded it, and this was a very important consideration. It was a mystery to him what the gas was composed of which had no illuminating power. There might possibly be something in it which would tend to destroy the luminosity of the other gases, by increasing the rapidity of combustion, or otherwise affecting the flame when the gases came to be consumed, and thus bring down the illuminating power in a greater ratio than was indicated by the 50 feet of non-luminous gas. The best plan, in his (Mr. Carr's) opinion, was to have a gasholder, to put the whole of the gas into it, and then test it after it had been mixed together. Mr. Ball had touched on a very important question with reference to the testing of coals when he referred to the residual products. He (Mr. Carr) had tested a great many samples of coal at different times with an experimental apparatus, and had always tested for the residual products as well as for the quantity and quality of the gas produced. He had noticed that the same coal would give very different results under different temperatures, and that he obtained a less quantity of gas and a less illuminating power with a larger quantity of tar from the same coal. He had found very often that coals which gave a low illuminating power, and not quite so large a quantity of gas, gave a sufficiently large quantity of very good tar to make up for the loss in quantity and quality, and on this account it might be considered good gas coal. In making analyses and estimating the value of different coals for the benefit of his Committee and himself, he adopted the following plan:—He took 18-candle gas as being worth 3s. per 1000 cubic feet, or 2d. per 1000 cubic feet per candle; the coke at the selling price, whatever that might from time to time be; and the tar and liquor, ditto. In working them out in this way he was often very much surprised with the results. For instance, the same coal worked off at different times and temperatures would give widely different results as far as the details went, but the sum of the results would be pretty much the same. Sometimes he would get a large quantity of tar with a comparatively small quantity of gas of low illuminating power, and at other times plenty of rich gas with very little tar. But the money values, reckoned out in the above way, would generally balance each other; and, therefore, coals which gave a large quantity of thin tar, although they might not give so much gas as others, were not to be despised as gas coals, nor could their value be fully appreciated without taking this item into consideration. They were not only useful on this account, however, but also from the fact that they worked off very freely, and gave very little trouble by choked ascension-pipes and that kind of thing. On the other hand, gas managers had coals coming to them with splendid printed analyses (which ignored the question of tar altogether), and while these analyses might be pretty well borne out as far as the quantity and quality of the gas to be obtained from them was concerned, the coal was very difficult to work, and the hydraulic main would soon be filled up with pitch if the working was not very carefully conducted. He should like to hear the opinion of Mr. Hislop on this question. The more it was ventilated, and the more freedom there was among the members in giving expression to their opinion, the more likely would they be to get at some settled idea as to the value of coals.

Mr. G. R. HISLOP (Paisley) said he had listened with no little interest to the paper and discussion; and he must say that, in the main, he very much agreed with Mr. Carr. In the first place, the coal tested should represent the entire seam; and, if possible, should be taken from two or three different parts of the seam in proportion to the output. There were also many other circumstances which went to affect the results obtained—too many, indeed, to refer to at present. The amount of water in a sample of coal when examined very much affected the results, as within certain limits a difference of each 1 per cent. in the coal would affect the gaseous products to the extent of 5 per cent. It was further most essential to value all the products from the coal; as to estimate the gaseous products apart from the solid and liquid products rendered the analysis altogether incomplete. In England the secondary products were, perhaps, of higher importance than in Scotland; but he had made it a point for many years to most carefully estimate the commercial value of tar, liquor, and coke, which in his analyses were summed up and represented in one figure. They were accurately ascertained in the commercial way, and therefore a simple sum in proportion would determine the relative value of coals taken

in that connection. A good deal of discussion had arisen as to the scale of magnitude on which these analyses should be conducted; but analysts were inclined to think they were entitled to show what was contained in any given sample of coal, and that those who had to manufacture from it on a practically large scale must do their utmost to come as near to the analytical results as possible. It would be a mistake, however, in all cases, to expect to find results on a large scale such as were given in an analysis. Every gas manager, according to his mode of working, the nature of his settings, and the heats with which he worked, should make a certain deduction, according to his experience, in each case, for the difference which would exist between an examination on a somewhat small scale and one on a commercial scale. If these matters were properly considered, no manager would experience difficulty in taking a printed analysis in guiding him as to what he would obtain in general working. With regard to the charges being protracted too long, he had been in the habit for many years of using plugs in the top of the ascension-pipes, and found them exceedingly useful in time of defective quality or scarcity of gas, when they required to take the retorts quicker, in order to maintain a supply of gas, as by raising the plug the condition of the charge could be ascertained, and when it was found the charges were sufficiently exhausted the diluent gases could be escaped, or the retorts re-charged, and thus valuable time would be saved. He found on Sundays, when labour was suspended, they were very useful; because, instead of slackening the retort-doors, he put the plugs up, and allowed the inferior gases to escape through the roof of the house.

Mr. T. ANDERSON (Bath) having made a few remarks,

Mr. C. R. MEAD (Sutton) said it appeared to him there was one omission which was very often made when results were given of the testing of gas coal, and that was the temperature of the retorts in which the coal was distilled. They all knew very well that different results were obtained in different gas-works where the same quality of coal was used. For instance, there was a coal they all knew very well in the South—the ordinary Pelaw Main gas coal—from which some managers were able to get paid for 8000 feet of gas per ton, whilst others obtained 9000 feet per ton, and at one works in the neighbourhood of London they were paid for over 10,000 feet, the leakage in each of the gas-works being, comparatively speaking, equal. There was no doubt in his mind that at these different works the variation in quantity was obtained entirely by the difference of the heats at which the retorts were worked. Some coal would give vastly different results with different heats in the working; and hence he believed there was no practical analysis of coal worth anything unless the temperature of the retorts in which it was distilled was stated. It was not fair to distil at a low temperature, and then give the volume of gas as being small from a certain quality of coal. He would further say to those who managed small gas-works, and had no weighing machine, that there was something else to be guarded against in testing a sample of coal. Most gas managers had been visited by gentlemen who had agencies for the sale of coal, and a very common practice amongst them was to offer to "send a truck of, say, 5 tons to test the coal by." Now, he would advise his friends always to get means to weigh the sample of coal thus sent before testing it; for he had found, in some cases, that the first truck, which should have contained 5 tons, contained nearly 6 tons, and if they looked at the result of the testing of the first truck of coal, and then tested the coal bought in bulk, which would be only 5 tons to the truck, they would get a very different result from what was in both cases a truck of coal.

Mr. W. SUGG (Westminster) said that, as an experimentalist, he was much interested in this paper. Mr. Veevers had opened up a subject of very great interest indeed by the manner in which he had carried out his results, showing what could be obtained from coal at the different hours of the charge, and he had not found anywhere else results given so fully as they were in these experiments. Next, with regard to the manner in which the experiments were carried out. A somewhat similar plan had been adopted a good many years ago by Mr. W. Mann, of the late City of London Gas Company; namely, taking off from a retort-bench the centre retort, registering the quantity of gas made from it, and carrying it off from the ascension-pipe to a separate set of purifiers and condensers. But Mr. Mann found that taking off the whole of the gas was very inconvenient, because he could not get a gasholder large enough to contain all the gas made from a large-sized retort. He therefore adopted the plan of passing the gas through a meter having a fractional meter on the top of it; and, by this means, he obtained an

accurate sample of the whole of the gas which was produced, and passed through the large meter. This small quantity was collected in a little gasholder and analyzed. The results he obtained were perfectly independent of tar or liquor, which could be made by the apparatus, and this had always been a difficult thing to ascertain, especially in small experiments, though a small apparatus would be found most useful, from the greater ease with which the temperature in the whole of the working could be regulated. For, in the first place, with regard to the temperature of distillation, this could be much more easily regulated by the use of gas than by means of coke—in fact, it could be regulated to the greatest possible nicety. M. Audouin, of Paris, had carried this out very well, in a small apparatus in which he used only 300 grains of coal, and obtained surprisingly correct results. This, however, he (Mr. Sugg) thought was much too small a quantity. The furnace should be heated entirely by gas and air burners, and by this means the temperature could be maintained to a nicety. It could either be regulated by the melting point of different metals, or by the mode M. Audouin adopted of taking a piece of platinum (or iron) of a certain size, dropping it into water when it was at its greatest temperature, and seeing how much the temperature of the water was raised by it. This would give a very good index to the heat of the retort. Then the only way of obtaining the tar and ammoniacal liquor in a small experiment was, he (Mr. Sugg) thought, by collecting the gas over water, and in this way the tar could be collected, but the ammoniacal liquor it would be almost impossible to estimate, unless the apparatus were kept going for some considerable time. He thought Mr. Carr had slightly misunderstood the direction of Mr. Veevers's experiments, because he said the only way to get at an accurate result of what was contained in the coal was by taking the whole of it. This was, no doubt, perfectly correct as a commercial experiment, but Mr. Carr had lost sight of the point that Mr. Veevers evidently intended to work out, which was to show what was the illuminating power and quantity of gas obtained during every hour of a charge of coal. This had been tried in an inefficient way by a few persons only at home and abroad. It might be within the recollection of a great many of those present that at one time there was considerable doubt as to when the greatest amount of sulphur was given off, whether from the first, second, or third hour of the charge. It was generally believed that the greatest quantity was given off during the last hour, but some experiments which he had the pleasure of seeing performed by Mr. T. N. Kirkham at Fulham showed conclusively, as far as he could ascertain, that the last hour of the charge did not give off any greater amount of sulphur than the first. Since that period he had heard remarks on the subject made by foreign gas engineers, who, many of them, use much higher heats than were common in England, and there did seem something remarkable in the results they obtained. He was struck by the remarks of Mr. Hislop who spoke of the mode of testing which he adopted; but this gentleman did not seem to recollect that heats in Scotland were much higher than those used in London and the neighbourhood. This was one of the main points to be attended to in the experimental trials of coal, and this point could only be determined by experiments on a small scale in the direction which Mr. Veevers had pointed out, and with a furnace regulated by gas.

The PRESIDENT said that in the very interesting discussion which had followed this paper there was yet one condition, essential to the accuracy of tests for the purposes of comparison, which appeared to him to have been overlooked, and this was the temperature down to which the process of condensation had been carried. In various experiments he had conducted in testing coals, he had found considerable difference with the same coal, in the illuminating power of the gas when it was condensed, say, to about 40° Fahr., and when gas from the same coal was condensed to 60° Fahr. He regarded it as absolutely necessary for the purpose of determining the comparative values of different kinds of coal, that in testing them the same temperature of condensation should always be observed.

Mr. VEEVERS, in reply, said he feared that some points of his paper had not been distinctly heard, because he had certainly mentioned tar and ammoniacal liquor as entering into the estimation of the value of a coal. The object of the paper was not to go into elaborate scientific tests, but to point out a method by which an ordinary working manager, who had not much time on his hands to devote to scientific analyses, should be able to check the quality of the coals he was using in his works. Of course, to this simple method could be added any further scientific investigation which might be

needed—as to the different temperatures to be employed, and more elaborate results as to the tar and ammoniacal liquor obtained. Time would not allow him to answer the whole of the remarks which had been made, but he might say broadly that his object was to give a simple method of testing coal and cannel. He gave the result in the quantity of gas made, because it rather surprised him to find that, in practical working with coal and cannel, he afterwards obtained somewhat similar results to those realized without the use of a gasholder, and it was the absence of a gasholder and tank which made his plan so economical in small works.

(III.)

RETORT FURNACES.

By Mr. FRANK LIVESSEY, of London.

The object of this paper is to give to the Association an account of some successful experiments to reduce the retort fuel account at the South Metropolitan Gas-Works, which has been accomplished by the adoption of gas generator furnaces and other arrangements. Gas generator furnaces, or furnaces for the conversion of coal or coke into a gas fuel, chiefly carbonic oxide, have of late received much attention in gas-works in France and Germany, with very favourable results; the advantages from them being not only the saving in fuel, but also the greater heat to be obtained and the freedom from dust in the retort-flues.

The theory upon which the carbonic oxide furnace is constructed is a well-known one; but it will perhaps render the paper more complete to state it. When air enters through the bars or at the lower part of a furnace, the oxygen combines with the heated carbon and forms carbonic acid (CO_2); but should there be a deep layer of fuel—say 3 or 4 feet—the supply of oxygen becomes less in proportion to the carbon, and the carbonic acid takes up another equivalent of carbon, and carbonic oxide (CO) is formed. The resultant mixture of gases, according to one authority, should be composed of carburetted hydrogen, nitrogen, carbonic acid, and carbonic oxide, in about the following proportions:—

Combustible gases	carbonic oxide . . .	25 per cent.
	carburetted hydrogen	11 "
Incombustible gases.	carbonic acid . . .	4 "
	nitrogen . . .	60 "

In the JOURNAL OF GAS LIGHTING of July 29, 1879, "Isca" gives the composition of gases from a grate generator properly supplied with steam as under:—

Combustible Gases.		Incombustible Gases.	
CO	H	CO_2	N
20.4	9.8	9.3	60.5 = 100
18.9	9.8	9.2	62.1 = 100
20.6	10.6	9.3	59.5 = 100

If there is a very strong draught, or if the air entrance be large in proportion to the capacity of fuel, the quantity of the two incombustible gases will be greatly increased, thus destroying the object to be attained. The combustion of the fuel is most intense at the bottom part of the furnace, becoming less as the top of the fuel is reached, where a greater heat than a dull red indicates the presence of carbonic acid. It is necessary that the air supplied to burn this gas should be heated previously to its being delivered in the combustion chamber, below the retorts, and to do this economically several plans have been tried. The object to be attained is, of course, to heat the air by means of the waste heat, and naturally the main flue is at once suggested. Unfortunately, the main flue in this case, as in many other works, was at the top of the beds, so rendering necessary a strong draught to pull air down into the combustion chamber, and a still stronger draught in the furnace, which is at a lower level. This is very objectionable, for, should there be any cracks in the furnace, air will be drawn in, and will destroy more or less of the carbonic oxide.

In several French settings that have been especially arranged for gas furnaces the main flue is carried beneath the retort-settings, and the air for the combustion of the carbonic oxide is there heated; one plan being to pass the air through the flue in a number of small pipes, somewhat after the plan of the battery condenser, where the gas represents the waste heat, and the cooling tubes the air to be heated. This plan of heating the air, though certainly the most economical, cannot in all cases be adopted. One plan tried was to draw the air backwards and forwards up the sides of the furnace itself; but in this there is an element of danger, for should there be a crack between the cold air flue and the furnace, air will be admitted into the furnace, and so burn the carbonic oxide where the heat is not required. This difficulty can be overcome by making the air-flues of cast-iron tubes; the air may

then be heated in the way just spoken of, or underneath the bottom retort.

From many different furnaces that were tried, two successful ones are here selected for description. The first (Fig. 1) was constructed in the coke-hole of a stage house, after the usual form of a gas generator furnace. The opening for charging was made to be air-tight when closed; the flue taking gases into the combustion-chamber in the setting. There were four cast-iron plates sloping to the fire. The lower ones supported the bars, which in this case were old inch tubing, and they projected out some distance in front, in order to move them about and break up the clinker. Upon these lower iron plates also a constant stream of water was allowed to run, the greater part of which was converted into steam, so keeping the upper plate cool, as well as checking the great heat at these air entrances. The front and sides were stepped back from the grate in order to prevent the air creeping up the sides, and so escaping the passage through the fuel—a very necessary condition. The position of the charging-hole and the shape of the furnace must be well considered, for should there be at any place a less depth of fuel than 3 feet, the percentage of carbonic acid will be large, and heat will be generated in the furnace instead of under the retorts. Furnaces built previous to this one, where fire-tiles had been used in place of the iron plates, and where neither water nor steam was supplied, melted away so rapidly as to render them useless. It was found necessary to supply steam or water at all places where air was admitted, as the decomposition of the steam reduced the temperature where it was most intense and was not required, and supplied fuel higher up.

In a paper on "Gas Generator Furnaces" in the Transactions of the French Society, it is stated that as much heat is required to decompose water as is given off by its combustion. The advantage to be gained, as before stated, by the use of steam, is to reduce the temperature at the grate and air entrances, where the intense heat will melt everything with which it comes in contact, and supply it in the mass of the fuel where it is useful.

The hot air in this furnace was supplied by two 8-inch pipes running into a flue of the same area passing under the flue of the bottom retort, and then into the combustion chamber under the centre middle retort. The size of this furnace, which heated the whole length of a through bed of seven retorts, was, at 2 feet above the bars, 5 feet long and 3 feet wide. The area of the grate was 33 in. \times 9 in. = 297 square inches, less three bars, 132 square inches; leaving 165 square inches. The area of the hot-air flues, two 8-inch pipes = 100 square inches; but the draught being much greater through the pipes, the area may be taken roughly as 200 through the pipe, against 160 through the grate.

After working for four months there was little or no sign of burning away, as the furnace was not certainly $1\frac{1}{2}$ inches wider at any part than when first built. The saving of fuel was on the average about 20 per cent. It is essential that the fuel as it burns away and reduces in bulk should not leave the sides, and so make a passage for the air, but, on the contrary, should wedge itself in; for should the air find a passage up the sides or ends of the furnace, carbonic acid gas will be formed, and the bricks will be rapidly burnt away. It is better that the hot-air flues should exceed in area that of the grate; they can then be closed until the best results are obtained.

The experience gained from this furnace, and from several others that were tried, led to the conclusion that the chief economy in working was obtained by the deep layer of fuel and the heated air supply. If the same results could be obtained in an ordinary setting, it would certainly be an advantage, as a large amount of brickwork would be saved, and the disadvantage of having the coke-hole blocked up with so many large furnaces would be removed.

The accompanying drawing (Fig. 2) shows the plan adopted to carry out this idea. The furnace in an ordinary stage retort-house was cut out, and an opening cut through the arch below, as shown in the drawing. Two furnaces were used in this case, one at each end of the through bed. The opening in the arch which formed the grate is 25 inches long, 2 inches wide, increasing to 21 inches wide in the body of the furnace, and 4 ft. 6 in. long, leaving a depth of 5 feet from the grate to the holes admitting hot air. The ordinary furnace door was removed and replaced by an air-tight one. It was also raised to keep a good depth of fuel in the furnace. Steam is supplied to the grate by means of a $\frac{1}{2}$ -inch pipe having six small holes to direct it into the fuel. The air for combustion of the carbonic oxide is heated under the flue of the bottom retort, and is delivered in the furnace, above the level of the fuel, about 9 inches below the springing of the furnace arch.

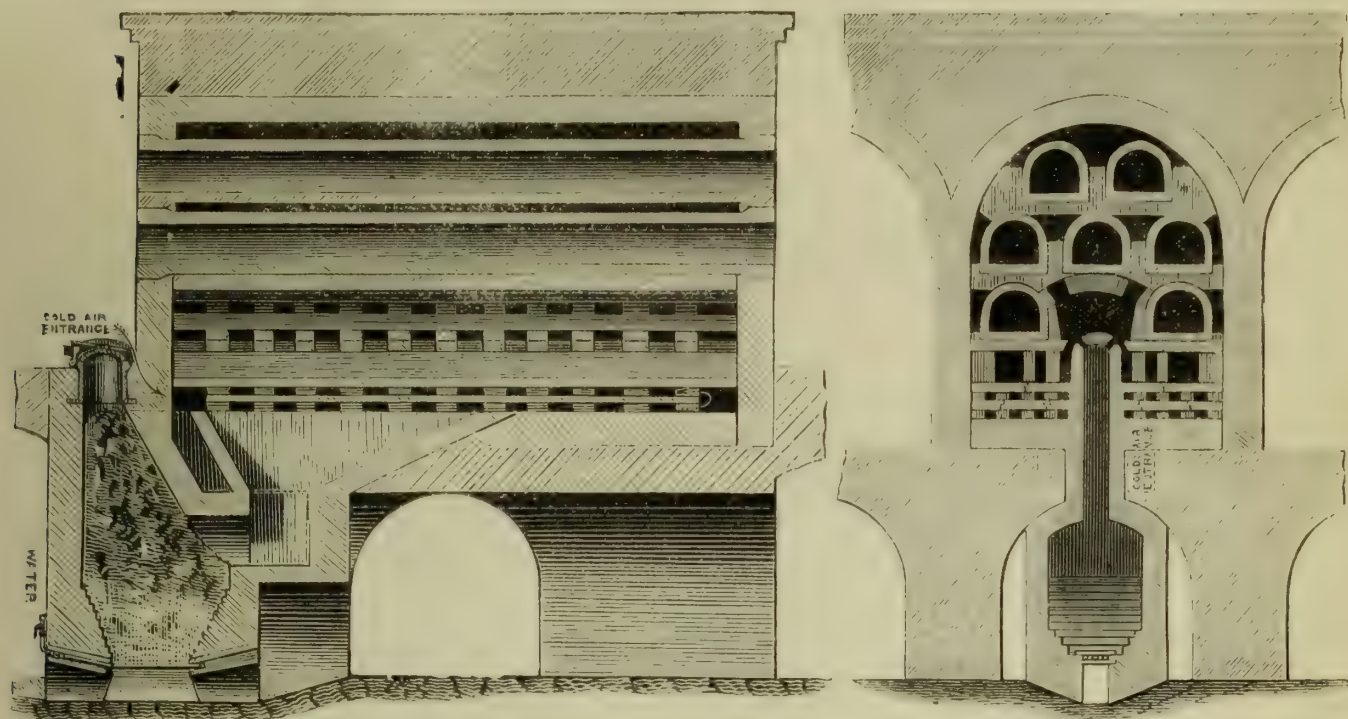


FIG. 1.

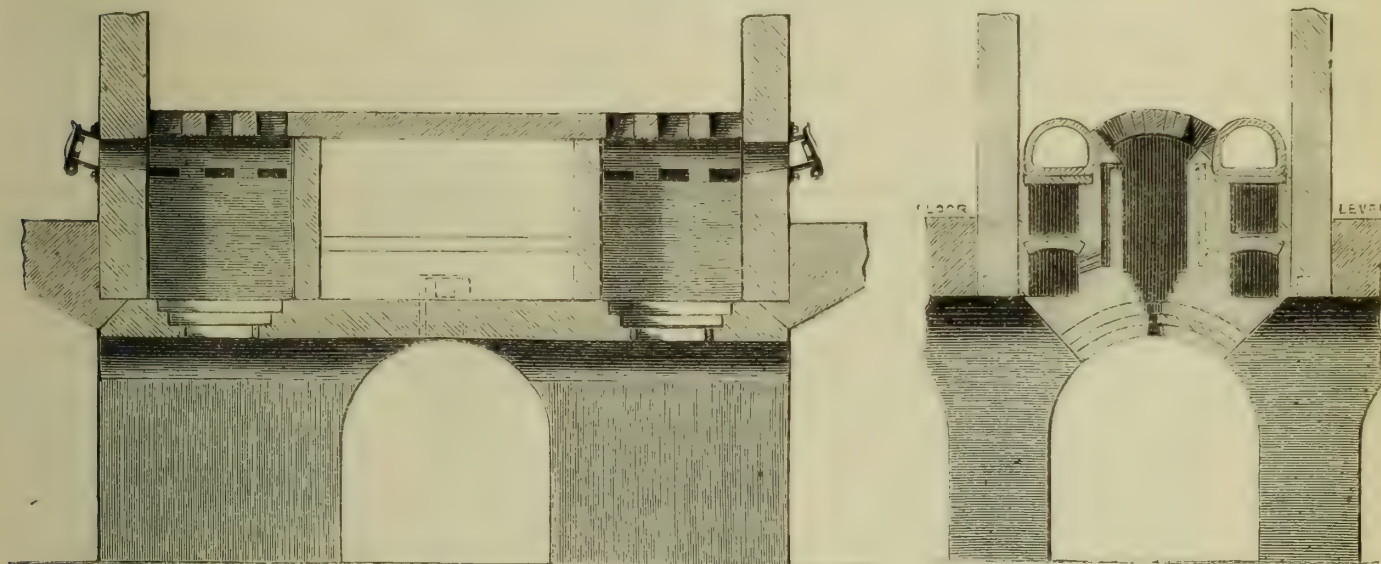


FIG. 2.

The consumption of fuel was quite as low in this as in the first one described, being about 20 per cent. saving on the ordinary furnace, and it possessed the advantages of making very little breeze, and requiring but little attention. The fire was not once raked out during the three months it was at work. The grate area was 25 inches \times 2 inches = 50 square inches for each furnace, and the hot air supply about 28 square inches; but as the draught was much greater here than through the fuel, as much air entered, and probably more. There was no perceptible increase in size after three months working, and it was then only let down because it was no longer wanted. The heat in this setting was much higher than in any of the adjoining ones, while the fuel consumed was less, and the firemen's labour reduced. No fire-bars were used, and the only attention required was to prick out the grate occasionally, and to fill up the furnace as required, which was at longer intervals than in the ordinary furnace.

Having given a description of some successful furnaces, it may prove interesting to state the reasons of failure of some of the unsuccessful ones. In one case a large grate area was allowed, with the intention of checking the air supply by means of a damper, but without success, as it proved to be only an ordinary furnace making carbonic acid instead of carbonic oxide, and maintaining a constantly running stream of clinker; or, in other words, a machine for melting fire-

bricks. In another design the air was heated by the main flue, and was drawn from the top of the beds; but as the draught was not strong enough in the furnace, the air supply was insufficient, and a large portion of the carbonic oxide passed through the setting without burning. This was shown by taking a plug out of the main flue at a point where it was only receiving the waste heat from this particular bench; a piece of glass was then placed over the hole and made air-tight round the edges with fire-clay. On examining the flue no flame whatever was seen, but on waiting till the glass cracked and admitted air, the gases in the flue at once caught light. In nearly all cases where neither water nor steam was supplied, the melting away of the furnace was so rapid as to make its adoption quite out of the question.

The object of this paper has been to give a description of an application of the gas generator furnaces to heating retorts, and to show where success, and where failure, is likely to obtain. A ready means of analyzing the resultant gases from a furnace would be of use, could such a process be discovered; but, in default of this, the knowledge that the furnace is making carbonic oxide instead of carbonic acid is sufficient, and is very soon gained. It is a pleasant duty to mention that these experiments, which have been so far successful, have been under the superintendence of Mr. J. Somerville, whose perseverance and ingenuity to overcome many difficulties deserve great praise. Mr. Tanner, the foreman of

the Old Kent Road works, has also made some valuable suggestions that have materially aided the working.

In conclusion, the writer urges the necessity of further experiments being made, for as every step in the reduction of working expenses will make the consumption of gas greater, and give to it more varied uses, so will this greater consumption render the manufacture of gas more important.

(IV.)

REGENERATIVE FURNACES AS APPLIED TO THE HEATING OF RETORTS.

By Mr. G. E. STEVENSON, of Peterborough.

Two years ago I had the honour to read a paper before you on the subject of "Retort Setting." Although I was aware at that time of the introduction of regenerative furnaces for heating retorts on the Continent, and had seen at Frankfort-on-the-Maine some furnaces at work on the system invented by Herr George Liegel, Manager of the gas-works at Stralsund, I was not acquainted with the details of the system he employs, and did not possess sufficient knowledge of this principle of heating, to justify allusion to it in the paper I then read. Being a short time afterwards placed in communication with Herr Liegel, and believing that the regenerative principle was a more scientific mode of heating than the usual method employed, I devoted some time and attention to the examination of the different systems of generator furnaces in use, and to the Liegel generator in particular, being early convinced that this system possessed advantages over other forms of regenerative furnaces, in the greater simplicity of its construction, and more direct application of the productive gases to the retorts requiring to be heated.

The principle of a regenerative furnace may be briefly stated as follows:—Instead of constructing the furnace so that immediate and complete combustion of the fuel shall take place, it is so designed that the primary supply of air, entering at the bottom of the furnace, shall be sufficient only for the combustion of a portion of the fuel lying nearest to the point of ingress of the air, and that the carbonic acid gas generated by the combustion of this portion of the fuel shall, in passing through a further considerable stratum of coal or coke, as the case may be, yield up a portion of its oxygen to this mass of fuel, and become thereby reduced to carbonic oxide. The oxygen absorbed by the stratum of fuel through which the carbonic acid gas, as the product of the initial combustion, passes, maintains the whole mass of fuel in a state of slow and partial combustion, and the hot gases passing away (consisting chiefly of carbonic oxide) are capable of being rekindled and finally consumed to carbonic acid. This is effected by introducing at the proper place a second supply of fresh air, heated to a temperature sufficiently high to cause the ignition and subsequent combustion of the carbonic oxide gas. By this means a perfect and complete combustion is finally effected, and, what is a matter of great importance, this final combustion is made to take place in intimate contact with the object requiring to be heated, the heat of a flame being always much greater than the heat of the extinct gases resulting from the combustion.

The name "regenerative" furnace was given to this principle of heating by Dr. Siemens, when he applied it to his steel puddling furnaces. In an analogous form to that of the original Siemens furnaces, the principle has been applied by the Paris Gas Company to the heating of their retort-settings. The arrangement is a very complicated one. The primary combustion takes place at some distance from the retorts, the gases of combustion being conducted by flues to the retort-settings, and there mixed with a fresh supply of air, which has previously been heated to the required temperature. To effect this, the secondary air supply has to be conducted through channels heated by the waste gases from the retort-settings. These waste gases are first passed through the channels, in order to heat them to the requisite degree, after which they are turned off, and a fresh air supply is conducted through the same channels, until they have become too cold, when the process is again reversed. By an arrangement of valves the changing of the currents of air and gases is effected simultaneously, two sets of channels receiving alternately the hot gases and the fresh air. This system is very complicated and expensive, and though it may prove successful where capital expenditure is not a matter of much importance, the competition existing between our undertakings in regard to the price charged for gas would present a serious obstacle to the general introduction of so costly a carbonizing plant in this country.

Another form of regenerative furnace existing and finding

favour on the Continent is that of Herr Oechelhäuser, a manufacturer of gas plant, and also Engineer to the German Continental Gas Company. In his system a furnace is built at the back of the retort-settings, in the shape of a square cupola, and the products of combustion from one such furnace are made to serve for the heating of two settings of retorts. The furnace is filled from the top of the retort-bench by means of a hoist, and the gases are introduced into the retort-setting from the back. The secondary air supply is heated by being conducted along flues passing up and down the back of the settings and beneath the bottom flues of the retorts. In this manner the complicated alternating system of the Siemens furnace is avoided, and much economy in construction effected. There are, however, few retort-houses in this country in which such a furnace could be introduced. In large works the prevailing custom is to place the retort-bench in the centre of the retort-house, the retorts being either "throughs" or situated back to back. In smaller works, where the retort-bench is single, it is usually placed close to the back wall of the house, and I take it for granted that few engineers, in designing a retort-house, would be prepared to allow room for constructing such a furnace behind the retort-settings. Moreover, it would not be desirable, in any but very large works, to have furnaces capable of heating two retort-settings at a time.

The next adaptation of the regenerative principle which merits consideration is that of Herr Liegel, of Stralsund. In this system the furnace is placed beneath the retorts themselves, as in the ordinary method of firing. The accompanying illustration (Fig. 1) shows a setting of eight retorts, as erected at the Maidstone Gas-Works, in which the furnace is of the most approved form. It is constructed very deep, and of a peculiar shape. At the bottom is a narrow aperture or slit for the admission of air, and immediately above the slit the furnace spreads out to a width much greater than that of an ordinary furnace. From the point of extreme width the furnace diminishes upwards, the courses of brickwork being set over gradually as the furnace ascends. The front part of the furnace is brought forward below the ground level, and formed into a kind of sack, into which the fuel is tipped through an opening in the floor. This part of the furnace is partially divided from the portion beneath the retorts by an arch, which supports the front wall of the setting. At the top of the furnace, on either side, are the channels delivering the secondary air supply from flues constructed beneath the bottom retorts. The currents of air pass backwards and forwards along these flues, and become warmed by the heat from the bottom retort-flues immediately above them. It is, however, not absolutely necessary to heat the air in the Liegel furnace, because the combustible gases, never having left the proximity of the furnace, do not require igniting afresh, as in the case of the Siemens furnaces. The slit at the bottom of the furnace is formed by large fire-clay blocks built into either side of the furnace. Below the slit the blocks recede rapidly from the centre line, and beneath the slit a small fire-grate is constructed, the sides of which are formed so as to leave air spaces between them and the under sides of the main slit blocks, the purpose of which is to cool the latter, and prevent them from fusing with the heat of the furnace.

The peculiar construction of this part of the furnace is designed to obviate the necessity of clinkering. The intensity of the combustion immediately above the slit is such that the slag runs out of the furnace in a melted condition, and does not clinker and stop up the slit. It is, however, necessary to control the degree of fusibility of the slag. If the slag melts too quickly, and leaves the furnace-blocks clean, these latter cannot long resist the great heat to which they are exposed. Liegel has discovered that if the slag be maintained in a semi-melted or viscous condition, it will, by spreading in a thin layer over the brickwork, protect it from the action of the fire. The draught in the furnace must therefore be regulated to attain this object, and to assist in controlling the fusibility of the slag, the small fire-grate is inserted beneath the slit, and upon this a fire must be maintained (fed with breeze falling through the slit) of such proportions as may be found necessary for the requisite melting of the slag, and freeing the same from the slit-blocks. The clearing of the slit is assisted by the fireman with a light hook, which, being drawn along the slit, removes the semi-melted slag clinging to it. Beyond this, no cleaning of the fire is required. A tunnel is constructed beneath the retort-house floor, for the purpose of approaching the furnace, and for removing the clinker and ashes.

In cases where it is found inconvenient, on account of the presence of water, or from any other cause, to excavate to the depth required for the furnace in its normal form, the

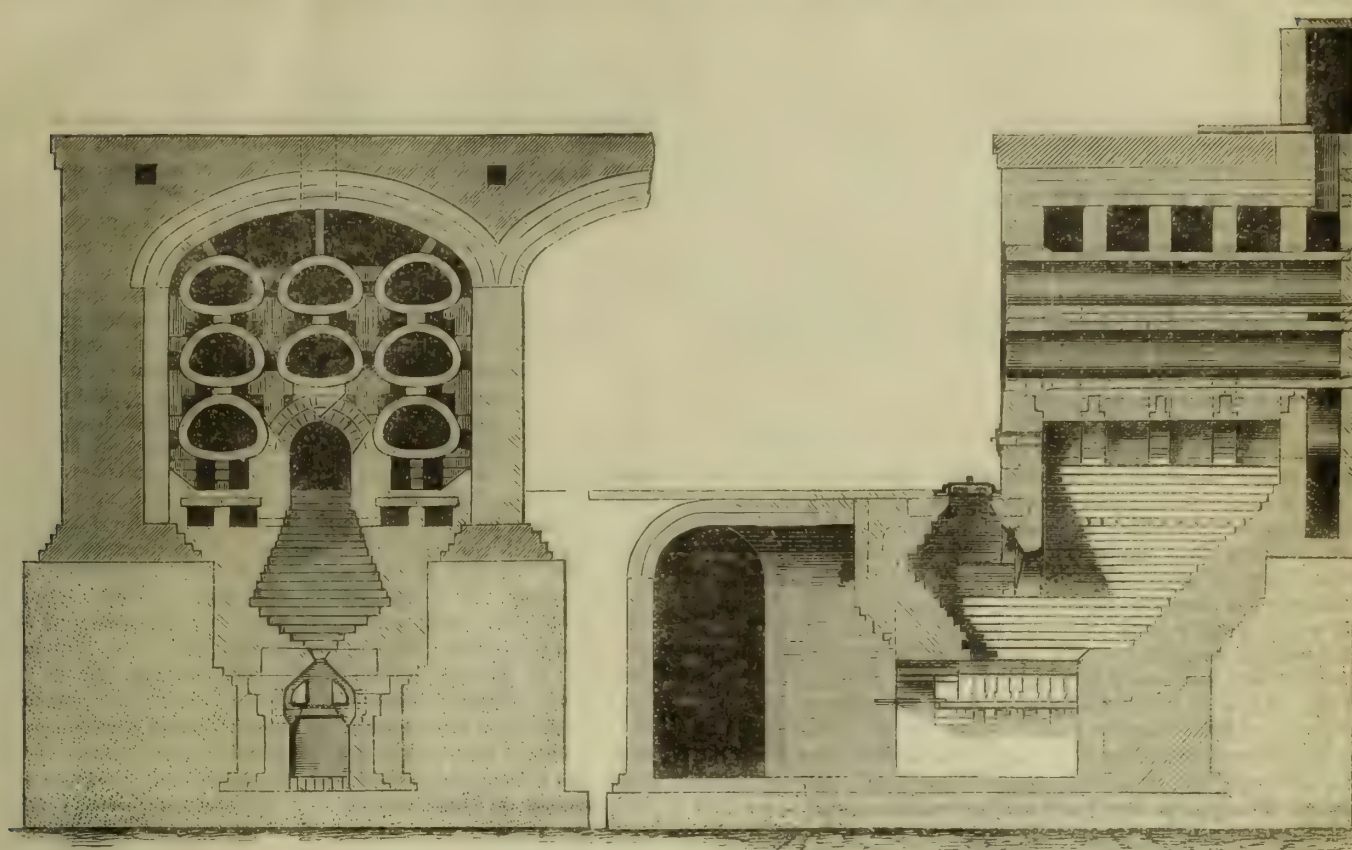


FIG. 1.

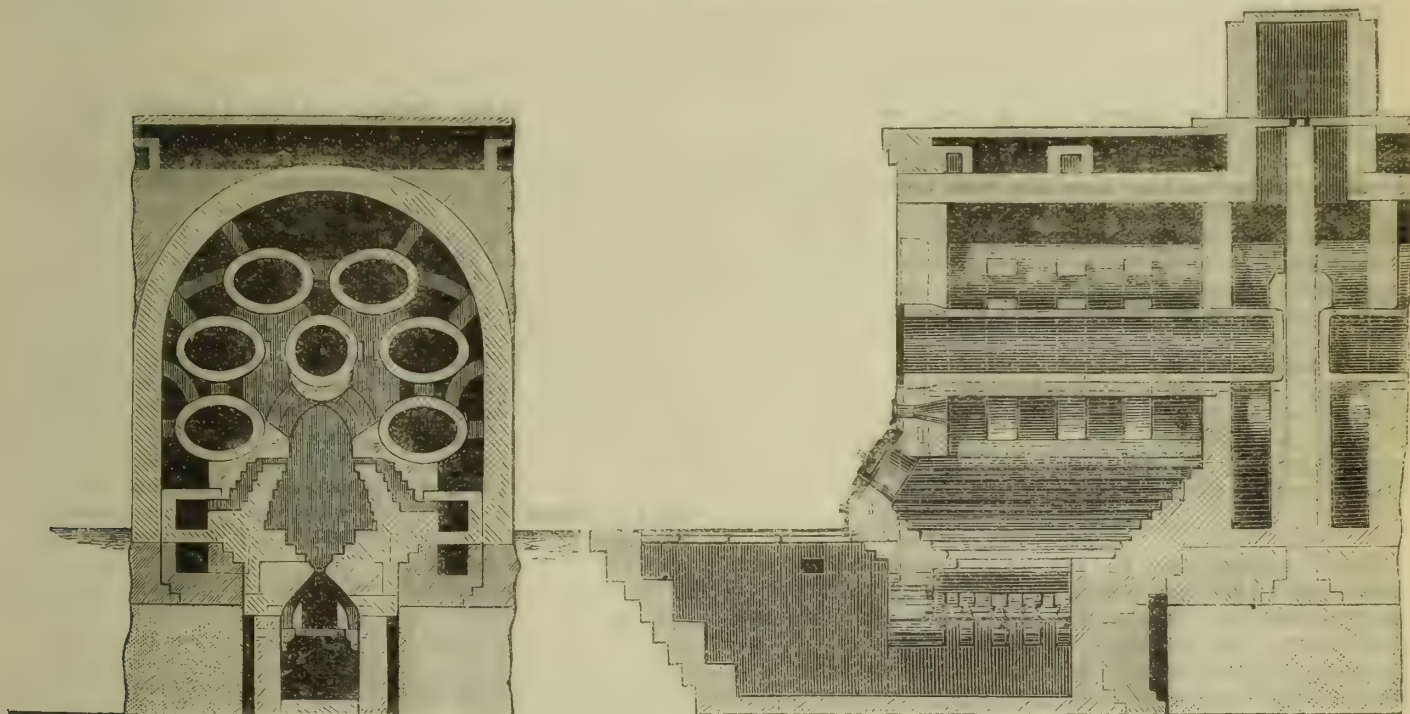


FIG. 2.

system may be applied without the tunnel by constructing the furnace of less depth, and providing for approach to the slit by means of a pit, with steps to descend into it. This method has been adopted in designing the furnace at the Peterborough Gas-Works, where, on account of the high level at which the water stands in the ground, a tunnel could not be constructed. It will be seen, on referring to the illustration (Fig. 2), that in this case the furnace is fired by an inclined opening in the front wall of the setting, and the underground "sack" is dispensed with. This furnace costs less to construct than the deeper ones, but the latter are more perfect in their action and more economical in their results.

The advantages which a regenerative furnace possesses over the ordinary method of heating are mainly greater economy of fuel and greater heating power. The reason for this is to be found in the fact that, for the complete combustion of such fuel as coke or coal, a much greater supply of air must be admitted into the furnace than the theoretically requisite quantity. The speed at which the air must necessarily pass through the furnace to develop the proper heat,

and also the impossibility of the whole of the oxygen of the air coming into contact with the carbon to be taken up, compels the admission, through the grate-bars of an ordinary retort furnace, of about double the quantity of air theoretically necessary, and consequently double the quantity of nitrogen, the direct effect of which is to stultify the combustion and reduce the heat. In a regenerative furnace one-half only of the combustion takes place under these unfavourable circumstances. This must be evident when it is considered that the preliminary object to be attained is the production of carbonic oxide (CO), and not carbonic acid (CO_2); the former gas requiring for its formation one-half the quantity of oxygen to combine with an equal quantity of carbon that is required for the complete combustion of the same. The other half of the oxygen is not introduced until the fuel is in a gaseous form, when a much more thorough intermingling of fuel and oxygen is readily attained than can be realized so long as the fuel consists of solid material.

The Liegel furnace possesses an advantage over other forms of generator furnaces in the fact that clinkering is abolished.

The labour of keeping the slit clear is trifling compared with that of the ordinary process of clinkering, which I do not hesitate to say is a strain on the constitution of the firemen, from which they ought to be relieved if it be possible, and it also exerts a detrimental influence on the furnace and the retorts, which cannot be too seriously estimated. In generator furnaces constructed with grate fires, great difficulty is experienced in removing the clinker and clearing the furnace. For this reason experiments have been made in introducing steam into the furnaces. The steam has the effect of rendering the clinker light and friable, and preventing it from adhering strongly to the brickwork of the furnace. This, however, necessitates additional expenditure in fuel to generate the steam, and I believe it will be found that the continued use of steam in the furnaces has a detrimental effect upon the brickwork.

I regret that I am, as yet, unable to place before you the results of a personal trial of the system. I have had one of these furnaces constructed at the Peterborough Gas-Works, but in consequence of difficulties which have been met with in contending with underground water, and also delays in procuring the necessary fire-clay blocks, it is only within the last few days that the furnace has been completed ready for work. Mr. West, of Maidstone, has also constructed four settings with these furnaces; and, although he has not made any very lengthy trial of them as yet, he will doubtless be kind enough to give you his opinion of their merits. It is, however, not necessary to wait for results at home to judge of the value of this principle of heating. There are now upwards of 200 retort-settings heated by these furnaces on the Continent, and they are being introduced into America. The Metropolitan Gas Company of New York, having made trial of the system last year, are so satisfied with the result that they are at the present time constructing a new bench of eight settings on this principle. Also in Newark, New Jersey, two settings are being built. In the most improved settings of nine retorts each, the fuel account is now reduced to 10 per cent., and the production of gas per mouthpiece with ordinary oval retorts reaches 9000 feet per diem. The repairs required by the furnace, if properly worked, are extremely small, a furnace lasting three seasons without requiring to be relined.

In further proof of the economy effected by these furnaces, I will just state that they have also been applied to heating steam boilers with remarkable success. A Cornish boiler at the Stralsund Gas-Works, heated by a Liegel furnace, evaporates 12 lbs. of water per pound of fuel, whereas the proportion for boilers fired in the usual manner varies from 6 lbs. to 7 lbs., or, at the most, 8 lbs. of water per pound of coal.

At a future meeting I hope to be in a position to place before you the results of personal experience in regard to the working of these furnaces. In the meantime, however, I trust others will make trial of this system, and thus be prepared to confirm the statements made by the inventor and those who have adopted his furnaces in other countries.

Discussion.

The PRESIDENT said the subject of regenerator furnaces was novel to the Association, but he did not think on this account that the discussion would be by any means less instructive. He was glad to see amongst them the illustrious inventor of the regenerator furnace, and they would be under very great obligation to Dr. Siemens if he would favour them with his views on the subject.

Dr. SIEMENS said the authors of the two papers before them had drawn a distinction between the furnaces they had described and the Siemens regenerative furnace, but if too much time had not passed since his early experiments it could easily be shown that the furnaces now put forward had a very strong family likeness to the very earliest furnaces he adopted. In the first instance, he naturally confined the regeneration to the air, using a gas producer very much of the form shown in the diagram, in order to supply the furnace with heated gas. In one variety of that furnace in which the currents were not reversed, he used tubular regenerators; but he soon convinced himself that in doing away with the reversing action only a seeming simplification was effected; for it was far easier to maintain in good working condition brickwork loosely piled into a chamber, than flues through the sides of which the heat had to be transmitted. In the one case there was no leakage, and in the other there was, as well as breakages of the sides of the flues or tubes employed. He therefore soon abandoned the tubular regenerator, and confined his attention to the reciprocal regenerator, in which the currents of cold air and

of hot products of combustion were reversed from time to time. The gas producer was at first closely attached to the furnace in a similar manner to that shown, but he found that two evils arose from this construction. In the first place, the temperature attainable in such a furnace was much below that which resulted if both air and gas were regenerated. This objection would not, however, apply to gas-retorts where the heat to be attained was only moderate. But another evil was this, that when reversals of the current were employed, the quantity of the products of combustion which was available for heating the regenerator must be larger than the quantity of air that came in to take up this heat again. Hence it followed that the air regenerator became gradually heated right through to the chimney end. In order to attain perfect regulation, the volume of gases which ascended through the regenerators, in order to take up heat, must be equal to the amount of gases passing through the furnace in order to give up that heat. The Paris Gas-Works had been specially mentioned in the first paper, and he was somewhat struck with the omission of his name in connection with them, because it was now nearly 20 years since he first designed furnaces for the Paris Gas Company, and the Vaugirard works were by degrees entirely changed in favour of his system. His arrangement with the Company was to the effect that they should ascertain their saving in fuel, and pay him a percentage of the saving as a royalty. For a number of years the Company returned a saving of 35 per cent., which, as it was their own determination, he might take for granted was not against themselves. These furnaces were supplied from separate gas producers, in which water was admitted under the grates; and they had the air and gas regenerator. The success of this furnace was complete, and other retort benches were put up on the same system one after the other. He admitted that the system was a costly one, and he could see in the recent endeavours to modify the arrangement a natural desire to economize in the first cost. At the same time he noticed a reduction in the percentage of saving from 35 per cent. to 25 per cent., and this was just such a result as he should have expected; because, in order to get the maximum economy, it was essential to have a separate gas producer and the double regenerator. The author of the first paper mentioned the fact of water being introduced at the bottom of the gas producer as a means of improving the draught; but he (Dr. Siemens) must confess that he never looked upon it in that light, and did not see well how it could improve the draught, nor did they want much draught in the producer. The effect was entirely a chemical one. If water or steam was introduced at the bottom of the gas producer, especially when coke was used as the fuel, the decomposition of that water or vapour took place in passing through the lower part of the fuel in the gas producer where the temperature exceeded the point at which water was decomposed in contact with heated carbon. Carbonic oxide and hydrogen gases were thereupon developed, which in their formation absorbed or rendered latent a very large amount of heat, and this heat was reproduced in the furnace when the gas raised from the decomposition of the carbonic oxide and hydrogen met with heated oxygen in combustion. Therefore the introduction of the vapour or water at the foot of the gas producer resulted in simply a transportation of heat from the point in the producer where it was not wanted, to the furnace where it was wanted. There was no creating heat in it, nor could direct advantage be claimed beyond that of carrying the heat from one point to another. There was, however, an incidental advantage in the admission of water or steam, in that it kept down the temperature of the fire-grate and prevented the brickwork being injuriously acted upon. He had for the first time seen the modification of the regenerative furnace to which Herr Liegel's name was attached. Many years ago he tried to construct gas producers with an accumulation of heat at the bottom to render the slag fluid, in order that it might run off instead of being dragged out of the bars, and if this could be practically accomplished, a very great gain would, no doubt, be effected, because the clinkering of the bars not only involved a considerable expenditure of labour, but much waste of fuel which must necessarily be dragged out with the clinker. The great difficulty which he experienced, however, was that the clinker would not melt under all circumstances. Sometimes it would, if it happened to be of a fusible composition; but in dealing with other descriptions of fuel the clinker would not melt, and instead of flowing at the bottom, it only clogged up the producer. He should be much interested to hear of the success of the proposed furnace in this respect. In conclusion, he could only thank the President for the opportunity he had given

him of expressing his views on this subject, and the pleasure he felt in seeing that the regenerative system was at last finding favour with gas engineers.

Mr. J. WEST (Maidstone) said the first time the importance of this subject was impressed upon his mind was when the members of the Association visited the Paris Gas-Works. He then came to the conclusion that the system of heating retorts there adopted was in principle the proper one; but he was not aware until now that Dr. Siemens was the prime mover and arranger of the system. He was, however, glad to inform him that he had certainly set his (Mr. West's) mind upon it; and seeing that he had not himself time to go into the matter, he tried to find some one in England who had some experience of the principle, not being aware at the time that Dr. Siemens had arranged the retort furnaces in Paris. Knowing that they should at some future time erect a new retort-house at Maidstone, he was very anxious to obtain the assistance of some one who had a knowledge of the working of the principle, and he came across Mr. Stevenson, who was acting on behalf of Herr Liegel. He talked the matter over with him, and the result was that his Company arranged for a few of their new retort-settings to be erected upon that plan. They had intended to make a complete experiment, and to lay the results before this meeting, but they found it impossible to get anything done in time. He further stated that after he had made a start and arranged with Mr. Stevenson, he found that Mr. Livesey was working in the same direction. He had also another plan which he intended to work side by side with Liegel's system, one which was a combination of two or three of these furnaces which Mr. Livesey and others had arranged, for the object of gas managers should be to get at the best possible plan. He did not care whether it was Siemens's, Liegel's, Livesey's, Somerville's, or whose it was; what they wanted, first of all, was to satisfy themselves that the principle was a correct one, and of this he thought there could be no doubt. He was firmly convinced there was saving of fuel, but he did not attach so much importance to this as he did to the fact of regular heat being applied to the retorts, because in this way they could obtain a larger volume of gas than they could at present. They were all aware of the great loss of volume and illuminating power under the old system, where they had to empty the furnaces, during which time the cold air was rushing through them. Then they had to be heated again from the sides of the furnace, and the heat had to be transmitted from the hot furnaces to the cold coke. Now in any regenerative system the coke was left in a mass for months. In the case that had been mentioned in the first paper the furnace was not emptied for three months, during the whole of which time there was a constant and regular heat, that was to say, if the bottom slit of the furnace was attended to in a proper manner. As to the objection which Dr. Siemens had urged, that it might not be possible to run the slag off from the bottom of Liegel's furnace, he could only say that he had a difficulty in preventing the running down of the bricks; there was no doubt about the slag. The difficulty was to get a material to stand the intense heat of the bottom of the furnace. They had only put the furnace to work about a fortnight previously, and they had been in actual working about eight days, during which time, although they had not had any figures prepared, he had seen enough to convince him that it would be the system of the future. The men took well to the system, and although it had only been started a few days they were already up to the regular make of 8000 feet per mouthpiece; and he anticipated in a short time they would go on increasing, because they all knew that retorts only lighted a few days could not be expected to produce so much gas as those which had been alight six months. He was very desirous that the whole system should be thoroughly gone into. It was important that it should not be left in the hands of any single individual, and he would suggest that the Association should inaugurate and adopt some system whereby a few scientific men might be brought together who would fully investigate a system of this kind, or any system which was worthy of consideration. He himself had not the time to go into the experiments in the way they should be gone into; and, therefore, he thought there should be some gentlemen appointed who should go down to Maidstone, where they would have liberty to do as they liked, and test this system when it was ready. What they wanted to know was that they had the best furnace, which would produce the best results with the least expenditure of capital. His own impression, when he was in Paris, was that the system was a good one, but that the paraphernalia in connection with it was too elaborate, and that it might perhaps be worked out in a more

simple way. What they wanted to know was, whether it would be worth while to spend the extra money in producing probably better results. This would be a matter of calculation; but he was firmly convinced that good results would arise from the system.

Mr. W. J. WARNER (South Shields) thought this matter had really been carried beyond the experimental stage. It was no new system, for he remembered having seen it in the Birmingham works many years ago, although it was not so successful as to warrant its continuance. But that was only with reference to gas-works; its application to glass-works was almost universal, and on the Continent it was being worked constantly. Only a few days previously he passed through some enormous plate-glass works on the Tyne, where the system was going to be thoroughly adopted, and he might tell them what was said by Mr. Charles Mark Palmer, on visiting his works. He said, "What! you use coke furnaces! You are 20 years behind the times." He (Mr. Warner) thought there could be very few experiments required to confirm the economy of regenerator furnaces, as had been proved on the Continent, where so much attention was paid to the subject of fuel for furnaces.

Mr. G. LIVESEY (London) said he regretted he had not lately been able to give so much attention to this interesting work as he should have liked, from being occupied in other ways. The Siemens furnace was universally known, and it was thus hardly necessary to make special mention of Dr. Siemens's name, as every one knew it. The different applications of the principle were for them to carry out. There had not been much done in England certainly with regard to the heating of gas-retorts on the Siemens plan, but what he saw at one of the Paris works some years ago convinced him that it was the right system, and ever since he had been thinking of it. A year or two ago, at the South Metropolitan Gas-Works, they began to make experiments, but difficulties arose because the circumstances varied, and it was therefore not practicable to copy exactly any given system; it had to be adopted to suit special circumstances. Some 12 or 15 years ago Mr. Frank Clarke Hills, whose name was well known in connection with gas-works, gave considerable attention to the utilization of waste heat, and patented a plan for making use of it to heat the air that fed the ordinary furnace. He placed in the flue, under the bottom retort, a cast-iron pipe 9 inches by 4½ inches, which went the whole length of the setting. Air that entered at the north end he made to travel to the south end to feed the south furnace; and for the other side, the air entered at the south end, travelled to the north end, and fed the north furnace. The result of heating the air was remarkable, and showed there was much to be gained by it; but they were obliged to give up this plan of Mr. Hills's, because it was too good—it melted everything; it melted the bars completely. Then an attempt was made, both at their works and at the Chartered Company's works, to do without bars, and to have brickwork only; but that melted in the same way—everything was carried away by the immense heat. This showed the enormous loss that was being sustained by the heat that escaped after it had done its work in the ordinary settings. Now, applying this to the Siemens principle, he thought they had a process which would result in a great benefit. Dr. Siemens spoke about the percentage of saving, but he (Mr. Livesey) would remind him that at present the application of his furnace in England was in its infancy; it was not yet complete and perfect. For instance, with regard to the settings, to which his brother had referred, there was one great defect, that the hot air flues were of brick underneath the flue of the bottom retort, and it was impossible to keep brickwork tight. He was quite satisfied that the cold air was being drawn into the retort flues, and only a portion of it was heated and reached the combustion chamber above the furnace. A considerable proportion he was satisfied was sucked through into the ordinary flue, and carried away up the shaft, thus having a detrimental effect in two ways. The idea which led them to adopt the second plan was this: They noticed that in the stage house, where the regenerative furnace was placed, there was an enormous heat radiated from the furnace itself, and the idea at once occurred: "Here is a great loss of heat through the brickwork; cannot we adopt the Siemens system in the setting itself?" He had no doubt the plan would be somewhat modified, but so far it seemed to have a beneficial effect. As his brother had explained, they had a deep furnace, and supplied the hot air above the fuel, which was not dealt with so well as it would be when they had iron tubes for heating it, and they also prevented clinkering by means of the steam at the bottom, which was a great point to

have accomplished. One had only to go into the archway underneath, and look up into the furnace, to see that there was no intense heat there. The steam by its decomposition simply transferred the heat from where it was not wanted to where it was wanted, and there was no trouble whatever with the clinkering. This principle carried out further would, he believed, be found very beneficial. He quite agreed with what Dr. Siemens said about carrying out the principle in its entirety—namely, reversing the current; but there was great difficulty in applying this to retort-settings—there was not room for the chambers for heating the air. They were at present content with endeavouring to get the proper amount of heated air, and he thought they would be able to obtain a sufficient amount of hot air from the waste heat in the flues. He intended in future to have the main flue under the setting, instead of on the top of it, by passing the air-tube through this flue where the heat had done its work as far as the retort-setting was concerned. By this means they should get the air heated to a sufficient extent to accomplish all they required without the reversing chamber. He was satisfied that in England they were behind the Continent in this matter, possibly because fuel was so cheap they had been wasteful and extravagant with it. He did not feel that the gasmen of England would be doing their duty unless they pursued this object farther, and he had no doubt they would be rewarded by success.

Mr. C. R. MEAD (Sutton) said that the general public gave gasmen the credit of being very much behind the times. Mr. Warner told them they were 20 years behind; but he (Mr. Mead) was afraid they were 25 years behind, for it was just 25 years since he had had the pleasure of testing one of Dr. Siemens's regenerative furnaces. The furnace he had put up did not require more room in the retort-house than the present bench of retorts, except it required more depth. In that case the furnace gases were turned through two flues under the ordinary settings. The flues were built with hollow walls—that was simply bricks laid loosely in—with apertures between the bricks, so that the furnace gas, after having passed to the retort ovens, passed through these hollow walls to get to the chimney. When the bricks on one flue became thoroughly heated, a valve at the back of the flue was shifted, and this turned the air that went to supply the furnaces through the flue containing the hot bricks. There was no question in the world that the saving in heat was enormous, and the only reason why it did not succeed in the small works where he had tried it was, that the men who had charge of the work, and ought to have reversed the valves, neglected to do so. He wished to impress on those who spoke of its not being practical in England, on account of the room it occupied, that it really occupied no more room in the retort-house than ordinary settings. The whole of the regenerative furnaces and flues might be placed on the ordinary settings, and required no more length than was used now. That the system would become universal he had no doubt, though he had very great doubt that his friend Dr. Siemens would get the benefit of it.

Mr. S. HUNTER (Salford) said he thought it very desirable that a system of this kind should be tested; but as for adopting it in works having an underground arrangement simply consisting of an opening in the floor, and expecting men to go into the chamber, where an intense heat must prevail, it would probably result in failure. Perhaps they might have some information as to what class of works should turn their attention to the adoption of this method. He saw no difficulty about it in large works where they could apply a stage floor, where there was plenty of height, and a space beneath the floor; but he thought there would be great difficulty in small works.

Mr. A. F. WILSON (London) said that his experience with reference to the adoption of this apparatus in a small works was this: Some few years ago his attention was directed to the subject, and he had thought of it a great deal since. Three years ago a furnace was put up in some works he was in charge of, and it was very successful. The setting in these works was the ordinary setting; there was nothing underground, but they took out the middle retort, and formed a deep furnace, the form of which was very much like diagram Fig. 2. This was so successful that they at once adopted it to eight or ten furnaces, and after three years experience the results were so satisfactory that he should have no hesitation in recommending its adoption in even the smallest works. It was a mere question of designing the retort-bench, if a new one were being built; but where the benches were already built they could be converted by withdrawing the middle retort. On the question of wear and tear, he thought six retorts in an oven more economical than seven. They made

a chamber for the combustion of the gases in the centre of the furnace, and built a deep furnace with two doors. This was practically a regenerative furnace. The works he referred to were those at Aldershot.

Mr. DENNY LANE (Cork) said he was very glad that the honour of this improved furnace had been restored to the original inventor, Dr. Siemens, for he feared, when he heard the names of Liegel and others connected with an invention which was solely and indisputably that of Dr. Siemens, that he would be denied the credit of it. To put the matter in a practical point of view: What gas managers were suffering from at present was the too great ability of Dr. Siemens; because if he were not a man of such great powers that he had managed to apply scientific principles to so many practical objects—if his attention had not been diverted by his great improvements in the manufacture of steel, by the great electrical achievements by which he had spanned the oceans with electric wires, and by so many other subjects—and had paid a little more attention to the special application of the regenerative system to gas-works, the whole question would have been solved long and long ago. They were suffering from an *embarras de richesse* of Dr. Siemens's mind; but if at any time his learned friend could contrive to limit his genius, and, like Burke, give up to gas-works what was intended for mankind, the whole question, as far as gas managers were concerned, would be exhausted.

Mr. W. CARR (Halifax) said they were very much indebted to the authors of the papers for coming forward with their very limited experience of the furnaces they had been trying. When he was in Paris two years ago he, like Mr. West, was struck with the effect of the regenerative furnaces there, and felt satisfied that it was a step in the right direction, and one which ought to have been taken long ago. The difficulty he had always had to contend with, for he had aimed at getting the highest heats possible, had always been the destructiveness of the furnaces in which great heat was obtained. As the furnace had to be placed in close proximity to the retorts themselves, when the furnace went the retort-setting went with it, and great damage was done, and great wear and tear was occasioned, which meant a loss of money and not an economical system of working. He had tried in various ways to obviate this difficulty, but the only real and certain system of getting rid of the objectionable feature was not to work at such high heats, which, to his mind, meant a loss of profit at the end of the year. But the way out of the difficulty seemed to him to be perfectly clear when he saw the furnaces in Paris. From the discussion that had taken place, he thought there was no doubt about who was the author and inventor of the principle; but Dr. Siemens would allow that other people had tried to modify his arrangement, and to make it applicable to the circumstances of those people to whom the arrangement which obtained in Paris was not quite so convenient as it might be. Dr. Siemens said he had himself tried various systems from time to time, and all that was claimed by the authors of the papers for the different names which were mentioned, was that the arrangements described were not inventions, but applications of the Siemens principle. He was somewhat in doubt as to the exact point where Mr. Mead left them when he closed his remarks. He said that he had tried this system 25 years ago, and found only one fault in connection with it—that the men would not change the valves at the right time. He (Mr. Carr) did not know whether Mr. Mead had come to the conclusion that the progress of evolution had gone on at such a rapid rate that men were now fit to be entrusted with this duty, but it was a great pity that some effort was not made at the time to obtain the help of some men who would have attended better to the regulation of the valves. For their sakes it was a pity, as Mr. Denny Lane had suggested, that Dr. Siemens had not devoted more attention to the subject of gas furnaces; but, as far as the community at large were concerned, there was no doubt the work he had done in the scientific world had been of gigantic benefit, and they were much honoured by having him amongst them that day, and hearing the very clear and lucid speech he had made, and the forcible manner in which he had put some of the fundamental principles of the regenerative furnace before them. Personally he felt very grateful to him, and he had no doubt, from the reception his name had met with, that the feeling was expressed by every member present. With regard to the question of regenerative furnaces, he should endeavour to do something to further the object they all had in view, and he hoped that it would not be long before they had such a system of regenerative furnaces at work that they might be able to attain something like a uniform temperature in carbonizing, and when that came they would have advanced a

considerable stage towards a more profitable and scientific application of their business.

Mr. G. ANDERSON (London) said this was one of the things he had something to do with. He had heard a good deal about these regenerative furnaces, but sometimes their friends were in a considerable difficulty from not having good accommodation. In some places it was not possible to go down a couple of feet below the floor without getting into water, which was a bad way of getting steam. However, he could deduce from what he had heard that there was great advantage from these furnaces if properly applied. One thing which struck him in reading about them, which he had not heard answered by the readers of the papers or even by Dr. Siemens, was that all these regenerative furnaces were argued from the principle that a saving was effected because the carbonic oxide was converted into carbonic acid. But supposing all the fuel was converted into carbonic acid, without the secondary process would there be a saving of fuel? This was a question he should very much like Dr. Siemens to answer. The reader of the first paper said there must be 3 or 4 feet in depth of fuel, or carbonic oxide could not be made. Granting all this, if he had only 18 inches of fuel with which he could heat retorts very well, and which produced carbonic acid, where was the advantage of first producing carbonic oxide, and then giving it another atom of oxygen to make carbonic acid? No doubt the doing away with clinkering of the fires would be a grand thing, for the opening of the furnace for a quarter of an hour or twenty minutes to take off the clinkers, while large volumes of cold air were rushing through the furnace and cracking the retorts, was a thing which would be avoided with these furnaces. Another question he should like to ask was this: It appeared to him that an inferior fuel might be used with these furnaces; but could breeze be used, or breeze and coke, instead of all coke, as at present? If the full calorific value could be obtained out of the breeze it would be a considerable advantage, because it did not fetch the price it ought to, considering its calorific value. These were questions which those who were trying the furnaces would be able to answer when they had tried them further. He had no doubt they should have these regenerative furnaces soon in use, and he had hoped that he and his friend Mr. Lane might have introduced them at Cork; but there they had a solid limestone foundation, and if they had to get down a certain depth it meant excavating in solid rock.

The PRESIDENT said it was not necessary to ask Dr. Siemens to reply to the inquiry of Mr. G. Anderson, because that gentleman had apparently misapprehended the object of these furnaces, which was, not the production but the reduction of the carbonic acid. They might congratulate themselves that this question, although of very recent importation, had already taken firm root amongst them; and he hoped the result would soon be made apparent in the wiping off of that reproach to which Mr. Livesey had referred; and the placing themselves upon a level, at the very least, with continental practice.

Mr. F. LIVESEY, in reply, said he quite agreed with the sentiment expressed with reference to Dr. Siemens. There was no doubt whatever that to him belonged all the credit of the invention of the regenerative furnaces. Dr. Siemens said that they only effected a saving of 25 per cent., whereas they should have more; but he (Mr. Livesey) must remind them that the arrangements he described were not perfect by any means, and no one was more aware of this than himself. For instance, in this arrangement the air was heated underneath the bottom retort, which was generally the coolest one in the bench, and, of course, if heated under there it might take away heat from it, so cooling the coolest part of the retort-setting; but notwithstanding this they were able to keep the bottom retort sufficiently hot to carbonize the coals, and also to effect a saving of 25 per cent. of fuel. With regard to clinkering, in the second arrangement described they found there was no hard clinker formed, and after the furnace had been at work for three months it was not burnt away at all; the only clinker formed being from the coke, which was very friable, and could be pricked out with an ordinary tool by a man attending two or three times a day. There was no large hard lump of clinker as in ordinary furnaces. The steam kept the bottom of the furnace very cool, and the only portions at all burnt were the corners of the bricks which formed the steps. In future it would be put in as a smooth surface instead of the bricks being stepped back. It would be much better if the air could be heated by the waste heat, instead of taking it away from the retort-setting. Dr. Siemens had very properly corrected him in saying that the water improved the draught. He meant to say that steam would improve the draught, not water. The water would only decrease

the temperature at the grate, and give combustion higher up, where it was more needed. Mr. Hunter referred to the size of the works where these furnaces could be used, but he did not think this had anything to do with the adoption of the plan. It was, perhaps, more easily worked out in a stage retort-house, although they were now trying it on the floor. All that was necessary was to make a few steps down in front of the furnace, so as to get it a little deeper. If the retort-settings were a little higher there would then be no necessity to do this. In reply to Mr. Anderson as to the use of breeze, he might say they were able to use a small proportion, but it would be impossible to get any air through a mass of breeze 3 feet thick and 4 or 5 feet wide.

Mr. STEVENSON said there seemed to be a little misapprehension on the part of Mr. Anderson as to the action of these furnaces. The furnace was designed for the purpose of preventing the primary formation of carbonic acid in any quantity. There was a primary formation of carbonic acid just at the lower part of the furnace, but the gases of combustion passed through so great a depth of fuel in the body of the furnace, that in coming in contact with the carbon of the fuel they became reduced to carbonic oxide—the coke was partially consumed, and the carbonic acid became reduced. The reason of the saving was explained in the paper, that the gaseous fuel could be so much more intimately mingled with the atmospheric air necessary for its consumption than solid fuel could; and, therefore, the quantity of air necessary for the complete combustion of gaseous fuel would be very much nearer the theoretical quantity than that required for the combustion of coke or coal. Breeze could be used in the Liegel furnace, and in any regenerative furnace, in certain quantities. He would not say they could use all that was produced, but very little would be produced. There seemed to be some idea that there was an attempt on the part of some of these German gas managers to wrest from Dr. Siemens the credit of being the inventor of the regenerative principle, but this was not the case at all. It was only just to say on their behalf that there was no question whatever that Dr. Siemens was the inventor; in fact, as had been stated, it received its name from him. But a man like Herr Liegel was entitled to the full credit of having worked out an arrangement like the one described, even if it were like something Dr. Siemens had worked out in early days, and he (Mr. Stevenson) was quite convinced that it had been worked out almost as a new invention. One of the obstacles to the introduction of this principle into small gas-works would be that in any form whatever the regenerative furnace cost more than the ordinary one, and some of the few questions put to him when inquiries were made about it was, what would be the proportionate cost. This he was not prepared at present to state, or he should have mentioned it in his paper; but it was so far reasonable that in a comparatively short time the furnace would repay its extra cost. It could be applied in any sized works, and the majority of those using it in Germany were very small works. Those employing Oechelhäuser's were considerably larger. He did not know any besides the Paris Gas-Works, which were very large, that used the complete Siemens furnace. Mr. George Livesey said the principle was still in its experimental stage, but he must differ from him as to that with regard to the Liegel furnace. It might not be complete, but it had been worked out, and had been used in its present form for several years. It might be experimental in England to this extent, that if new works were being constructed, the engineer, as he had had no experience of it, might hesitate to put it in at first starting, lest from the inexperience of workmen some failure might result; but this would not be on account of the furnace itself being in an experimental condition.

(V.)

THE CONSTRUCTION OF GASHOLDERS;

OR,

MODIFICATIONS AND IMPROVEMENTS IN GASHOLDERS AND THEIR GUIDE FRAMING FOR WITHSTANDING WIND PRESSURE WITH GREATER CERTAINTY, AND ESPECIALLY WITH REFERENCE TO THE PRACTICAL APPLICATION OF THE CENTRAL COLUMN PRINCIPLE OF GUIDING.

By Mr. G. BARKER, of Birmingham.

The object of this paper is to elicit a practical discussion upon the best mode of guiding large gasholders, so as to successfully withstand the most severe wind pressure.

That a great difference exists in the opinions and practice of engineers, regarding the construction of gasholders and their guide framing, is evident from the paper read before this Association by Mr. Corbet Woodall in the year 1874,

from which, for the sake of connection, the first paragraph is reproduced. Mr. Woodall said: "In 1868 an interesting and valuable paper, followed by an equally interesting discussion, was contributed to this Association, on the subject of gasholders. When, at the request of our Secretary, I undertook to furnish a paper on the same subject, it was with the feeling that the discussion to which I have referred stopped far short of exhausting the interest of the questions then raised, and that the continuance of that diversity of opinion and practice among engineers, to which Mr. Anderson then referred, made the matter one worthy of renewed consideration."

This difference of opinion seems to have been evidenced in a still greater degree by the discussion following the paper read by Mr. Harry Edward Jones in this building, before the members of the Institution of Civil Engineers, in June, 1875—just five years ago—when, at the conclusion, the President (Mr. Harrison) said: "The paper has at any rate elicited the fact that gas manufacturers are not unanimous. I hope their differences will result in an active competition to improve the process of manufacture, and if this shall be accomplished at a diminished cost they will receive the hearty thanks of the country."

In the discussion on the last-named paper, the most radical differences of opinion were expressed regarding the form, construction, and strength of gasholder framework, and the economical distribution of metal in such framework. That great divergences of opinion still exist, is clearly proved by the variety of designs and strengths of structures recently built, and the stability of these structures varies as much as their outward appearance. The author thinks there are three causes which bring about this state of things. The first, and by far the least, is the uncertain data regarding wind pressure; the second and chief cause is the great difficulty which exists in making any reliable calculations of the stability of the framework, because of its complicated form; and the third is the treacherous material used.

As regards the first uncertainty—viz., wind pressure—we have recently had our stock of data increased in connection with the Tay Bridge inquiry; but the evidence adduced tends rather to increase than otherwise the difficulty of arriving at a definite conclusion. For example, Sir George Airy, the Astronomer-Royal, said that the maximum wind pressure recorded at Greenwich was 40 lbs., and then the instrument gave way. If it had not given way, he believed it would have registered 50 lbs. pressure per square foot. He believed this was sometimes exceeded in Scotland, and it might reach from 50 lbs. to 100 lbs.; especially in the Valley of the Tay, and that in some notes based upon rough calculations, he had put down 120 lbs. to the square foot as what should be provided against in that particular locality. Mr. Robert Henry Scott, Secretary of the Meteorological Office, said he agreed with the opinion of the Astronomer-Royal that the wind in Scotland might rise to a pressure of 50 lbs. per square foot. On the other hand, Dr. Pole thought that 20 lbs. per square foot was sufficient allowance for the wind in the case of the Tay Bridge; but Dr. Pole said, under examination by Mr. Bidder, that in England there might occur a pressure of from 40 lbs. to 50 lbs. on the anemometer, and probably more in Scotland. The late Professor Rankin gives 55 lbs. as a probable wind pressure, and it is said that French engineers allow for the same pressure in designing bridges. In gasholder framework, the author has always taken 56 lbs. (half a hundredweight) as the maximum wind pressure.

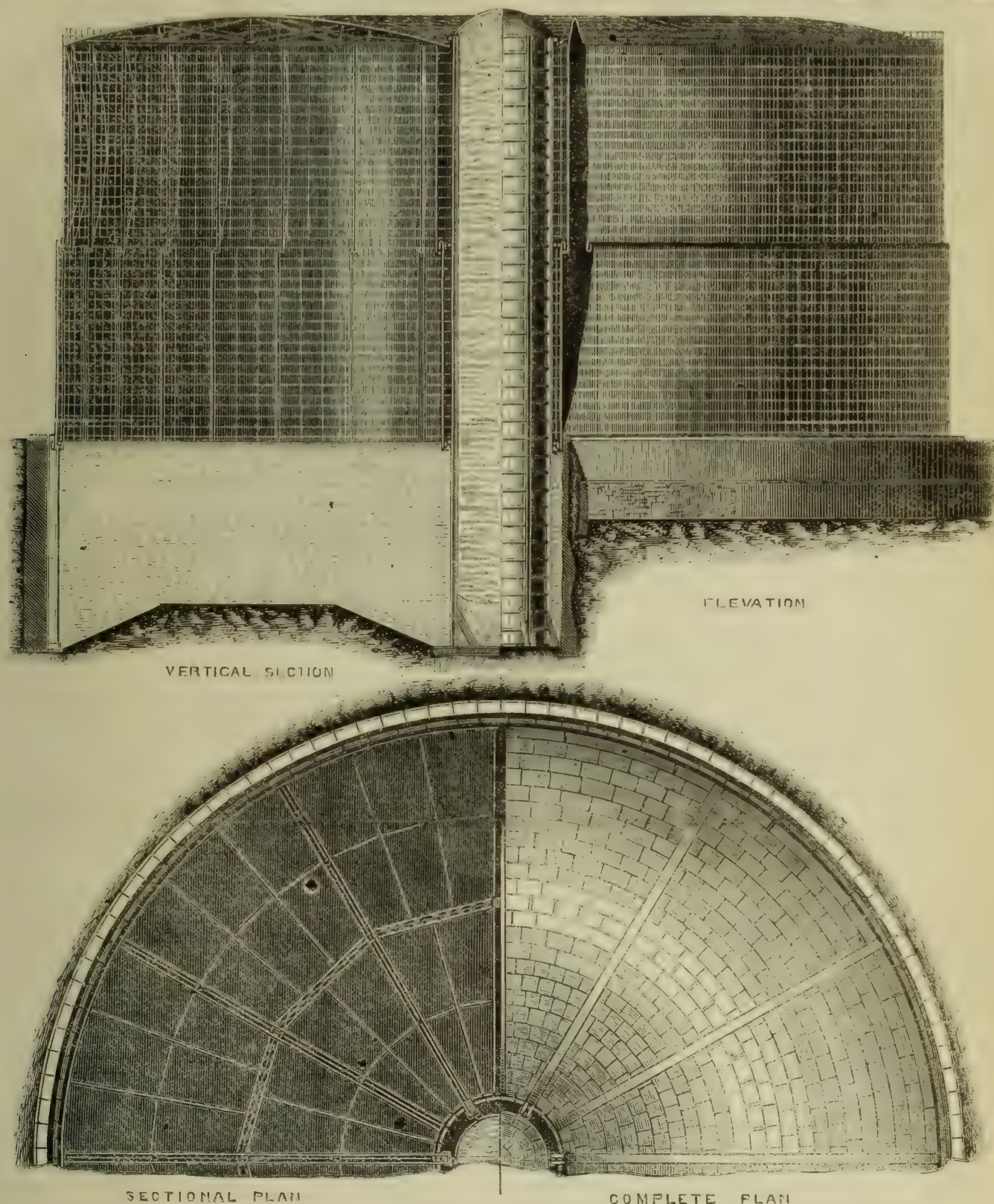
With reference to the second point—viz., the complicated nature of the present plan of constructing gasholder framework, and the consequent difficulty of calculating its stability—the data afforded by the Tay Bridge inquiry is again most valuable, because the piers were very similar to gasholder framing; i.e., they were composed of cast-iron columns and wrought-iron bracing, the base of the six columns forming an oblong hexagon, or a similar base to that of a gasholder surrounded by a framework. A structure of this description requires difficult and tedious calculations to ascertain the strains upon the various members, and after all there are uncertainties in such structures, which are not common to those of more simple design. The material also of the Tay Bridge piers was of a similar kind to that now used in gasholder framing, and the author is of opinion that, had the strains been definitely ascertained, cast iron was not commendable in such a position where it was subject to suddenly alternating strains and shocks. His letters published in *Engineering* on this subject in 1876, and in January of this year, immediately after the fall of the Tay Bridge, giving the results of long experience in cast iron, show how little reliance can be placed on that metal when subjected to tension

or concussion. Cast iron is admittedly a suitable and economical metal, for the members of structures subjected to compressive strains only. The tensile strength of sound cast iron as used in this country varies from 7 to 14 tons per square inch, with exceptional specimens giving as high a result in the testing machine as 18 and 19 tons per square inch, and registering as low as 4 tons per square inch, the appearance of the sections of such weak metal suggesting nothing very exceptional to the eye in the broken fracture. The strength of cast iron under compression probably varies from five to nine times its tensile strength, and taking the lowest tensile strength before mentioned, we have a material capable of bearing 20 tons per square inch in compression, and therefore suitable for simple compression. In columns such as are used around gasholders, where any side may at any moment be thrown into tension by a sudden gust of wind, cast iron cannot be considered the most suitable material, and ought not to be used unless the margin of strength be very great. In the author's letter to *Engineering* of January last, before referred to, 2 tons per square inch was mentioned as the most which can be relied upon in such positions as the piers of a bridge, and even this low estimate would only apply in the place of such cast iron as would give an average strength in tension of, say, 11 tons per square inch. In the more ordinary classes of cast iron, such as that used in general foundry work, it would not be safe to count upon more than from 1 ton to 1½ tons in tension.

In gasholder framework the supports, whether stanchions or columns, are liable to the strains such as have been described—i.e., in modern structures where the tops are supposed to be effectively connected together by girders. For example, supposing the strains to be efficiently transmitted by these girders, then it will be clear that any column or stanchion may have any part of its circumference or sides brought into either tension or compression, and a steady force applied against any column from inside the circle would draw all the columns down, supposing that the tension girders did not give way at their junctions, for the ring of girders has a tendency to straighten itself into two direct lines from the point of strain to the point of greatest resistance. The connecting girders may either be considered as acting like the links of a chain—simply connecting together the tops of the upright supports—or as a rigid ring or arch of sufficient stiffness to keep its polygon form. Modern practice in the construction of such rings, is to connect the outer frame of the holder, at the top, by wrought-iron lattice girders, the ends of which are butted together behind the entablatures, and firmly connected by top and bottom fish-plates, of sufficient section to make the junctions the stiffest part of the ring. Thus in a 200-foot holder we have a 20-sided figure, maintained in shape by, first, the stability of each column, due to the sum of its weight, and the foundations grasped by its holding-down bolts and foundation plates; and, secondly, by the 12-inch wide and 4-feet deep girders which form the rings.

Now, it is very easy to ascertain the stability due to the weight of a column added to any base grasped by the foundation bolts, but the additional resistance to overturning due to the 12-inch rings of girders is generally a most uncertain element in the calculation; and it is to be feared it is often greatly over-estimated. Let it be supposed that the holder is driven against any of the columns as ordinarily placed, and it will be at once obvious that the girders are the wrong way to resist a strain—viz., with the edges of the flanges to sustain the strains; indeed, the mass of metal is concentrated at the neutral axis of the girder, and it is comparatively ineffective under such conditions. Probably this error has been fallen into in the first place to give a better appearance, and has with very few exceptions been followed like a sheep's track ever since; the main consideration of maintaining the shape of the framework at the top, as the tank so perfectly does at the bottom, having been lost sight of. Really what is required at the top is another rigid ring like the tank itself, which would resist any tendency to alteration from its original shape. The girders being merely turned on their side has the effect of producing a ring 4 feet wide, bounded on both its edges by a 12-inch plate and two angle-irons, which are properly placed at the farthest position from the neutral axis of the beam, when resisting a force applied as in the previous case. This simple modification would increase the stiffness of the ring by about twenty times its previous strength—i.e., it would have so much greater power of resistance to alteration in its original shape, and yet the same strength in direct tension, and would consequently tend to ensure all the columns acting in unison.

It has been suggested in favour of the old plan that the curb of the gasholder itself would help to resist any ten-



dency the guide-frame might have to collapse; but though this might, to some extent, be true, it seems to the author a doubtful policy to calculate upon the gasholder sustaining its own guide-frame, when the guide-frame is designed to steady the gasholder.

The cross bracing-rods between the columns are another element of uncertainty, and the author believes that no one has yet laid down any rule respecting the assistance they afford. They are therefore generally thrown in, and it is considered that they can at least do no harm if they do no good; but perhaps we may be favoured with recent and reliable data regarding this point. To present to the eye an appearance of strength, which may or may not exist in reality, is a condition of things which leads to waste of material, or else to a false sense of security. The statement made, I believe, by a very high authority—Mr. Hawksley—that where the columns are properly tied at the top, the total strength will be the stability of one support multiplied by the whole number, is, no doubt, a safe conclusion. But there are those who advocate just the opposite theory—viz., that the framework may be considered a solid ring, or its equivalent, with a base equal to the whole diameter of the

holder. The author believes, and no doubt many gentlemen will agree with him, that the truth lies between these views; but *where*, is the great question. The present form of the connecting girders is such that it is quite impossible to do more than say that they assist the columns or stanchions to some extent. The author believes that links pivoted at each column would be in many respects better than stiff joints, unless the stiffness be sufficient to keep the upper ring in its original shape, because the intermediate condition between a rigid ring and a moveable joint would, in case of a breaking strain, probably result in snapping off the girders sideways, close to their junctions with the uprights, and thus their intended utility as tensional connecting members would be destroyed.

The author has now the pleasure of placing before the meeting some suggestions for guiding gasholders by a central column instead of by outside framework.

The central principle, though known many years ago, only occurs, I believe, once in the Patent Records. It is there mentioned, and illustrated in a very crude form, as a mast guiding a small holder intended for producing gas from petroleum. This small holder has its top corner or curb

rounded similar to the holders that have been built at Beckton. The specification is dated 1872, and is in the joint names of T. A. Howland and C. G. McKnight.

Gasholders on the central principle were constructed more than 20 years ago, by Messrs. Thomas Piggott and Co., for Sweden. They were small one-lift holders, guided at the centre by a wood post or mast, which was greased to allow the holder to slip up and down easily. A central holder was erected at the Horseferry Road works some 20 years ago, and is said to have failed because it was unsteady. About this time also, Messrs. Piggott commenced to make a gasholder which was to have been guided by a central column; but the idea was given up, and the holder was completed with outside guides. A length of the central column still stands in the makers yard at Birmingham. It is 8 feet long by 4 feet external diameter, and is provided with internal flanges for bolting the various lengths together. It is not improbable that the unsteadiness of the holder at Horseferry Road led to the abandonment of the one commenced by Messrs. Piggott.

There is also in St. Petersburg a two-lift gasholder 130 feet in diameter, guided by a central column, which is still working satisfactorily; but this holder is not subjected to wind pressure, as it is protected by a strong brick building. The central column is composed of cast-iron plates lightened out, and has doubtless been used for the twofold purpose of supporting the rafters of the outer building, and of guiding the holder, the latter appearing to be quite secondary. A column under such conditions can have but very little to do. Messrs. Laidlaw and Son, of Glasgow, made this holder. There may have been others tried, and the author will be pleased if his paper should have the effect of bringing them forward for discussion.

The guiding columns on the central principle are so simple in construction that a practical man with a 2-foot rule may ascertain in a few minutes their resistance to overturning. The central column is composed principally of earthwork excavated out of the tank, and surrounded by a suitable casing or casings, made from the most appropriate materials at hand. The author's first idea was to concentrate at the centre of the tank one-third of the present outside columns, so as to tie them together by direct cross girders at the top, and so produce a stiff support; but, in going farther into the subject, it was manifest that a number of rings tied together at the centre, though a great improvement upon the present system, would neither be so stable nor so economical as a single tube of considerable diameter, filled with earthwork excavated out of the tank.

It will be noticed that one of the principal features of this system is the arched instead of the dome form of roof, which falls partly towards the outside, and partly towards the central column, reducing the span by more than one-half. This form of roof adds greatly to the stiffness of the holder, and at the same time effects a saving in material as compared with gasholders having trussed roofs. The author believes also it will be found that this plan allows of a holder being constructed which approaches nearer to the correct theoretical form than any other, for its outside may be made equally flexible in all directions, while at the same time it is thoroughly tied together in every part.

A holder thus formed is very much like an umbrella, with a large number of light ribs which spring from the cup and form a parabolic arch at the top, finally resting against the central tube, or turning down both sides alike. The general shape is maintained by diagonal truss rods, which radiate either to the centre or side of the inner tube, and tie the whole together. This mode of construction is very clearly illustrated by a modern bicycle wheel, with its large number of very light radial rods. All the ribs and a part of the diagonals concentrate at the inner curb, to stiffen the ring for receiving the roller carriage to guide the holder. No truss-rods are used in the roof, because the small span of the arch and the number of the ribs, with the diagonal cross ties, render it quite self-supporting when grounded.

It should be carefully noted that there is no existing system of either trussed or untrussed roofs which cannot be used with equal facility; indeed, whichever kind of roof is preferred, the first cost will be reduced by the adoption of the central system. The surface exposed to the wind is also less, because when the roof has risen towards the centre of the arch, it then commences to fall towards the central column. This arched form does not lessen the capacity of the holder for storing gas, but merely removes a totally useless space, as the gas which accumulates at that part cannot be drawn out. The centre of gravity in these holders will also be found lower than in any other existing plan, because of the lightness of the roof ribs, roller carriages, outer curb, &c.

The internal pressure of the gas would be slightly reduced by this proposed mode of construction, because of the reduced weight of the holder. This is probably not advisable, because the inner pressure should, no doubt, exceed the greatest outside pressure of wind, for the purpose of preventing any liability of the plates to buckle inwards, or any vibrations of the plates, and this remark especially applies to holders with untrussed roofs. It would certainly be very dangerous to reduce the internal pressure too much; but considering the tendency of holders to tipple over, any extra weight required might with great advantage be added at the base of the upper lift, which is practically the foundation of the side walls, and this part is generally out of the water. The tipping of a gasholder is, of course, a calamity, and ought to be most carefully guarded against. The author remembers some 20 years ago seeing a gasholder tipple; the bottom edge on one side lifting out of the water, and at the same time the escaping gas took fire. The night being dark, the effect of the flames was grand and impressive. Fortunately no lives were lost, but it was a sight not easily to be forgotten.

It may be objected that the water in the inner cup will be liable to freeze, and would be in an inaccessible position. It will therefore be well to remember the similar position of the inner cup of a central-column holder, when covered by hinged plates, to that of water in an ordinary well, in which the temperature does not vary much from winter to summer, and will generally be found a little over or under 50° Fahr., according to the depth. The inner cup freezing did certainly present a difficulty until last winter, but during the long hard frost which prevailed, the outside cistern which supplies the bath-room at the author's house became solid ice, and the supply had to be carried each morning from the pump. The temperature was most agreeable, being 16° higher than that previously used.

Reverting to the stability of columns, I would remind you that the stability of hollow columns increases as the squares of their diameters—this shows the advantage of large columns over small ones; but the stability of solid columns increases as the cubes of their diameters, which is a fact that has not been taken advantage of in the designing of gasholders. The results of a few experiments are given in the following tables:—

Experiments in Tilting Tubes.

Diameter of Tubes.	Length of Tubes.	Weight of Tubes.	Force required to pull over Empty.	Remarks.
Inches.	Inches.	Drams.	Grains.	
1	9	13	50	—
2	9	26	200	—
4	9	52	800	—

The same Tubes filled up with Sand.

Diameter of Tubes.	Length of Tubes.	Weight of Tubes.	Force required to pull it over Full.	Remarks.
Inches.	Inches.	Drams.	Grains.	
1	9	64	240	Rammed.
2	9	230	1,980	Do.
4	9	736	11,640	Not much rammed.

The tubes were all one length and one thickness.

It may now be instructive to compare the stability of an actual example of a modern outside guide-frame with a central column constructed in the way proposed by the author. Taking, then, a 200-feet gasholder with two lifts, or 80 feet high, surrounded by 20 columns or stanchions, each of which weighs, say, 20 tons, there would require a force of 7 tons at A, on the accompanying diagram (Fig. 1), to overturn one column—i.e., after allowing that the foundation bolts grasp 12 feet cube of brickwork, or 1728 cubic feet each. Thus we get a total stability, supposing the whole of the columns to be brought into action, of $20 \times 7 = 140$ tons. But it must be remembered that before all these columns could be brought into action the side of the tank would probably be split, because one or more columns must be considerably bent *outwards* before the others would be brought into action at all, and thus there is always the tendency to split the tank directly below the foundation bolts. This, of course, will right itself when the pressure is removed which caused the split; but it must be placed amongst the weak points of the outside system, for it certainly is desirable that the tank walls should be as free as possible from strains. More formidable levers could scarcely be placed for destroying the tank than are these columns. It is

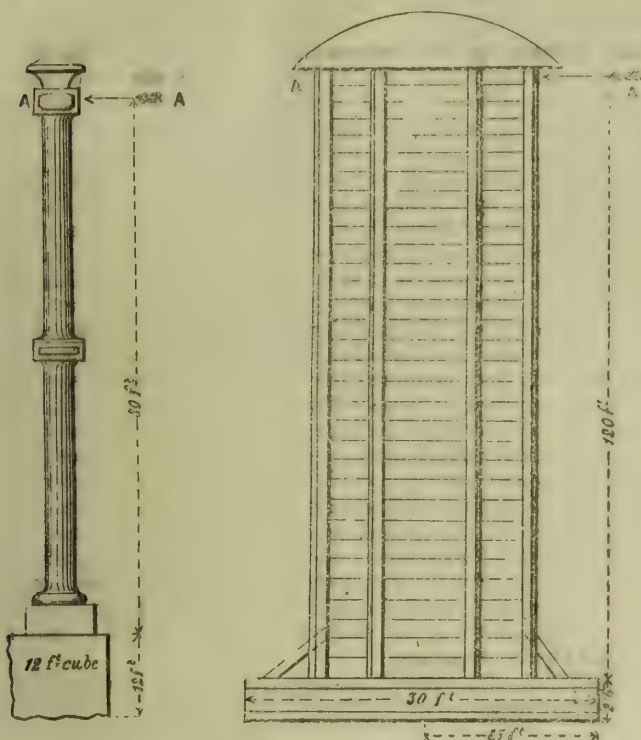


FIG. 1.

FIG. 2.

probably impossible for any one to say how much trouble in leakage has been caused from time to time in this way. The fact that the weight of the columns would close any crack when the tank is empty, rather increases the danger than otherwise. Annoyance under such conditions might continue a secret for a long time, and thus cause endless trouble and expense.

The central column shown in the sketch, Fig. 2, is composed of wrought-iron plates and rolled joists, 15 inches deep by 6 inches wide, and fished on the face with 6-inch channel irons, and also at each side of the web, thus forming the roller guides. These joists are stiffened sideways by 240 T-iron circular gusset ribs, all of which are bent to one block, and punched duplicate. The plates are placed inside the framework, with roughly-butt joints, double rivetted to the cross rings. There will thus be no impediment offered to the free settlement of the earthwork inside, and the ribs would always be accessible for examination. We will take this column as 20 feet in diameter and 120 feet high, with a 30-foot base. When filled up it would weigh with the casing about 2000 tons, and it would require a force of 250 tons acting in the direction of the arrow at A to turn it over. This gives 80 per cent. greater stability than in the case of all the 20 columns previously considered, with less than one-third the weight of metal contained in the outside framework.

As regards the tank, there would be just about the same amount of excavation in both cases, as the 20 recesses for the outside pillars would just about balance the amount of earth required to be excavated at the centre, for filling up the column. Lifting the earth into the column would cost rather less than to cart it away, especially in large towns. The erection, too, of the central column presents neither difficulty nor danger, and requires no scaffolding; the earth is filled in while the work proceeds, and thus there is always a solid footing for the men to work upon. Indeed, all practical men agree as to the ease with which this central column could be built.

Now with reference to guiding. The author here speaks with great diffidence, not because there are any doubts on his mind, but because the holder at Horseferry Road is said not to have been satisfactory, and the one commenced by Messrs. Piggott was discontinued, and mainly because the central system has not been fairly tried. We must not, however, forget that the screw propeller failed time after time, and a host of other important inventions have required several trials before they were successful. The holders which have been tried on the central principle seem to have been carried out in a very crude manner, and the author attributes their failure to their want of stability and imperfect details, such as guides, guide-rollers, &c. The roller carriages, as now proposed for the central system, are shown with triple rollers—viz., one front main roller, and two small side fraction

rollers. When it is remembered how great the facilities are for erecting truly, and for readjusting the central column guides, as against outside guides, how easily fitted, and how little affected by contraction and expansion, the author believes that a central holder would ride quite as steadily as an outside one, and it would be readjusted with greater facility at the centre than at the side. Indeed, the whole success would depend, first, upon a perfectly stable column, which can certainly be obtained, and next upon the details of the guide-roller carriages, neither of which presents great difficulty to a practical engineer. Where land is scarce and dear, the central system will have the advantage of storing about 20 per cent. more gas than the same area of ground would do on the existing principle with outside guides.

Hitherto no mention has been made of economy—indeed, it has been purposely avoided, because it seemed desirable that the systems should be compared as regards safety and efficiency, altogether apart from cost. Yet economy is an important matter, and it is a considerable item in the present comparison. According to all the calculations made, it may be considered that two-thirds of the dead weight in metal will be saved, and this will be equally the case should the outside framework be reduced in weight; for when it is seen how cheaply stability may be obtained by this system of concentration, it will also be evident that whatever outside system may be adopted, the same strength can be given by concentration with about one-sixth of the same metal. The author is, however, quite content to place the figures at one-third, thus throwing in the extra margin of stability. Speaking roughly, but safely, the economy in gasholder construction will be about 20 per cent.—i.e., taking the dead and floating ironwork together. Thus, a gasholder costing for ironwork £15,000 for the outside system, will only cost £12,000 for the central system; or one on the outside system costing £10,000, would be obtained for £8000 on the central system. These figures are fully borne out by actual tenders sent in by eminent firms.

The advantages claimed for the central system may be briefly summed up as follows:—

1. Stability can be obtained with *absolute certainty*.
2. Storage capacity, per square foot of land, *20 per cent.*
3. Economy in metal for guiding, *two-thirds*.
4. Centre of gravity of vessel, *lower*.
5. Strain on the tank walls, *none*.
6. First cost, *20 per cent. less*.
7. Cost of tank, *equal* in both cases.

In conclusion, the author wishes it to be most clearly understood that the reference made to the present outside framework, and connecting guides especially, is not by way of instructing gas engineers, who have especially studied this subject, but purely for the purpose of eliciting a discussion as to what is the best modern practice in outside framework, as compared with the suggested central system.

Discussion.

Mr. CORBET WOODALL said he had hoped that before the discussion on this paper had been taken they would have heard a description of the gasholder, on the same principle, designed by Mr. Wyatt for the Chartered Gas Company, for he felt they were very much at a loss in entering on the discussion without having that illustration before them. He believed Mr. Wyatt had given to the question of the central guide, as opposed to the outside framing, a large amount of attention, and had arrived at very much the same conclusion as Mr. Barker had done. The paper itself was admirably prepared, and the points were very clearly stated. He (Mr. Woodall) was pleased to hear the remarks made on the respective advantages of using wrought iron as opposed to cast iron in gasholder guide-framing, and there could be no doubt of the importance of this point, because of the extreme difficulty of satisfying themselves of the quality of the metal put into cast columns and stanchions; and also of satisfying themselves of the even division of the metal, especially in columns. It was, therefore, a very risky material to use. For instance, he heard from a gasholder maker a short time ago that one of a set of columns to be used for guiding a gasholder had been duly cast at the foundry, loaded on trucks, sent by rail somewhere in the South of England, unloaded and brought on to the works, and yet when being hoisted on to its place it absolutely dropped in two. One could realize such a circumstance without very much reflecting on those who had the passing of that column when delivered. On the other hand, with wrought iron, while it was equally easy to determine what should be, theoretically, the section of metal to bear the calculated strain when provided, there was far less occasion for anxiety as to its behaviour.

He did not quite catch whether Mr. Barker expressed an opinion on the desirability of placing connecting girders horizontally instead of vertically in connecting stanchions or columns. It seemed to him that when they had, as they had in many places in the country, the framings constructed and working quite satisfactorily without any girders at all in the sense usually employed—namely, to exercise an influence both as struts and ties—it was not of very much consequence how they lay. He thought it was not so much a question of appearance in the first place, as of greater economy in the material which resulted when they placed a girder on edge, in its legitimate position, rather than on its flat, where its own weight tended to deflect it, and so exercise an undue strain on the framing to which it was attached. With reference to the diagonal bracing, Mr. G. Livesey, in designing the enormous gasholder he was constructing at the South Metropolitan Company's works, had largely adopted the theory of the French engineers, who disregarded altogether the question of holding-down bolts, and treated the whole framing as one complete structure, and trusted to every portion of it contributing its share to the support of every other portion. From this point of view a more frequent and complete bracing was not only advisable, but absolutely necessary, and the idea of making a complete ring of framework of this kind seemed to have very much to recommend it. In a wrought-iron stanchion it appeared to him (Mr. Woodall) there was no difficulty in getting all the strength which could be required by any circumstances of wind or weight likely to be brought to bear on the gasholder, and such a frame did not involve much more expenditure of metal than was necessary in order to make the stanchions strong enough to support themselves. One point he should have liked more information upon, and that was how Mr. Barker proved the point claimed that there was, with the same area, a saving of 20 per cent. in the storage capacity by the use of the central column.

Mr. GEORGE LIVESEY said he had only heard the last part of the paper, but he could not agree with the principle suggested for supporting gasholders. It seemed to him that gasholders would in the future probably be carried up to a much greater height than they had been in the past. He had hoped to have had the finished drawings of the gasholder now being constructed at the South Metropolitan works ready to be shown, but it had not been found possible to get them finished. That gasholder would have three lifts of 53 feet 6 inches each, rising to the height of about 160 feet. Now, a central column would have to be something like 220 feet long, starting from the bottom of the tank, and he confessed that on the calculations he had made as to the possible wind pressure on so large a surface, he would not for one moment think of entrusting the resistance to so small a base as a central column must necessarily have. What he had sought to do was to get as large a base as possible. The base of his column—for it was a column after all—was the whole framing of the gasholder, which was 220 feet in diameter by 160 feet high. It was, in fact, in principle a cylinder outside the gasholder. To all intents and purposes the framing they had been led to adopt at the South Metropolitan works was a braced cylinder. If a wrought-iron cylinder could be erected with a number of ribs for rollers to work upon, that would be what they wanted. They could not do this, but in place of a wrought-iron cylinder they had a series of ribs. The stanchions were 22 inches deep at the bottom and 15 inches at the top, and were merely ribs to receive the strain of the rollers, and were fastened together by 20 diagonal braces. There were 5 tiers of struts in height, and 10 tiers of diagonal bracings starting from the bottom. The object was so to brace the framing together that it was one complete and perfect whole, and he believed it would do without any holding-down bolts at all. The utmost pressure of the wind upon it was about 300 tons, and the weight of the framing was 500 tons, so that the weight alone would be sufficient to resist the action of the wind. Of course they were having holding-down bolts, but only three in number, to each standard. He could not agree with Mr. Barker in his statement that the tank would cost no more on his plan than on the other, for there would certainly be a greatly increased amount of excavation. For instance, in gasholders now-a-days, if the soil would stand during excavation at a steep angle, where clay puddle was not used, but the cone concreted and rendered, an angle of less than 1 to 1 was sufficient. The lower part of the excavation in the tank he was making was 6 inches to 1 foot, so that it left a very large amount of the centre untouched in the ground. This was left in to the original level of the surface of the ground; but under Mr. Barker's plan the greater portion of the core would have to be taken

out, and this would add very largely to the expense, and there would be a difficulty in disposing of it. He was quite satisfied that to do so would add many thousand pounds to the expense of constructing the tank. If Mr. Barker could show that by his plan he could get the same safety with diminished cost, gasmen would be very pleased to adopt his principle, but he must confess he did not like the inner side sheeting of the gasholder. It seemed to him it would be "out of sight, out of mind," and would be very apt to be neglected. The cup might lose its water, and nobody know it, and the sheeting might be rusted through from neglect. He was sorry to say so much in disparagement of the idea, but he did feel that the diagonal bracing in conjunction with the outside standards was the most secure form. These diagonals were brought into much greater use when the French system of tangential rollers was adopted. He had combined the English and French systems, each carriage having three rollers, two being tangential, as in France, combined with the usual radial roller; the tangential rollers bearing on the side of the standard threw a direct strain on the diagonal bracing, which being thus placed in tension, there was almost the full tensile strength of the iron to resist the pressure of the roller, which was ample to meet all requirements. The central column, he might say, was not new, for at the South Metropolitan works there were, nearly 50 years ago, some gasholders 40 feet in diameter and 20 feet high, guided entirely by a central cast-iron hollow column about 5 feet in diameter.

Mr. W. R. COOPER (Banbury) said he understood that Mr. Barker's column, when filled with earth, would weigh about 42,000 tons. He should think in localities where the soil was treacherous, there would be great difficulty in getting a foundation for such a column.

Mr. D. LAIDLAW (Glasgow) said they had built a large gasholder in St. Petersburg some years ago, with a central pillar. There it had to be inside a building, and the reason it was put up with a central pillar was, so that it could carry the roof of the building as well. It had now worked for 20 years very satisfactorily.

Mr. G. ANDERSON (London) said he was glad that people were taking to the idea of diagonal braces for gasholders. A few years ago no one thought they looked well enough, but he was pleased that he might have been of some use in drawing attention to this point. He fancied that he must have misunderstood Mr. Barker in stating that he considered there was no use for diagonal bracings. Any man who had been on a scaffolding before the diagonal bracings were put on knew how very shaky the poles were, although the horizontal braces were all right. It was only when the diagonals were put on that the scaffolding was fitted to go up; torsion of the whole was so much easier without diagonal bracing. The main thing in the paper just read, however, was the central column, and theoretically he thought there was a great deal of truth in what Mr. Barker had said. But he did not think they would ever get such a thing properly painted inside. The gasholder did not rise above the column, and unless there were space left for a man to go down, they would never get the thing painted. Anything out of sight like that was very apt to be neglected; there would be a difficulty in the men getting in, and if they did get in, they would not do their work so well as when they could be seen on the outside. The weight of the column, too, was a very important thing. Suppose such a high column actually came into use, the wind pressure would be exercised at the top of it—say, 100 or 200 feet high—which would give it a tremendous leverage, and if it was carried down through the tank, and the tank made round it, there was a great chance as to whether the tank would remain tight with a high wind rocking at the column. Therefore, although it looked beautiful, and had some good points he should not like to adopt it.

Mr. R. MORTON (London) said he thought the diagonals of a scaffolding were not quite analogous to the ties in the present case, as they acted both as struts and ties, whilst these were merely ties. This matter had been forced upon his attention lately, but he believed in outside framing, and in a pretty good base to each standard, be it column or upright, of whatever kind. He was not going to cut his bases down as Mr. Livesey had to something like 21 inches by 15 inches, but was keeping them larger. Some of his friends advised him not to put any diagonal ties at all, as they were of no use; they would be valuable if used as struts. But as they were placed on the diagram, if one came into compression the opposite one at the same moment came into tension, and in that way he thought the diagonal bracing was certainly a great improvement. Mr. Livesey's framing would be nothing

at all without diagonal braces, and if it succeeded there, where the standards were simply guides with no base of their own at all, surely, with the addition of diagonal braces, and the columns or standards with larger bases, the structure would be more secure still.

Mr. J. SOMERVILLE (London) said that in the South Metropolitan holder the ribs were tied together by diagonal braces, and they had adopted a peculiar form of roller, having two tangential rollers on the same carriage, and one radial roller. In the 24 columns they had an impact of three-fourths of the circumference instead of one-fourth as usual. The two sides received an impact from the tangential rollers, and consequently the strain was distributed much more evenly.

Mr. BARKER, in reply, said that laying aside the diagonal compression, and treating the top of the standards and the outside framework of the gasholder, they must to some extent look upon part of the section of the framework as acting as a girder sideways, and in that case it would be better to have the girder turned on its side. This was the impression he had formed from looking at the top of it. It all depended upon whether the framework was treated as a solid cylinder, or as merely a tie at the top of the girders. If it was treated as a solid cylinder, then the top girders would be material. If they had a solid cylinder which would turn over by an attack internally at any single point, the stability of the cylinder would be the square of the diameter, but in the case of a solid column filled with sand the stability would be as the cube of the diameter; so that there was a great advantage gained there. As, however, a large base could be obtained round the holder, it was equivalent to weight; a 20 feet column with a 30 feet base would take 250 tons to turn it over. He owned the objection could be brought against a central column that there might be a bad foundation, which would be a difficulty. With regard to the very high column Mr. Livesey referred to, he should tell them that the stability would not decrease with the height. If the column were made twice the height and filled with sand, it would take just the same amount to turn it over as it did now. With reference to Mr. Wyatt's plan, he could only say that he had abandoned the patent for his tank because he found it to be more expensive, but it was not at all similar to his. He had the inner holder inside the annular holder. He placed his framework in the inner ring, and therefore had to build columns in his tank to receive his framework. He (Mr. Barker) did nothing of the kind. Mr. Wyatt had a vertical side all round his inner holder, which caused extra expense, and also the rib of his inner holder, which would cost money, and reduce the capacity of the holders. The whole thing turned on concentration, and the cube of the diameter. With regard to the facility of painting, there would be a space of not less than 3 feet, sufficient to let a man be slung down the central column to examine it at any time and paint it, so that he did not think this disadvantage was worth consideration, and the outside framework, outside the plates, would have a kind of ladder for a man to rest upon while he painted or attended to the inside. With regard to the diagonal bracing, he did not say that it was no good, but it was a source of uncertainty. No authority had laid down any data as to the amount of solidity it would give to the cylinder when attached from the inside. It was a circumstance brought forward in discussion five years ago when Mr. Chance's paper was read; if they could construct a holder which, when attached from the inside, had sufficient sustaining power to turn over as a tube it would be perfection. The amount of earthwork excavated out of the centre of the tank was filled into the column as it was built up, and they need only take sufficient away to fill the column—2000 tons would be sufficient for a 20 feet column, and the hoisting of it would be a matter of very small expense.

The PRESIDENT said they were indebted to Mr. Barker for the able manner in which he had brought under their notice a very important subject. He (the President) apprehended, however, that considerable difficulty would be experienced in getting any one to make a trial, on any considerable scale, of the system of construction advocated by Mr. Barker. There was no doubt that the objections urged against the central column had considerable force, and there was one that occurred to him which had not been mentioned during the discussion, but which it was desirable to bear in mind. With an outside framing there was often considerable difficulty in maintaining gasholders properly level, and they had to be in some instances almost periodically adjusted. He apprehended that, with a central column, this difficulty would be greatly increased, unless a very stiff, and, consequently, expensive inside framing were employed. With regard to the observations made by Mr. Woodall as to the

advantages of wrought iron over cast iron, it ought to be remembered that cast iron had borne the test of many years, whereas the introduction of wrought iron was of comparatively recent date. He did not desire to say a word in disparagement of the skilful application of wrought iron for this purpose; but still he would say, "Speak well of the bridge that has carried you safe." Cast iron, it must be remembered, for rigid structures, improved rather than otherwise through age; whereas just the contrary was the case with wrought iron, which would require more than ordinary care to prevent rapid deterioration.

(VI.)

THE DESIRABILITY OF ADOPTING AND PUBLISHING A FORM OF YEARLY STATISTICS OF WORKING RESULTS.

By Mr. G. E. STEVENSON, of Peterborough.

The want of a uniform standard of comparison between the working results obtained by different gas undertakings leads to frequent misunderstanding in regard to the intrinsic value of the results obtained in the management of this or that individual gas-works, and is the source of much fruitless discussion between gas engineers and managers when they meet to talk over the success or failure of the past, and the prospect of improvement in the future. The discrepancies which exist between the results obtained in different gas-works extend to every department over which the manager has control. From the carbonizing to the distribution, and even in the price charged for the gas supplied, the variation is so great as to be unaccountable if the quality and cost of the raw material—viz., the coal carbonized—were to be alone considered.

If we start with the retort-house, we find that the quantity of gas produced from a ton of coal varies from 9000 to 11,000 cubic feet, and it will often be found that the manager and directors of a gas company making 9000 feet to the ton are as satisfied with their results as those who have attained to 11,000 feet. Still, considering the retort-house as the starting-point of gas manufacture, we find that the forms of the retorts used and the number of retorts contained in one setting are as variable as the results produced therefrom, and that in the principle of heating retorts there is no uniformity of opinion or of practice, some engineers advocating direct upward draught, and others preferring a return down draught and underneath flues; while the gas world, in this country at least, appears still undecided as to the advantages to be derived from the use of regenerative furnaces. The dispute as to the proportion of fuel necessary for the adequate heating of retorts is one which continually arises, and which depends for its solution upon the adoption of a uniform retort-setting and furnace, and an approved method of carbonization.

If we turn to the distribution, we find that, although the quantity of gas sold per ton of coal must depend mainly upon the produce in the retort-house, the difference in the proportion of unaccounted-for gas is very considerable, ranging from 5 per cent. to, in some cases, as much as 25 per cent. of the total quantity registered by the station-meter. In respect to this, however, it is very important to notice that the proportion of mileage of the mains to the gas consumed exercises a considerable influence over the percentage of unaccounted-for gas; so that what would be an excessive leakage, demonstrating neglectful management, in some cases, may, in others, be the lowest point to which, with the utmost attention, the manager finds he can reduce the loss.

All this points to the desirability of adopting a more complete form of statistical record, in accordance with which the results of different gas-works may be worked out and published, in order that we may have the means of judging correctly in regard to the value of the working in each individual concern, and be able to arrive in process of time at a more uniform standard of opinion and practice in regard to the forms of carbonizing and other apparatus pertaining to the manufacture of gas. This is the more necessary as the manager of gas-works is often so tied down to his duties, that it is impossible for him to leave his works to visit other places; so that if he be desirous of seeing what is done elsewhere, he cannot always indulge the wish, and often cannot afford to incur the expense of travelling. Very few directors of gas companies have any desire to encourage their manager to make such inquiries. For the most part they are satisfied if his working be not worse than the results of previous years, and prefer to see him located at his office-desk than find him seeking information by visiting other works.

I think, therefore, that the work of providing information as

to working results is one which an Association like this might well take up. I am aware that an attempt to publish some such statement has been made by the Editor of the "Gas and Water Companies Directory," and much credit is due to the author of this effort. At the same time the points upon which information has been published are so few, that no true idea of the condition of the various undertakings, except in regard to their size and extent, can be obtained therefrom. The authority which would attach to statistics if published by the British Association of Gas Managers would give them a greater importance and reliability, and would also, I venture to think, draw forth much information from reluctant quarters, whence, at the present time, no figures can be obtained. I would, therefore, suggest to the Committee of the Association the desirability of adopting a form of statistics, and of forwarding a copy to each member of the Association at the close of the working year, to be filled up by him with the year's results worked out in each particular. The working year should, in my opinion, end with June 30, and not with Dec. 31. The collected results could then be published annually as an appendix to the Report of the Proceedings of the Association, or in separate sheets if preferred.

In the hope that the Committee and the members generally will approve of the suggestion, I have prepared a draft form of statistics embodying, so far as I can see, the information that would be required, the headings of which I will, with your permission, read:—

- Name of town.

Population.
- Capital invested in undertaking.
- Coal.—Description of coal carbonized; description of cannel carbonized; percentage of cannel; cost price of coal per ton delivered into works; total quantity of coal carbonized.
- Gas.—Total quantity of gas produced; gas made per ton of coal carbonized; average illuminating power; average make per mouthpiece per diem; total quantity of gas sold; gas sold per ton of coal carbonized; quantity of gas used on works per cent. of gas made; quantity of gas unaccounted for, per cent. of gas made; cost of manufacturing per 1000 feet produced.
- Coke.—Total quantity produced; quantity of coke per ton of coal carbonized; total quantity used for fuel; percentage of coke produced; percentage of coal carbonized; total quantity remaining for sale, per ton of coal carbonized; average price realized per ton of coke sold.
- Tar.—Total quantity produced; produced per ton of coal carbonized; average price obtained per ton of tar sold.
- Ammoniacal Liquor.—Total quantity produced; produced per ton of coal carbonized; average strength; average price obtained per 1000 gallons sold.
- Sulphate of Ammonia.—Total quantity manufactured; quantity made per ton of coal carbonized; cost of manufacturing per ton of sulphate; average price obtained per ton of sulphate sold; amount realized per ton of coal carbonized; total amount realized per ton for residuals.
- Retorts.—Description of retorts and settings in use, single or through; number in each setting; method of stoking employed; duration of charges; cost of repairs of retorts and plant per 1000 feet of gas made.
- Distribution.—Number of meters in use; price of gas to private consumers; number of public lamps; price of gas to public lamps; percentage of gas consumed in public lighting; mileage of mains in district supplied; consumption of gas per mile of mains; cost of distribution per 1000 feet of gas sold.
- Cost of management and all other expenses per 1000 feet of gas sold.
- Net cost of gas delivered to consumers per 1000 cubic feet.
- Capital expended per million feet of gas made.
- Dividends paid per 1000 feet of gas sold.

The publication of statistics such as these, although not quite so complete, is customary in some of the Gas Managers Associations on the Continent, and has, I believe, been productive of very good results, tending to the establishment of a more uniform standard of working than has hitherto obtained amongst ourselves.

For the purpose of comparison, and as evidence of the necessity for such statistics, I have sought to obtain the result of the last year's working from a number of gas-works. With this end in view, a hundred circulars were sent out addressed to the engineers of different works, and containing a statement to be filled up in reference to the working results. Twenty-four of these were returned with

the queries more or less fully answered. The list of queries was not so complete as it should have been. I afterwards found that several important items had been omitted in framing the statement. The information received was, however, sufficient to enable me to tabulate the most important elements in the working results of some twenty gas undertakings, and, through the kindness of some friends who forwarded me their half-yearly balance-sheet and accounts, I have obtained the means of comparison in pretty nearly every item appearing on the draft form of statistics.

A simple comparison of the extreme high and low results in the several particulars will be the best evidence of the discrepancies arising between the different statements of working results:—

	Highest.	Lowest.
Cost price of coal per ton	19s. 4½d.	9s. 6d.
Average make of gas per ton	11,160 c. ft.	9400 c. ft.
Average sale of gas per ton.	10,754 c. ft.	8240 c. ft.
Unaccounted-for gas per cent.	16·24	4·00
Cost of carbonizing per 1000 feet	4·21d.	2·39d.
Fuel per cent. of coke produced	51·0	13·6
Tar sold per ton of coal	14 gals.	8 gals.
Liquor produced per ton of coal	28 gals. 11 oz.	10 gals.
Amount realized by sale of liquor per ton of coal	2s. 4d.	[10–20 oz. 0s. 3d.]
Where sulphate is manufactured	2s. 3½d.	10·8d.
Price of gas to private consumers	4s. 7d.	2s. 1d.
Consumption of gas per mile of mains, cubic feet.	4,720,000	1,356,000
Net cost of gas delivered to consumers	3s.	1s. 7½d.
Capital expended per million feet made	£1984	£416

The results between which these comparisons are drawn are taken from works varying in size from 500 million feet to 10 million feet per annum, and situated in different parts of the kingdom. This fact is sufficient to account for the difference in the price of coal, which we may dismiss with the remark that every gas manager must judge for himself what coal will be most economical for him to use, having regard to the situation and circumstances in which his works are placed.

In regard to the make of gas, the works having the highest make uses coal of the best quality; the cost per ton is, however, not so great as in the case of another gas-works in the same neighbourhood, where the make per ton is much less. The illuminating power also is given as half a candle more in the former than in the latter case. On the other hand, the fuel account is less in the case of the works not making so much gas per ton, although it is also remarkably low in the case of the works making 11,000 feet per ton. In the case of the works which makes an average of 9400 feet per ton, the average quality of the mixed coals used is probably better than the coal used in another works in the same district making 9850 feet per ton. The cost of the coal, too, in the former works is 5s. 6d. more than in the latter; so that, unless there are exceptional circumstances of which the statement received gives no account, here is a clear case for improvement, either in regard to the make per ton or to the price paid for the coals.

Looking now at the fuel account, we find one company using 51 per cent. of the coke produced, and another using 13½ per cent. This method of estimating the proportion of fuel is, however, manifestly unfair. The average quantity of coke produced from a ton of coal varies considerably, according to the description of coal used. The gas-works using 51 per cent. of fuel produces only 1148 lbs. of coke per ton of coal, whereas the works using 13½ per cent. produces 1456 lbs. per ton, and another works where the fuel account is 35 per cent. produces 1498 lbs. of coke per ton of coal. In this latter case the fuel consumed is at the rate of 524 lbs. of coke per ton of coal carbonized, and in the first case, where the fuel account is 51 per cent., the coke used amounts to 585 lbs. per ton, or about 11 per cent. more than the other, whereas the percentage calculated on the produce of coke is nearly half as much again for the latter as for the former works. In continental gas-works, where a decimal system of weights and measures is in use, the percentage of fuel is reckoned on the 100 kilogrammes of coal carbonized, and this gives a much truer idea of the state of the fuel account than the method adopted in this country. I would, however, suggest the method of reckoning the fuel in pounds of coke per ton of coal carbonized, as being the most suitable for our conditions of measurement, and as more actually representing the state of things than any system of percentage can do.

The production of tar we need not dwell upon, this being

dependent more upon the kind of coal employed than upon the process of carbonizing.

Ammoniacal liquor varies exceedingly in quantity and in strength, and this even where the whole of the ammonia is taken out of the gas. At one gas-works, where not a trace of ammonia is ever permitted to pass the outlet of the final scrubber, the quantity of liquor averages 22 gallons to the ton of coal, and the strength is 9 oz.; therefore, $22 \times 9 = 198 \times 17 \div 49 = 68.7$ oz. of free ammonia to the ton of coal. At another gas-works the produce averages 28 gallons to the ton, and the strength is 11 oz.; therefore, $28 \times 11 = 308 \times 17 \div 49 = 106.8$ oz. of free ammonia. The same class of coal is carbonized at both these works, so that the difference in the resulting quantity of ammonia cannot be due to the different quality of the coal, but must be connected in some way with a difference in the distillation of the coal, and perhaps in the condensation of the gas.

The price obtained for liquor is, for the most part, proportionate to the strength. There are, however, many cases where the liquor is of considerable strength, but small in quantity, and the amount realized per ton of coal is low, pointing to the probability that the whole of the ammonia is not taken out of the gas. One company whose works are unfavourably situated for carriage, realizes the astounding sum of 3d. per ton of coal by the sale of the liquor! This is evidently a case where the manufacture of sulphate of ammonia should be adopted, as the sulphate would cost infinitely less for carriage, in proportion to its value, than the liquor does at present.

In regard to the carbonizing plant, the shape of the retorts and their number in each setting vary considerably; but there is nothing in the results received to give evidence of superiority in any one form of retort-setting. The charges of coal are mostly of six hours duration, some few of four hours, and in one case of five hours. The charging is chiefly done by hand, with the scoop or shovel, some works of considerable size using the shovel. In two works from which results were received, mechanical charging and drawing machinery are in use on different systems, but the best results are to be found amongst those using the shovel.

Taking now the question of unaccounted-for gas and the consumption of gas per mile of main, we find these two are intimately connected one with another. The largest consumption per mile is 4,720,000 feet, and the least is 1,356,000 feet. In the former case the leakage is 8 per cent. of the make, but is equal to 413,000 feet per mile of main. In the latter case the leakage is 11 per cent., but only 150,000 feet per mile. It is therefore evident that the percentage of unaccounted-for gas may be high, and yet the leakage from the mains comparatively small, so that, whenever a statement of the leakage is made, the mileage of mains should be a factor in the calculation.

The price at which gas is sold is governed as much, or more, by the capital invested in the concern, and the dividends or interest to be paid thereon, as by the cost price of the gas itself. In comparing the statements received, the difference between the cost price of the cheapest and the dearest gas supplied is found to be nearly 100 per cent. of the latter, but the difference between the profit derived from the sale of 1000 feet of gas amounts to more than 300 per cent., the lowest dividends which are paid being 9d., and the highest 2s. 5d. per 1000 feet.

Sufficient has, I think, been said to show the desirability of having some more complete and easy method of comparing the working at different gas-works in different parts of the country, and I will now leave the question in your hands for discussion, in the hope that some system such as that suggested in this paper may be found feasible for the Association to adopt.

Discussion.

Mr. CORBET WOODALL said the subject now brought forward was a very important one indeed, and, in his opinion, the most important aspect of it was the suggestion that the machinery of the Association might be used to give effect in providing more exact information and data than they at present possessed with reference to a great many subjects connected with gas manufacture. As an illustration, he might mention that the previous night he was in conversation with two gentlemen who had been all their lives intimately connected with gas manufacture, and a question arose as to whether or not the quality of gas which had been stored for a fortnight was materially deteriorated. He felt it was a most extraordinary thing that there should be any difference of opinion, as to so simple a matter, amongst men of

such large experience. At the same time, he thought it was hardly desirable to go to the extent Mr. Stevenson had suggested, and to open up the whole details of their working, not simply to one another—to which personally he should not have any objection—but to the world at large, and especially to those whom they must still regard as in some sense the natural enemies of gas companies. Some arrangement might be made, and the reference to the Committee was most desirable, for if they had particulars from many sources upon these doubtful matters of manufacture and procedure available to them, it would be a great help. They had heard a good deal about the advantages of comparison, but he would suggest that any action to be taken should be rather in a set of distinct lines, with a special object in view, than simply the gathering together of a great mass of information, which might be used in an objectionable way. Take, for instance, the statistics suggested with reference to the price of products. One could well understand how useful these might be to certain buyers; on the other hand, they might be useful to those who were obtaining a low price, as indicating what others were doing, and what they might do if they tried, but it would be undesirable to place such materials in the hands of buyers. He would suggest, therefore, that if any reference were made to the Committee it should be with the object of obtaining information on such points as were still in dispute.

Mr. R. MITCHELL (Coatbridge) said that in the West of Scotland Association of Gas Managers they had for a considerable time past published such statistics as were suggested in the paper; but there had been a construction put upon the information given which had, to a considerable extent, crippled the usefulness of the publication, and the dread to which Mr. Woodall had referred had in a great degree been realized by the Scotch gas managers. It was always prudent and courteous to one's brother managers to give them information, but when it was printed in public reports there was no saying to what use it might be put; and, therefore, though he would gladly communicate anything to a brother manager, he should refrain from giving detailed information when intended for publication.

Mr. J. HEPWORTH (Carlisle) said this subject was a very comprehensive one, and he agreed to some extent with Mr. Stevenson that a knowledge of such subjects would be very desirable; but he also agreed with the opinions expressed elsewhere, that some of the results, if they found their way into hands unfavourable to gas companies, might be misused. After all, too, there was great difficulty in getting reliable results of this character. In the West of Scotland Association they found the same difficulty. The gentleman who had just spoken—the late President of that Association—had favoured him with a copy of the report he had referred to, and he (Mr. Hepworth) found, for instance, that in ascertaining the area of the condensers there were such discrepancies as could only arise from a different method of computation being resorted to; and, therefore, if the returns when obtained were published, in order to be useful they must be got out by one person who could overhaul, and go through the whole statistics of the several works. Even then there would be a possibility that the general impression formed might be to some extent inaccurate, and he almost thought there was an instance of this in the paper just read. Mr. Stevenson referred to two places rather near together, and made the remark that the price of coal was very much too high in one place as compared with the other, taking into account the illuminating power. Now, two places might be not very far distant, yet one might be on the top of a coal pit, so to speak, and the other 50 or 60 miles away, in which case the price of coal would probably be exactly double. So when one went to form general conclusions, unless the most minute circumstances were known, one was apt to be misled. He thought with Mr. Woodall that if the matter was taken up by the Committee they might make some valuable suggestions, and he generally agreed with the opinion expressed, that if these returns were got out they should be reserved, if possible, for the sole use of the members, and not published for general use.

Mr. C. GANDON (Sydenham) said there would be great difficulty in obtaining the information suggested by Mr. Stevenson, as was shown by one fact mentioned by himself, that out of 100 circulars he sent out he had only 24 replies, although he said they were not intended for publication, so far as the names of the companies were concerned. If, therefore, it was known that the replies would be published, the difficulty would apply still more. Again, if the particulars were obtained they would not be of much service, unless they could make absolute comparisons of the state of the working

in each case. One manager might be making 10,000 feet of gas per ton out of his coal, and another only 8000 feet, and if they were using a different coal, that was no guide whatever. It would be necessary to get the actual state of affairs in each case, and this they could do very nearly as well themselves by applying to the managers of surrounding gas-works. Thanks to the British Association and similar associations of gas managers, they were all now very willing to impart information to one another; but he could easily understand they would have a great objection to that information being made public.

Mr. W. J. WARNER (South Shields) said he quite agreed with Mr. Stevenson that every detail should be worked out to the minutest possible degree; that was to say, every class of labour should be worked out at the cost per 1000 feet, for he always took this as the standard. They sold the gas at so much per 1000 feet, and they should deal with its cost in the same way. The expenditure on every item, too, of material and labour should be worked out under the broad headings of manufacture, distribution, working expenses, and capital. He would do this very minutely, but he would keep it to himself—for his own use. Then, again, he would take broader lines, and would deal with the suggestion somewhat in the manner he shadowed forth at the last meeting of the Association; that was to say, in localities and districts in which there was something in common amongst the works and material. These workings should be averaged, and these averages they would be able to use for the purpose of measuring their own work. In this direction only he thought the Committee could move if Mr. Stevenson's suggestion was adopted. The Committee might prepare forms for managers to work to, by which they could measure their own working, and then they could get something satisfactory to themselves and for those outside. As Mr. Hepworth had observed, there was very much in circumstances to influence workings; for instance, at places in Shropshire and Staffordshire the houses were in blocks, tied together with chains and bands, and every expedient was resorted to for preventing leakage. This was a very different state of things to what occurred in a portion of his own district, in which he had to blast the limestone to lay his mains in. Therefore, it was not possible to compare the working in such places with his own district as far as leakage was concerned; and the same with many other matters.

Mr. GEORGE LIVESY said there were two questions which arose in relation to this subject—first, was such a scheme practicable? and, secondly, if it were, what would be the use of it? Circumstances varied to so great an extent that the comparison would, he thought, be worthless if returns were obtained—which he doubted would be done. The managers who were working well would be perhaps disposed to send their statistics to show how clever they were, but those who were not working well, or who were placed in adverse circumstances, would be deficient, he was going to say, in common sense if they furnished everybody with the means of finding fault with them. He was afraid also that the statistics—without impugning in any shape the honour of those who sent them—would be hardly reliable. There was a general tendency to exaggerate, even when not intending it, which would probably affect the recorded results. Again, it might do mischief. Far be it from him to say one word against the fullest publicity. In past days, not only with regard to gas, but to most other things, there had been a good deal too much secrecy, and if a brother manager came and asked for information, he ought to have it in the most free and candid manner, without any reserve or hesitation. But if all this information were published, what use would be made of it? It would get into the hands of persons totally incapable of understanding it; and, without saying anything in disparagement of directors, it was not likely that men who came to the works once a week or once a month, for an hour or two, could fully understand the business. They would get hold of certain figures—probably make per ton—and, disregarding all other circumstances, they would say, "So-and-so is making 11,700 feet per ton, you are only making 10,000; how is it?" The 11,700 feet was a real case. It was put to him by a friend, who asked what he thought of it. "They make 11,700 feet per ton, and sell nearly 11,000 feet; 35 per cent. of their coke is made use of for fuel, and the retorts are burnt out in an incredibly short space of time; a very large percentage of rich cannel coal is used, and the gas supplied to the consumer is cut down in quality to the lowest point." He (Mr. Livesey) said he thought it was wrong altogether; they were paying a great deal too dear for their whistle. But directors, and others who did not understand the thing, would say, "Here is 11,700 feet per ton being made at one

place, and why cannot it be made at another?" disregarding altogether the other circumstances, which took all the gilt off the gingerbread. Then public bodies, who were not particularly well disposed towards gas companies, would take out those parts which served their purpose, and ignore entirely those which did not. Therefore, while they were much indebted to Mr. Stevenson for bringing the matter forward, and though he was anxious that full information should be given to every one to whom it could be of use, he (Mr. Livesey) thought it would be a great mistake for the Association to undertake anything of the kind proposed.

Mr. J. M'CRAE (Bury St. Edmund's) said that he desired to support Mr. Stevenson's suggestion. He had great faith in comparisons, and in these days of opposition, when the gas profession was threatened, to say the least, with an entire collapse, they ought to aim at perfection. It was unattainable, no doubt; but they ought to strive to get as near as possible to it, and this, he took, it was Mr. Stevenson's idea. He (Mr. M'Crae) never could see why there should be any material difference in the results obtained in gas-works, if the capital account was as it ought to be. Some companies were, of course, not in that position, and they went out of the line, and could not be compared with other companies, because of their excess of capital; but there were some companies whose capitals were parallel, and whose results were not parallel, although they were using the same coal. Some gentlemen seemed to think it was inconvenient to have their statistics published, and it might be so in some few cases; but where the gas manager had good results he did not care who knew them. If a manager's results were bad, the sooner he improved them the better; and he thought the Association ought to encourage all attempts of the members to improve themselves. When they could compare results, they knew how they were working, and if they were not so good as others, they should try to improve. He could not agree with all that Mr. Livesey remarked. He said the information, if published, would very likely fall into the hands of persons quite incapable of judging of it; if so, he should not accept their judgment.

Mr. R. O. PATERSON (Cheltenham) said he felt somewhat in the position of a culprit in this matter, as he was one of the 100 to whom Mr. Stevenson had sent his papers to be filled up, and he had not done so. He was not ashamed to say it, for while he had no desire to withhold any information from a brother manager, when he knew the purpose to which the information was going to be applied, he felt in this instance he was not justified in giving it. Any statement of working results was valuable and useful, but with all respect to Mr. Stevenson, he (Mr. Paterson) would ask the members what they thought of his criticism on the returns he had obtained. Those statistics put into the hands of a hostile party, instead of into the hands of a friend like Mr. Stevenson, might be made a very powerful weapon for injury. His remarks on ammonia, for instance, were perfectly legitimate and fair from him, but in the hands of an opponent such information as that on which he had based his observations would be dangerous. The object of these statistics was that they might individually obtain such information as would enable them to improve their own working, and the question was, did the information Mr. Stevenson had set forth do this and no more? He thought it went a great deal farther, and if any reference were made to the Committee of the Association it would not be in their power to ask for information to complete the table Mr. Stevenson had prepared. If they wanted to improve their working, the best information they could get was the *net* cost of the manufacture of gas at different places. It was not fair to say one man made 11,000 feet of gas per ton from his coal, and without consideration condemn another who made only 8000 or 9000 feet; the latter might be manufacturing his gas cheaper than the former. If they wanted working results, which were really valuable, they should take three lines simply—first, the *net* cost of gas manufactured, or put into the gasholder; secondly, the *net* cost of gas distributed, and sent to the consumers meters—that covered all the cost of distribution and of management; and, third, the cost of gas, including dividends and interest. With these three items there was all the information necessary to know whether a particular manager was working as well as his neighbours, or as he ought to do. If they found a manager 20 or 50 miles distant was able to manufacture his gas cheaper, then it would be their duty to inquire the reason; and how could they get the information better than by going to him in a neighbourly manner, and saying, "Here is my result, can you put me in the way of improving my working, and coming up alongside of yourself?" He did not think it would be possible to get satisfactory information by dividing

the country into geographical districts or localities, as Mr. Warner suggested. He knew of an instance where one person was getting his coal 150 miles from the works; and another, 10 miles away, was getting his coal only 50 miles from the works. The one went north, the other south; but they would both be classed as in the same district. The different results obtained in different localities, judged from the point of view of the selling price of gas, were very often due to causes entirely beyond the company's control, and, therefore, if the cost of gas, including all expenses, dividends, and interest, were taken, there might result a calculation under the circumstances unfair to the present working. The proper way was to take the net cost of the gas manufactured, with the expense of distribution, and that was the only fair estimate of the efficiency or non-efficiency of the working.

Mr. H. WOODALL (Leeds) said, if it had never been proved before, this discussion had proved that there was "much virtue in an 'if.'" Mr. Stevenson, in dealing with the statistics he himself had obtained, had used the "if" very frequently, and there would be much scope for a shrewd man in manipulating the "if" to the satisfaction of his directors. He (Mr. Woodall) was of opinion that the best field whence a gas manager could obtain useful statistics was the little world that surrounded his own town; but even over the most contracted area there would always be divergence of opinion and experience. For instance, he was himself almost disposed to ignore the question of leakage, being of opinion that it was hardly worth the saving. Again, he was beginning to think that a high yield of gas per ton was an extravagant thing to go in for. In fact, he felt his faith in many of the traditions that had governed the conduct of managers for a long time past to be giving way. With regard to boards of directors, if a return which looked very important was sent in, of course the directors of every company would have access to the sheet, and comparisons would be made, not with the average, but with the best; and managers who did not come up to the best would have their salaries limited until that happy day arrived. Take, for instance, the make of gas per ton. A new man would go on to a works, and hope, of course, to realize a high yield; but probably he would find that his retort-house was built in the wrong place, and all the firing in the world would only produce a great absorption of moisture from the earth, so that it would be perfectly impossible for him under such conditions to realize the desired result. He must pull down his works to obtain better results, and the effect of this would be to enlarge the capital account, and he would be about as badly off at the end as he was at the beginning. Amongst the statistics already given to Mr. Stevenson he noticed that in one instance the price of gas was given at 2s. 1d. per 1000 feet. He was not aware of any place in the kingdom at which gas was being sold at that average price, and if in an item of this sort, coming under Mr. Stevenson's personal supervision, there were such a slip as that, one could easily perceive how very erroneous the statistics might be.

Mr. C. E. JONES (Chesterfield) said that this discussion had been useful in one sense, as it had brought out the qualifications of one of the members, Mr. M'Crae, in advocating a cause which would not bear scientific examination. If Mr. Stevenson desired to obtain the statistics of the working of gas companies, he could do so by applying for a copy of the accounts of every company working under the Gas-Works Clauses Act, 1871, which he could obtain at a shilling a copy. There the information was contained in such a form that it could be made of considerable service in drawing comparisons. But in order that the comparisons should be just there must be a just standard, and where was that standard to be found? The desired information could be obtained, as he had said, from the published accounts of the companies, and it could be applied in a similar manner to that followed by Mr. Field, and any manager getting Mr. Field's book could work out his own results, and have a good standard of comparison in the Metropolitan Gas Companies. It was said that there was a disinclination on the part of directors for managers to visit different places with the object of obtaining information; but, speaking for his own Board, he had never found that spirit manifested. Mr. Livesey, with his usual ability, had pointed out that the man who would not readily afford this information must be working badly; but that cut both ways. He (Mr. Jones) would have been very glad to supply statistical information of his working to any of his brother managers; but he objected to supply it, if it could be used to the detriment of the Company whose servant he was; and to use the machinery of the Association in order to put managers in opposition one to another, was not one of the objects of its founders, and he trusted the proposal put forward would never be sanctioned.

They knew very well that when they were before parliamentary committees—and even before their little local parliaments, such as lighting commissioners, town councils, and local boards—the members did not sufficiently understand the question, and made use of such information as was suggested in the paper for purposes which were not always just. On these grounds he was opposed to any scientific tabulation of working results. The rental of companies varied a great deal from circumstances he need not recapitulate, but without knowing all these facts it was possible to do a man an injustice, and say he was working badly, when he might be selling nearly all the gas he was making, and paying a good dividend into the bargain. Again, the commercial aspect of the question had not been touched upon. It was sometimes wise to put up with a positive loss rather than stir up agitation, and be called over the coals; for instance, he remembered one of his friends stating that they supplied gas to the public lamps at a known dead loss, because they wanted to keep well with the public body.

Mr. G. HELPS (Bath) said he agreed with many of the previous speakers that it would not be desirable to do as Mr. Stevenson recommended. Some short time ago some information was obtained from his office indirectly, which was used by an *employé* in a neighbouring town, against the gas company, in favour of the corporation of the town; and he had to contradict it. Although he was always very ready to give information to any brother gas manager or secretary, and had always received the same when he applied for it, he did not think it would be desirable to make such particulars as were asked for, public. For many years past he had been in the habit of exchanging copies of his half-yearly reports and accounts with many of his friends; he took care to have them from those on whom he could rely, and the information he obtained in this way was very valuable. He made statistical reports of it, and kept them by him, and if other gentlemen would do the same he thought it would answer the purpose much better than general information which would not be absolutely reliable.

Mr. C. R. MEAD (Sutton) said he also agreed that these returns would be dangerous, and he spoke not only as a manager and director of gas-works, but from his experience when a member of a local board. He always instructed his foreman and managers all round not to send returns to anybody, but, when applied to, to send the applicant to him. He was pleased at any time to give information to his brethren, but not to send it broadcast over the country. He would suggest that the members of the Association should send to the Committee copies of their balance-sheets every year, and then, if there was anything worth notice, the Committee could inquire into the matter, and get useful information which would be open to all the members of any gas managers association. This could be done without cost or publicity.

Mr. STEVENSON, in reply, said it was not necessary to attempt to answer the various objections made to his suggestions; but he must say that, after having heard all the ideas of many older and more experienced men than himself, he was still of opinion that the more complete the results were the better. He did not think they ought to publish anything which was not as complete as possible, and the more complete such records were, the safer they would be in the hands of anybody. There was considerable force in the objection made as to the possibility of the returns getting into the hands of persons who did not understand the business; but if anything were published, it should be for the benefit and use of the members only. He did think such a step would be a step in advance, as it would give those who were not able at present to produce the best results, and who perhaps had not the opportunity of knowing what results were elsewhere produced, a standard to go by, and set them on inquiry. He was of opinion that some day they would come to public statements of this kind, and he could not help thinking that the objections arose more from a lingering spirit of conservatism than from anything else. The more light they had the clearer things would appear, and the less mistakes would be made. The truth was always the truth, and it was strongest in the end.

BOLTON WATER-WORKS ARBITRATION.—The long-pending arbitration between Mr. P. R. Hoare and the Corporation of Bolton has at length been settled. The matter had been in abeyance for some time, and was resumed on the 8th of March last at the Surveyors Institute, Westminster, before A. S. Hill, Esq., Q.C., when an adjournment took place to suit the convenience of counsel. The question in dispute was as to the value of certain land adjoining the Wayoh and Bradshaw Brooks, in Chapelton, which had been taken from the representatives of the late Mr. P. R. Hoare, the banker, for the purposes of the Corporation Water-Works. After a litigation extending over several years, the parties have now agreed to an award by the Corporation of £6000, without costs on either side.

Parliamentary Intelligence.

HOUSE OF LORDS.
THURSDAY, JUNE 17.

LOCAL GOVERNMENT (GAS) PROVISIONAL ORDER BILL.—This Bill, brought from the Commons, was read the first time, and referred to the Examiners.

HOUSE OF COMMONS.
TUESDAY, JUNE 15.

LOCAL GOVERNMENT (GAS) PROVISIONAL ORDER BILL.—This Bill was reported without amendment: Provisional Order confirmed.

HYDRANTS IN THE METROPOLIS.—Sir Henry Selwin-Ibbetson gave notice that, on Tuesday, July 13, he will call attention to the report of the Metropolitan Fire Brigade Committee of 1877; and move—"That, in the opinion of this House, a greater amount of protection to life and property in the Metropolis would be attained by the transfer of the Fire Brigade to the Metropolitan Police, and by the establishment of hydrants on constantly charged mains throughout the Metropolis."

THE SEWAGE OF THE LOWER THAMES VALLEY.

Mr. CURTIS asked the President of the Local Government Board whether he had arrived at any decision respecting the sewage scheme of the Lower Thames Valley Main Sewerage Board; and whether he would lay upon the table the official reports of the Inspectors upon it.

Mr. DODSON: The Department has recently received the report of the Inspector, which has been referred back to him for some further information. The matter will receive my attention as early as practicable, but the question is one of unusual importance, and involving interests of great magnitude, and it cannot be disposed of without the most careful consideration. When a decision has been arrived at, I will see whether the report can be laid on the table; but it is not usual to do so, as these reports are intended for the guidance of the Board only. If the report is laid on the table, a similar course must be adopted with the evidence, which extended over more than 40 days.

WEDNESDAY, JUNE 16.

LOCAL GOVERNMENT (GAS) PROVISIONAL ORDER BILL.—This Bill was read the third time, and passed.

THURSDAY, JUNE 17.

GAS AND WATER ORDERS CONFIRMATION BILL.—This Bill was reported from the Select Committee: Provisional Orders confirmed.

FRIDAY, JUNE 18.

GAS AND WATER ORDERS CONFIRMATION BILL.—This Bill was read the third time, and passed.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

The Registrar-General publishes the following table in reference to the water supply of London during May. According to the returns furnished to him by the Metropolitan Water Companies, 145,745,332 gallons, or 662,188 cubic metres of water (equal to about as many *tuns* by measure, *tons* by weight), were supplied daily; or 250 gallons (113·6 decalitres), rather more than a *ton* by weight, to each house, and 35·2 gallons (16·0 decalitres) to each person, against 33·3 gallons during May, 1879.

COMPANIES.	Number of Houses, &c., supplied in		Aver. Daily Supply of Water in Gallons* during	
	May, 1879.	May, 1880.	May, 1879.	May, 1880.
Total supply	560,466	582,505	132,584,518	145,745,332
From Thames	265,860	279,750	68,303,106	74,614,416
„ Lea and other Sources . .	294,606	302,755	64,281,412	71,130,916
THAMES.				
Chelsea	29,700	30,071	8,480,200	9,108,100
West Middlesex	52,145	54,327	10,752,634	11,722,142
Southwark and Vauxhall . .	83,263	89,879	23,910,463	23,955,758
Grand Junction	39,648	41,352	12,101,909	13,554,816
Lambeth	61,104	64,121	13,057,900	16,273,600
LEA AND OTHER SOURCES.				
New River	128,099	130,373	27,065,000	29,703,000
East London	118,910	122,746	29,136,000	32,285,800
Kent	47,597	49,636	8,080,412	9,142,116

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for May, 1880, as compared with that for the corresponding month of 1879, shows an increase of 22,039 houses, and of 13,160,814 gallons of water supplied daily.

NEW GAS-WORKS FOR NEWBURY.

It will be remembered that for some time past the Newbury Town Council have had under consideration the question of extending their gas-works, or of erecting others of more suitable capacity for meeting the growing requirements of the town. The matter having been referred to the Gas Manager (Mr. J. G. O'Farrell), and that gentleman reporting to the effect that any extension of the existing works would at best be but a temporary remedy, the Council resolved, at their meeting on Feb. 20, [see ante, p. 328] that enlarged works should be erected on a site near the Great Western Railway, as originally proposed by the Gas Committee, the plans for the same to be prepared by, and the work to be carried out under the direction of Mr. O'Farrell. Acting on these instructions, the works were commenced, and such progress has been made that the concrete foundation for the new gasholder has been satisfactorily completed. The holder itself will be capable of containing 90,500 cubic feet of gas, and as regards size will present a striking contrast to the small holders now in use. The buildings will be of a substantial and suitable character, and will include a retort-house, with six benches of 7 retorts in each, adjoining which will be the coal stores, capable of holding 600 tons. A great saving in the matter of cartage will be effected by the construction of a siding, running from the goods yard of the Great Western Railway into the stores. The plans also embrace station-meter, engine, boiler, exhaust, and purifying houses, &c. The contracts will, it is hoped, be completed within four months, in order that the inhabitants may have the advantage of a full and efficient supply of gas by the time the winter has set in. Pipes are already being laid from the old works to the new site.

The laying of the foundation stone of the main block of buildings took place on Saturday, the 5th inst., the ceremony being performed by the Mayor (J. B. Stone, Esq.), in the presence of Alderman J. P. Jackson, Chairman of the Gas Committee, and other gentlemen. The stone is fixed at the north-east corner of the building, and bears on its front the

following inscription:—"This stone was laid by James Benjamin Stone, Mayor of Newbury, June 5, 1880.—Alderman Jackson, Chairman of the Gas Committee." An inscription on the east side runs as follows:—"H. Burke Godwin, Town Clerk; Joseph Gough O'Farrell, Engineer and Manager."

The company having assembled on a platform erected near the stone, Mr. O'FARRELL said, in the absence of the contractor, it became his pleasing duty to hand a trowel to the Mayor, and request him to lay the foundation stone of the gas-works, and thus inaugurate an undertaking of the highest possible importance to the borough.

The Mayor said he accepted the trowel with much pleasure, and he expressed a hope that the work to be inaugurated that day would be carried out satisfactorily, and that the undertaking might be completed without the occurrence of any accident to life or limb.

Alderman JACKSON said that, as Chairman of the Gas Committee, he had had a good deal to do with this matter, and he had every reason to be thankful that he had been successful in securing the removal of the gas-works to the new site. He had no doubt the undertaking would prove to be a source of profit, and a benefit to the town generally. It was to him a matter of great gratification to see the new works commenced, and he sincerely hoped that no untoward event would happen during their progress.

Alderman HICKMAN observed that, as one of the oldest inhabitants of Newbury, he felt much pleasure in attending, especially as he witnessed the laying of the foundation stone of the old gas-works in 1825. He was glad to be at the inauguration of the new works, which had been called into existence by an increase of population and a greater amount of prosperity in the borough, which he hoped would continue.

The stone having been lowered, and the level applied, the Mayor declared that the stone had been properly laid.

Votes of thanks were then presented to the Mayor, to Alderman Jackson, and also to Mr. O'Farrell, the latter of whom replied, remarking that it had been his ambition to see the works erected on the present site. He felt certain the undertaking would prove of advantage financially.

PRESENTATION OF A
TESTIMONIAL TO MR. EDWARD HORNER.

The testimonial resolved upon at the last meeting of the Phoenix Gas Company was presented to Mr. Horner, at the old board-room, 70, Bank-side, on Tuesday last. Most of the late Board, and representatives from the Shareholders and Officers, were present.

Mr. SHUTER, as the oldest friend, on behalf of the subscribers, stated that although all most readily acknowledged the great value Mr. Horner's services had been to the Company, yet the offering they had met together to beg of their late esteemed Chairman to accept, was made not by way of compensating that gentleman for those services, but as a personal pledge of affection in respect to past associations, and as an earnest of all good wishes for his future health and happiness.

Mr. HORNER, replying, thanked Mr. Shuter and all his friends, present and absent, for their kind expressions and good wishes. The beautiful gift he had received would be handed down, he trusted, to his children with pride, as a memento of the affection which it had that day been his lot to enjoy.

The present consisted of a set of four very chaste classical figures in silver, each bearing a fruit dish. They were designed by the celebrated sculptor Monti, whose "Veiled Nun" was the object of so much interest in the Exhibition of 1851; and were furnished by Messrs. Hancocks, of Bond Street. The cost was £220—just the sum received.

At the close of the meeting a very general feeling of admiration was expressed at the excellent manner in which all the arrangements had been carried out by Mr. I. A. Crookenden, the Honorary Secretary.

MR. T. O. PATERSON, of the Rochdale Corporation Gas-Works, has received the appointment, recently advertised in the JOURNAL, of Gas Engineer to the Corporation of Birkenhead. We understand that there was a large number of applications for the post; among those selected besides Mr. Paterson being Mr. J. McGilchrist, of Dumbarton; Mr. T. B. Ball, of New Wortley; and Mr. H. Hill, of Liverpool.

CHESHAM GAS AND COKE COMPANY, LIMITED.—This Company was originally constituted by provisional registration on July 1, 1846, and completely registered on Aug. 17, 1847. On Oct. 25, 1856, it was incorporated under the 1856 Act, and, in accordance with a resolution passed at a general meeting of Shareholders held on the 28th ult., was on the 2nd inst. incorporated as a limited company, under the Acts of 1862 and 1879. The nominal capital is £5850, in 290 £10 shares (all of which are allotted and fully paid up), 290 £5 shares, and 600 £2 10s. shares.

THE STOCKTON AND MIDDLESBROUGH CORPORATIONS WATER SUPPLY.—One of the Provisional Orders Confirmation Bills now before Parliament contains the Order granted by the Local Government Board "to amend, vary, and partially repeal the Stockton and Middlesbrough Corporations Water-Works Act, 1876," and several petitions have been lodged against it. The *Northern Echo*, writing on the subject, says: "Apart altogether from the special grounds of petition and complaint, affecting private estate or corporate public rights, which will, no doubt, come in due course before a Committee of the Commons for consideration, the important question is raised by these petitions, whether the Local Government Board have not far exceeded the authority conferred upon them by Parliament by making a Provisional Order for the important purpose of abstracting water from a river, extending the period for exercising compulsory powers of taking land and other property, and dispensing with all the notices to parties affected which would be necessary in the ordinary and invariable rule and practice of Parliament. It is alleged that in this particular instance, after an inquiry extending over 40 days, Parliament in the year 1876 made what was intended to be a final settlement of the questions affecting the water supply of the Tees towns and the abstraction of water from the River Tees. It is stated that all the parties interested in the river were then heard. It is further alleged that the present Provisional Order is the result of a perfunctory and insufficient investigation of *ex parte* statements by an Inspector, whose report is quite *ex parte* in its character; and it is held to be completely *ultra vires* of their powers for the Local Government Board, on any such report, to presume to make an Order repealing the former settled enactment of both Houses of Parliament. One of the petitioners, we learn, is Mr. John Bowes, of Streatham, who was a strong supporter of the Corporations of Stockton and Middlesbrough in 1875 and 1876. Another is the Darlington Corporation—whose opposition is probably put forth with a view of securing checks on over-pumping from their own source of supply. There is also a petition from Egglestone against postponing the execution of the new works in that neighbourhood. But, in the meantime, the principal point of public interest likely to be raised is that mentioned above, which aims at the legality of the Provisional Order itself."

London: Printed by WALTER KING (at the office of Clayton & Co., 17, Bouverie Street, Fleet Street), and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, June 22, 1880.

him on their part. Not only that, but on the day itself on which the accident occurred, he appeared to have gone out for a walk, and yet they were now asked to draw the inference that the effect of the gas had produced a weak heart. If a man had a weak heart naturally, it might be that a considerable dose of gas would functionally derange his heart, as it might his stomach or any other organ, but to suggest that it would produce a weak heart was extravagant and beyond all reasonable bounds. On this point medical gentlemen would be called who would state that a large quantity of gas would be either fatal by reason of abundance of bad qualities, or would pass off without much inconvenience. He, therefore, hoped the jury would be of opinion that there had been a zeal shown on the part of the plaintiff, and those who were associated with him in the case, to magnify the consequences of the inhalation of gas, and to present a largely exaggerated notion of what befell the plaintiff, and of what happened to him in consequence.

Mr. Thomas Hersey, examined by Mr. PAINE.

I am a Civil Engineer, and was in the service of the Imperial Gas Company from 1845 to 1876. The pipe in Ellesmere Road was laid under my direction. It was tested before leaving the Company's works with 300 feet head of water. On Feb. 25, 1879, I visited the Ellesmere Road, when the pipe was laid bare the whole length. My attention was drawn to the place where the pipe had been repaired. I saw the old piece of pipe afterwards. At my suggestion a shaft was sunk from the drain of the house to ascertain the condition of the soil, and it was found that the pipe had been broken immediately over where the house drain had been made. I found that just under the drain, and directly under where the fracture had taken place, a man could force a crowbar down 4 or 5 feet in the footway. The road would have been very solid in that part if it had not been for the drain, which led me to believe that the settlement in the drain had caused the fracture of the pipe. Supposing attention had been called to this particular drain in 1866, and all possible power had been put on to ram the earth, I have no doubt it might have been made a little better, but I do not think it is quite practicable for a Company to do such things as that. I never had notice of a house drain being made in all my experience. A spirit-level was applied at several points in the road, and the pipes were tested. They had the proper inclination; they should not be level, but should incline slightly, and they did so. All the joints were right but one, which was at some considerable distance from the plaintiff's house, where a water-pipe was under repair. The state of the bed in which the pipe lay must have been fairly good, or the pipe would not have retained its inclination so well as it apparently did. The broken piece of pipe was submitted to me at the Company's office, and I identify the piece now shown as being the same. It is about 12½ per cent. heavier than ordinary gas-pipe.

Cross-examined by Mr. WILLOUGHBY: It broke because there was not sufficient support for it, the ground being loose. The other portion of the pipe was doubtless left in the ground, and a collar placed over it. When the pipes were laid down there was a proper bed; we should not lay them otherwise. We should refuse to light a road unless the bed were in a good condition, and we always make an examination first. Having laid a main, we do not take the trouble to open the road unless it is necessary; but if the road was opened we should see that our interests were not interfered with. It is the first duty of an inspector to attend to the escapes of gas.

Mr. WILLOUGHBY: Would it not be advisable, to guard against anything of this sort, just to look after your pipes occasionally, to see whether they had subsided from time to time.

Lord COLERIDGE: Do you mean to infer it is the duty of the Company, from time to time, to make subterranean examinations to see the state of the pipes?

Mr. WILLOUGHBY: If it is the inherent nature of the earth that it should subside, and the Company know it, it is their duty to look after it, and take certain precautions.

Lord COLERIDGE: That would involve a new terror to the residents, because you would have the ground turned up every fortnight.

Mr. WILLOUGHBY: But if your lordship takes the other alternative—either to have an explosion or be poisoned—you will see the value of it.

Lord COLERIDGE: Everybody agrees that where there is an escape it ought to be attended to. That is only common sense.

Cross-examination resumed: I heard Emmett and Jackson say the trench was composed of rubbish, but I say it was not; it was so solid that a bar could not be got down 2 feet, while it could be got down 5 feet under the cutting. The ground in other places was very sweet, and there was no sign of any escape. If the earth which was produced in the bottle was all that could be collected, it was not much.

Mr. Alfred Grundy Windsor, examined by Mr. PAINE, said he was an Architect and Surveyor, and attended in Ellesmere Road on Feb. 25, 1879, and took measurements opposite No. 50, with a view to making a plan, which he produced and explained.

John Edwin Edney, examined by Mr. PAINE, said he was a service layer in the employment of the Gas Company. In 1873 he laid a service from the main to the premises in question, and in 1874 it was disconnected, and the main plugged in a proper manner. To do this it was necessary to open the road, and at this time there was no escape of gas apparent. On the day of the accident he was on the spot before the road was opened. When an opening was made a fracture was found in the main-pipe at a distance from the supply-pipe. The ground was solid underneath the main on each side where the service went in, but underneath the main, where the fracture was, it was very light—anything could be pushed through. It was repaired with a slip collar, and witness remained in charge till the following morning. Whilst there he saw no furniture removed; only a bundle, which looked like bedding.

Cross-examined by Mr. WILLOUGHBY: The Company only carried the pipe up to the iron railings, and there left it. When the pipe was disconnected, they took the band out of the main and plugged the main up, so that nothing from the main could get into the service-pipe. The point of fracture was about 5 or 6 feet from the plug, and a good deal of gas might have passed through it. He had no recollection of the pipe sinking in another portion of the road in 1870.

By the JURY: The landlord or tenant would lay the pipe from the front railing to the house, and in doing so would cut a hole in the brickwork. If that hole had been stopped, it would have kept a great portion of the gas out. It was the duty of the landlord or tenant to see that the hole was properly stopped up.

James William Newman, examined by Mr. PAINE.

I am a foreman of main-layers in the service of the defendant Company. On Dec. 17, 1878, I went to Ellesmere Road, and found that the ground had been opened, and it was quite soft under the fracture. On the following day we took out the fractured piece of the pipe, and replaced it by a new piece 6 feet long, which is an every-day occurrence. The piece of piping which has been produced came from Ellesmere Road. We always save the pieces where there is a breakage, and send them to the stores to be preserved, and that was done in the present instance. There was no connection between the service-pipe and the main on the 17th. I have inhaled gas on many occasions, but never found it had much effect on me after a night's rest.

Cross-examined by Mr. WILLOUGHBY: I went into the house after the accident and saw the service-pipe, which was fixed behind the front door, but that was not the Company's pipe. There was, no doubt, a ticket upon it, stating that if it was removed a reward of £5 would be given for information about its being removed, but such a ticket is always affixed to cap the service, so that it shall not be tampered with.

Mr. John Hall, examined by Mr. MORGAN HOWARD.

I am a Vestryman of the parish, and lived in Ellesmere Road in the year 1866. I was the instigator of the main sewer being made down the road. The houses were being built at the time, and we connected them with the sewer as fast as possible, open cuttings being made for the purpose. The ground was excavated at places underneath the gas and water mains, which were filled in by the person who had the contract to construct the sewer. At that time the parish had not taken to the roads; but in the early part of 1865 the cholera set in, and I called a meeting of the inhabitants, and we waited on the Vestry and asked them to put in the drains, because many of the houses had cesspools for draining into, right in front of the road. The Vestry agreed to do so on our paying two-thirds of the expenses. The excavations were filled in as they generally are. The men who undertake these jobs will take all the sand they can, and fill in with all the rubbish they can get hold of. I saw the main exposed in 1879, and inspected it, being at that time on the Works Committee of the Vestry.

Cross-examined by Mr. WILLOUGHBY: The rubbish is not allowed to be used if the Vestry have taken the roads. In 1864 the Metropolitan Board did not supervise matters of this sort, but they do now. It took about three weeks to lay the main drain, which was only a 3-inch pipe, and the road was open all the time.

By Lord COLERIDGE: The main drain went down the centre of the road, and it was the side drains that did the mischief.

Cross-examination continued: Most of the people made their connections with the sewer as it went on where they had cesspools, and in order to do that they would pass over or under the gas and water pipes, and they were supported on each side by the earth; nothing would be put under them to support them.

Mr. Henry Carter, examined by Mr. PAINE.

I am resident inspector of the district. Before the accident no complaint was made to me of any escape of gas in the Ellesmere Road, but as soon as I received information I went to the scene of the occurrence. I have heard the evidence as to the state of the pipe and of the ground immediately under it, and I perfectly agree with it. After I had been on the premises about an hour or an hour and a half, searching for the escape, Mr. Johnson walked with me down the street. At that time he answered my questions much better than he did those of the Attorney-General yesterday. The piece of pipe which was taken out was sent to my office, and is the same as that produced.

Cross-examined by Mr. WILLOUGHBY: The ground had sunk at some places along the road, but we cannot tell where it is falling in; it is a thing which occasionally happens, but not very often. If the ground sinks the pipes are liable to be broken or drawn from their sockets. If I saw any subsidence of the road, whether the gas was escaping or not, I should look after it to see that there was no breakage of the main. I have seen such a thing about half-a-dozen times in the course of a year. The road in question was made when I first saw it, but I do not know that it was a brickfield or what it was previously. The houses were all built when I first knew it.

Mr. Theophilus N. Bird, examined by Mr. PAINE.

I am a district inspector of the eastern division of the Gas Company's district, and on Dec. 17, 1878, was summoned to the spot in question. When I arrived the workmen had opened the ground. I inspected the hole and the soil underneath, and agree in the main with what our other witnesses have stated. The main was stripped under my directions, and I never saw a pipe in better condition after being in the ground so long. We have pipes in use now that have been in the ground for upwards of 40 years, but that pipe had only been in for 16 years. In 1879 the pipe was tested throughout its entire length, and was perfectly sound except at one spot, which was where the first syphon was placed. At that time the East London Water Company were laying a 3-inch water-pipe within 3 feet of the leakage at that spot. I also applied a spirit-level to every length, and found the pipe in such excellent condition that we filled in the ground without disturbing or altering a single pipe. I saw the piece which was removed, and it is the same as that now produced. My experience of ramming made soil is that it can never be consolidated as firmly as the native earth.

Cross-examined by Mr. WILLOUGHBY: The pipe taken out did not present the appearance of having been previously used; it broke on account of the subsidence of the soil. There had been an accident of a similar character in the same road on Dec. 6, 1879.

Mr. MORGAN HOWARD objected to the line of cross-examination.

Mr. WILLOUGHBY said he was entitled to show the condition of the whole length of pipe along the road.

Lord COLERIDGE said that if Mr. Howard objected he should reject the evidence, but the objection was not persisted in.

Cross-examination resumed: A report had been made on the subject of the main being broken. It was well known in the neighbourhood that the site in question was originally a brickfield, and that the soil was soft, but it was in every respect suitable for the pipes to lie in.

Mr. George Wilson Stevenson, examined by Mr. PAINE.

On Feb. 24, 1879, I attended by appointment at the Ellesmere Road, when the main-pipe was stripped from end to end. A shaft had been sunk immediately opposite No. 50, and I saw the place where the pipe had been fractured and mended. The soil was very loose, and I saw a crowbar put down to a depth of 4 or 5 feet—in fact, as low as it would descend, whilst the soil adjoining was quite hard. The surface soil was quite right, it being macadamized. The soft soil came up to the under side of the macadam.

Mr. PAINE: Supposing the Company had notice in 1866 that the made soil had been placed there, would it have been possible for them to have so packed it that there could not have been a subsidence subsequently?

Witness: I think it would have been impossible for them so to ram the soil as to make good the defective filling in, so that it would have been as good as the undisturbed native soil. From inquiries, I was told that the house drain had been made partly by tunnelling and partly by excavation, and I think it is quite impossible to fill in the tunnelling so effectually as an open cutting. My opinion, therefore, as to the cause of the subsidence was that the men, after doing the work, had contented themselves with loosely filling in, and that in consequence the ground had subsided and broken the pipe. This would not necessarily have been apparent from the surface of the road, because the macadam would have formed a hard crust. I examined the pipes, and am bound to say I never saw a better lot or a set of pipes better laid than these were. They were made by the Staveley Iron Company, and laid by Messrs. John Aird and Sons, and altogether the work was admirably done. As to the life of pipes, in rating cases we take 70 years, but it varies very much from the nature of the soil in which they are laid. The soil in question was very suitable for the lengthened life of a pipe. If a pipe were laid in a cinder sub-soil, its life

would be cut down by 20 or 25 years, because it would become oxidized. There is absolutely neither ammonia nor sulphuretted hydrogen in gas; in fact, the latter is prohibited under very serious penalties, and the former is taken out for profit, it being turned into sulphate of ammonia and sold for manure. Nothing would disclose a settlement of the ground except the actual opening of the road, and to suppose that this could be done periodically year by year, or even at periods of five years, would be absurd. I do not suppose the ratepayers would tolerate it for a moment.

Cross-examined by Mr. WILLOUGHBY: The drain over which the improper soil lay ran from the house to the main sewer down below. The width of the shaft was about 4 feet—large enough to move about in. I do not know how far the earth was loosened, but it was all loose in the immediate neighbourhood. The crowbar was put down between the pipe and the house, and also close to the pipe.

Mr. Robert P. Spice, examined by Mr. MORGAN HOWARD.

I heard the evidence of the last witness, and entirely agree with him. I may add that I have had many hundreds of miles of gas-mains laid under my supervision within the last 38 years, and I have never seen a better sample of pipe-laying, or a better quality of pipes than those in Ellesmere Road.

Cross-examined by Mr. WILLIS: The soil was very good, and there appeared no chance of the pipe subsiding, unless the soil beneath was taken away, which was what happened in this case.

Mr. MORGAN HOWARD said he had other witnesses of a similar character to the preceding, but would not call them unless necessary.

Dr. George Hastings, examined by Mr. PAINE.

On Feb. 11 of last year I saw the plaintiff and his family on behalf of the Gas Company, and I found very little the matter with them. The plaintiff told me of several of his sufferings, but I found no physical signs to account for them. The accident having happened two months before, I should say it was impossible for a gassy taste to remain after that length of time. At that time the wife and children were perfectly well. I have studied gas poisoning, and it is not my opinion that a powerful heart would be affected by the inhalation of gas. The patient would become insensible, and suffer loss of muscular power; but as soon as he came to, the muscular power would return. The fact of the man walking about on the day of the accident would show that it must have been a very slight attack of poisoning.

Cross-examined by Mr. WILLOUGHBY: Coal gas is a very disagreeable thing to inhale, but I do not think there was any sulphuretted hydrogen in it; at any rate, there ought not to be. The power of the lungs in absorbing gas is very great.

By Lord COLERIDGE: I never heard of a case of permanent injury being suffered by anybody from the effect emanating from coal gas.

Dr. Charles Meymott Tidy, examined by Mr. MORGAN HOWARD.

I have had considerable experience in coal gas poisoning, and also in the analysis of coal gas. Of all the constituents of the latter, carbonic acid is the one most to be feared, as it is the most poisonous compound. In unpurified coal gas traces of sulphuretted hydrogen may be found, but in purified coal gas there is not a trace. The operation of carbonic oxide is only upon the blood, and if that be expelled by the action of the lungs, there is an end of it. In very bad cases I have seen recovery take place after three days, and I have also seen the symptoms last to the end of the fourth day, but I have never known of an instance in which they have lasted over a week. I am quite clear upon the point that a man who is able to walk about the day after he has been acted upon by gas could not possibly have been in any very severe measure under the influence of it primarily.

Cross-examined by Mr. WILLOUGHBY: The constitution, of course, may have something to do with it, but not much in a case of volatile gas poisoning, because it is a poison taken into the blood and given off by the blood without any action on the tissue. I am assuming that the gas is that ordinarily supplied by the Company to the public, with the composition of which I am perfectly familiar, and which I know to be absolutely free from sulphuretted hydrogen. The Company may have been occasionally summoned for having sulphuretted hydrogen in their gas, but it was an accidental circumstance if it did happen. The Company have had an injunction granted against them, but in that case the complaint was that in purifying the gas from sulphuretted hydrogen it was necessary to use lime, and in the form of a sulphide the sulphuretted hydrogen was given off from the lime in the purifier. It had nothing to do with the gas, and the whole question arose from the nuisance emanating from the purifiers. The Act of Parliament is perfectly distinct upon this point, that there shall not be a single trace of sulphuretted hydrogen, and we test for it by allowing gas to blow upon a small piece of lead paper. Inhaling sulphur is not in the slightest degree injurious. Carburetted hydrogen is also perfectly innocuous; in fact, I should be prepared to drink a bottle of it at the present time. As a proof of this coalminers breathe it daily without it in the slightest degree affecting their health.

This being the case for the defendants,

Mr. MORGAN HOWARD said he had only a few observations to make. In the first place he submitted that it was a speculative case on the part of the plaintiffs, but if the jury thought he was entitled to anything in the shape of damages, they would have to consider who the person was that they had before them. He was not a large fish salesman, in the sense in which such a term was generally understood, nor was he a man who had anything at all approaching the income which had been stated. He had produced neither books nor vouchers, and but one witness who could give the faintest evidence with regard to his business; and anything more shadowy than that which had been placed before the jury by a plaintiff whose duty it was to do so he had never seen. He said that he had been very seriously hurt; that he had suffered very great injury; and that his heart was affected. It was to be regretted that he should have been annoyed for a moment by this escape of gas, but these were things which all must suffer from. Slight accidents of this kind were constantly occurring, and such cases must be approached by the jury as men of the world, and not from the point of view of a plaintiff who rushed too quickly into the hands of an enterprising solicitor who thought he had a case for making this great Company liable for an accident against which it was simply impossible for them to have taken precautions. The damage sustained by him might be judged by the fact that he was able to go out the very next day. His own evidence was that he was so greatly incapacitated by the effects of the gas that he lost his business; but this point must be left with the jury to determine, according to their own views. It was pretty clear that he was a man in a small way of business; and he could not, with the evidence brought forward, sustain the plea that he had suffered any permanent injury. The effect of the gas had caused a functional derangement merely, and not one of an organic character, and on this point the jury had heard the evidence of two of the most eminent doctors in the Metropolis. They had before them the case of a man for a brief period rendered insensible by gas, but who immediately afterwards said, "I will bring an action against the Gas Company; I will not write a single letter to them; I will give them no notice; I will not give them the slightest chance of negotiating with me; but, ill as I am, upset as I am, suffering from heart disease

as I am, I am going straight away to my attorney," who, with the zeal and enterprise of his profession, put himself into communication with the Gas Company, and the action was thus brought forward. The question substantially was, what transpired at the laying of the sewer in 1866? It had been proved in evidence that unless a series of subterranean excavations had been resorted to, such an event as had happened could not be guarded against. But was there not abundant evidence to prove that the Company had been vigilant? Directly after they heard of the escape they took steps to remedy the defect, and were on the spot, and had the pipes laid bare. Mr. Johnson had tried to make out that the pipe was rotten; but did the jury believe it was so, or anything approaching it? The jury might be left to form their own opinion whether it was not a well-made pipe, which had been subject to all reasonable tests. They also had it upon the testimony of eminent scientific men that there was not a trace of ammonia in the gas. The witnesses one and all said that better pipes they never saw, nor more excellent laying. It might be asked how the accident was to be accounted for. As his lordship had said, were the Gas Company to undertake a perpetual series of peripatetic investigations, breaking up every street, and laying open the pipes throughout their whole system from time to time, in order to see that there was not a momentary escape of gas? They had been told by the very eminent engineers who had been examined that the Company could not, even if the escape had been found out, having regard to the manner in which the house drainage was constructed, bring the soil back to the state in which Nature had originally made it. It might be that there was a single escape of gas, consequent upon a single subsidence of the ground, but how could the Company help it? It was an important case for the Gas Company—nay, more, it was an important case to the whole of the public whose interests were confided to them for the purpose of lighting the Metropolis; and the duties of gas companies would be simply intolerable if such labours were to be imposed upon them. The pipe was proved to have been sound in October, 1878, and the jury could easily draw an inference from the condition in which it must have been at the time. The Company had been to all sorts of trouble and expense in putting things right, and he (Mr. Morgan Howard) was driven to the conclusion, that if there was any escape of gas in the house, it might have been from the not very well constructed brick-work of the wall. The drainage had been formed without any notice to the Gas Company; and even if they had had notice, practical science did not enable them to take care that some isolated escapes should not take place. With these observations he left the case in the hands of the jury.

Mr. WILLOUGHBY, in replying upon the whole case, said he ventured to lay down the proposition that every person had a right to have his house unpolluted by injurious vapours, and that unless the persons who polluted his house could show that it had been done in the exercise of some lawful trade, properly carried on, he was entitled to compensation, not only for any injury his health had suffered, but for any loss which he might have been put to in consequence of it. It was quite true that gas companies had very great powers; but, on the other hand, the public and the Legislature were entitled to see that their powers were carried out in a fair and proper way. Two things they were bound to do—to maintain their pipes in a reasonably efficient and proper condition, and to take proper precautions to protect the health and the lives of the people who happened to live in the immediate neighbourhood of the places where their pipes were laid. Supposing there had been an explosion, could it be said that the Gas Company were to get out of their liability unless they could prove that they had taken every proper precaution, and that the accident was an unpreventable one? It had been given in evidence that the pipe was laid in 1864, and the scientific gentlemen who had been called had stated that they had never seen pipes better fitted for the work for which they were intended to be used; but if this were so it seemed an astonishing thing that the accident should have happened at all. It was not, however, altogether immaterial to consider the whole service of pipes in this road, and if there had been accidents at any other point, it was material to show that it was a faulty service at that spot, and that they had a character for the crimes, so to speak, which those pipes had committed. In 1869 an accident from that excellent service of a very similar character happened; and in 1872 another accident occurred in the same road. In 1869 and 1870, also, the road had sunk, and had to undergo repairs. What did that mean except that the road was faulty in some portions, and that the Company did not look to their main pipes as they ought to have done? It was not merely sufficient to place pipes in the road and let the gas go through them. The Company were bound to lay their pipes in a reasonable and proper way, while the places in which they were laid down should be in as good a condition as it was possible to make them, so that no danger might ensue to the neighbourhood; but it had been distinctly stated that the soil in which these pipes were laid was improper—that it was unsound and treacherous, and that it might give way. There was, of course, the usual contradiction which they always found in cases of this description, but it was for the jury to say which party was telling the truth. If the soil was so perfect, why was it that pipes had sunk and become fractured? It was well known that the servants of a gas company always approached these matters with a certain amount of bias, and their statements, when sifted, were not always found to be accurate; but there were documents which could not deceive. One report stated that, in 1869, the main was found to have sunk, which showed that the soil in that part of the road was treacherous, and in February, 1870, the same thing happened again; so that these documents strongly corroborated the evidence given by the plaintiff's witnesses. The Company's argument was that they laid down the main in a proper manner in 1864, but the evidence did not bear out this statement. In the year 1866 the drains were put in, and it was stated that the good soil was taken out and rubbish inserted in its place; and it was submitted that it was the duty of the gas and water companies to have watched carefully any operations going on in the road, and to see that they were not prejudiced by those operations, not only for their own sakes, but for the interests of the public; but the Company did not pretend that they ever went near the property in the year 1866. In 1873 the Gas Company fixed the service for the then tenants of the house, and in order to do so they must have dug down to the level of the gas-pipe, and they had then full opportunity of seeing the state of the ground; and if it had been treacherous, there were full opportunities of seeing it. If, therefore, they neglected that opportunity—as they undoubtedly did—they were responsible for the accident which had taken place. In 1874 the same opportunity occurred again, because then they disconnected the service they had previously laid in 1873. It was very well to say that the earth was not properly rammed down in 1866, but there was no reason why the observation might not equally apply to the Company themselves, because by disturbing the earth in the way they did they were far more likely to have interfered with the soil, and not have reinstated it in the safe and proper condition it was in before. The Company were, however, guilty of neglect in other ways, because prior to the accident, there was evidence of distinct and positive notice having been given of an escape of gas in the neighbourhood. It was true that this was contradicted by Mr. Carter, but there was the evidence, and if it was accurate the Company could not shuffle out of their liability. Another proof was that it had been ascertained that the service-pipe, although not actually belonging to the Company, was under their

control, as evidenced by their placing a notice over it warning any person against tampering with it. Something had been said about stopping up that hole; but whosoever duty it was that this should be done, it had nothing to do with the plaintiff. The Company had recognized their dominion over the pipe, and therefore the plaintiff could not very well have stopped up the hole. The negligence of any other person would not at all prejudice any right the plaintiff might have, because he stood in a very different position. With regard to the case of the wife and children, the case had never been presented as one of a serious character. Those persons had said they suffered but little, but still for that little they were entitled to compensation. He (Mr. Willoughby) did not say the damages in those cases should be large—in fact, it would have been better that their names should not have been introduced—but their claims had been put in, and would have to be dealt with. Coming to the plaintiff's position, it was undoubtedly the fact that he slept in, and inhaled the gas for a considerable time. Was that a pleasant thing to do—was it injurious, or was it not? Doctors had been called in, and they differed, as they usually did in such cases; but the jury must exercise their own good sense in the matter, and say how far the case was a genuine one or not. A young man carrying on a fairly good business at Billingsgate Market was suddenly struck down, and his system impregnated with coal gas. It might be, as Dr. Tidy had stated, that the gas was made of such excellent ingredients that sulphuretted hydrogen was never found in it; and as to something else which was in it, it was so innocuous that the Doctor seemed rather to like it, and said he would be happy to drink a bottle of it. That gentleman said that if it was dangerous it was only slightly so, and his whole evidence amounted to the statement that he had never heard or read of a case in which the patient did not recover within a week: but the good sense of the jury would tell them that this must depend upon the quantity inhaled, and also, to a great extent, upon the constitution of the person who inhaled it, as well as the ingredients of which the gas was composed. The evidence of Dr. Abbott, however, was distinct and positive. He said the man was not shamming at all, and that he was really laid up for five weeks from the effects of gas poisoning—that his system was impregnated with it, and that his heart was feeble. Of course, as it was now two years since the accident took place, the plaintiff had practically recovered; he was in a very different condition, and there was nothing much the matter with him. It was quite impossible to believe that a man sleeping in an atmosphere of this kind, and being found in a state of insensibility, would not suffer more serious effects than Dr. Tidy seemed to think. On the head of damages, he (Mr. Willoughby) contended that the plaintiff was entitled to a fair and reasonable sum for the expense he had been put to, and also for the loss of business and loss of health he had sustained. If a man embarked in a career which chiefly depended upon his own exertions, and was in any way incapacitated from attending to it, he found upon his return that his customers had gone elsewhere, and he had to make over again a business which at the time he was struck down might have proved a very good concern. That was what had occurred here. The figures given were something like £2 or £3 a week falling off, or about £100 a year from the time the accident happened to the present, and this was fairly to be considered, quite apart from the three months during which he was prevented more or less from attending to his affairs. In conclusion, it was submitted that the accident had arisen from the neglect of the Gas Company to take ordinary precautions, and they were therefore bound to compensate any one who had been injured through that neglect.

Lord COLERIDGE commenced his remarks to the jury by making some strong comments on multiplying the number of plaintiffs in cases like the present, the object of which might be summed up in one word—"Costs"—because there was no doubt the benefit which would accrue to the legal advisers would be ten times greater than any possible damage that could be supposed to have accrued to either of the plaintiffs in either of the actions. The first question was, had there been any negligence on the part of the defendants? If not the actions failed; but if there was any negligence, the next question was, what injury the plaintiffs had suffered, and what compensation they should receive? The term "negligence," in a matter like the present, meant the omission to do something which a reasonable man would do, or the doing of something which a reasonable man, guided by like considerations, would not do. The plaintiffs stated that the defendants were a large and powerful Company, and this might possibly explain the fact that they had two actions, two sets of briefs, two attorneys, and two sets of costs. Happily, however, costs were in the discretion of the judge, and the jury would hear what his judgment would be, at all events, in one of the cases, because it was an action which, in his opinion, the Court ought never to have been called upon to try. The plaintiffs case was that they were perfectly innocent, and, as they believed, protected from all connection with the main; but the gas found its way into their house and caused all the damage, and for that damage they would trouble the Company to pay so much as was right and proper under all the circumstances. The defendants said they did not dispute that the gas was made by them, and transmitted to this particular place, when one of their pipes broke, and that there was a considerable escape of gas from the pipe, which somehow or other got into the house; but for the breakage of the main they were not answerable, because it did not arise from any negligence of theirs; and if the defendants made out that defence, they were entitled to succeed. In a case like the present the onus lay on the plaintiff, who must show some act of negligence; he must put his finger on some act done wrongfully, or wrongfully omitted to be done, on the part of the defendants; and if he did not do that he did not discharge the burden which the law cast upon him, and he must fail. Did the plaintiffs in this case sustain the burden? As to the breaking of the main and the escape of gas there was really no dispute, and no answer was attempted to be made, and therefore the plaintiffs on this point had a case to lay before the jury. But the defendants said that the pipes were of the best quality, and laid by one of the best firms, in soil which afforded an excellent bed for them. It might be taken that reasonable care would be exercised by the Company, because otherwise they would be perpetually in danger of something happening to them, and the expense of keeping them in a fit and proper condition would, in the long run, be much greater than if they had made a proper outlay at first. They then said that after the pipes had been laid for a couple of years, a system of sewerage was carried down Ellesmere Road, and drains were formed connecting the sewer with the houses. It was not suggested that the making of the main sewer had anything to do with the damage which was the cause of the action, because the sewer was in the middle of the road, while the water and gas pipes were laid rather nearer the kerb. But the surface drains from the houses led at uncertain intervals from the houses into the main sewer, and of course they had to be carried under the water and gas pipes for the purpose of connecting them with the sewer; and the Company's contention was that at this particular spot the excavation made for that purpose had not been properly filled in, and so let down the pipe that at last it cracked and broke altogether. If that were so—and there appeared no reason to doubt that this was the *causa causans*—the question was, could the defendants by reasonable care have prevented it? If they had known beforehand what was going to happen,

and if by some known mode of operation they could have prevented the possible sinking of their pipe, there would have been reasonable evidence of negligence to be left to the jury. But what had been proved was that, as a matter of fact, when the pipe was taken up it was found lying in ground which was not the original earth, but rubbish which was liable to become compressed by the lapse of time, and that there was no known means of remedying this defect. The defendants said it was not as if those works had been carried on at well-known times, when they might have had notice of them, but they were done at uncertain times, and it was not pretended that notice had been given. They also said it was impossible, when work was done in such a way, to prevent the pipes from sinking and cracking in consequence of the inferior stuff put under them. Mr. Willoughby had said that the mains ought to have been looked at from time to time, and had this been done, the breaking might have been stopped; but it was preposterous to suppose that, as a matter of fact, gas companies could have their whole system of pipes perpetually being dug up to see whether there was anything the matter with them. One of the plaintiffs witnesses had stated positively that he had gone to the Company's office a week beforehand, and told them there was an escape of gas at this very spot, and if that were so there was great evidence of negligence. Mr. Carter, however, gave this statement a most distinct and definite contradiction, and it was for the jury to say which of the two witnesses they believed. If the Company had had warning, it was very odd indeed that they had taken no notice of it. They knew perfectly well what to do in the event of an escape. On previous occasions escapes had been remedied at once, and it was difficult to understand why Mr. Carter should have neglected his duty on the present occasion. Apart from this, if the jury believed the evidence of the defendants, his lordship said he had great difficulty in seeing what it was upon which counsel for the plaintiffs could put his finger and say, "This is an act of negligence." Something had been said about the condition of the pipes, that they were very bad in themselves, irrespective of being broken down; but two of the plaintiffs own witnesses had admitted that they were in a very good state. A piece of the pipe had been produced which had been practically traced from the spot where it was taken out of the ground to the court. Mr. Jackson said it was not the same piece of pipe, but perhaps he really saw some other piece, and this would be a way of reconciling his evidence with that of the other witnesses, when he said the pipe was in bad order. Evidence had been called as to the state of the pipe at other parts of the road, but what real light could it throw upon the state of a pipe at one place to show the state of another pipe at another part. As to the question of damages, supposing the defendants to be liable, for what amount would they be so liable? On this point his lordship remarked that he did not like to say all he felt, because the amount would be for the jury to consider. The first plaintiff's own account was very serious indeed. He said he was rendered insensible, that he was not able to attend to his business at all for five weeks, and not able to attend substantially for three months, and that, when he went back afterwards, he could not attend to his business so well as he did before. He also said he was making profits to the amount of £10 a week, and that the whole of this was lost for a period of five weeks; and he likewise stated that he was not by any means well at present, in which statement he was confirmed by the two doctors who had been called on his behalf. [His lordship read several extracts from the evidence of those gentlemen.] On the other hand, they had the evidence of two scientific witnesses who were called for the defence, and they both stated that the case could not be maintained. Neither of them denied that if a person inhaled gas long enough it would kill him, but they said that if after the inhalation the patient went out into the fresh air, the effect would soon be got rid of by exhalation. Dr. Tidy said—and he was confirmed by Dr. Hastings—that the effects of coal gas, when it did not kill, were, according to the best experience, exceedingly transitory. Science was altogether apart from common sense, and there were many matters which scientific men understood, but which unscientific men did not understand; but there were also matters of simple elementary knowledge, and bringing that knowledge to bear upon the present question, one saw the sense of what those two gentlemen had told them—viz., that if they got the coal gas out of the system, they, at the same time, got rid of the effects. This was the evidence as given on one side and the other. If the jury thought the plaintiff had been exaggerating as to his loss of trade and profits, they might also think he had been exaggerating as to his personal sufferings. He said he had been making a profit of £520 a year; but supposing they took off £50, or £100, or even half—if they thought he was making a profit of £250—it was for them to say what they thought he was entitled to. There was nothing to guide them; there were no accounts, not even a banking book. It might perhaps be suggested that he had kept no books in order to avoid paying income-tax, but possibly after the present case he might have to pay that tax. However, he had not produced books, and said he could not give a fragment of documentary evidence in the shape of an account, or any piece of paper to show that he had been making anything like the sum stated. If the jury thought he had been grossly exaggerating in any one matter upon which they could place their fingers, then from that they could judge whether he was likely to have exaggerated in others upon which they could not bring him to book, and, unfortunately (added his lordship), "as I have pointed out to you, there is no book to bring him to." With regard to the other plaintiffs, they must be left in the hands of the jury, as they did not appear to have been much the worse for the accident, although Miss Hannah said she had the taste of onions—and, what seemed to give a new terror, bad onions—in her mouth for months. With regard to the damages, the parties were all in the house, and they all seemed to have suffered in some way from the escape of gas; but how much they had suffered—or, in the case of the ladies, how little they had suffered—it was for the jury to say. There were two cases before them, and they would have to take both into consideration. If they should find in favour of the plaintiffs, they would have to consider the whole of the five or six separate cases. They had all breathed the gas, and were all entitled to something if the Company were proved guilty of negligence with regard to their pipes.

The jury having consulted in the box for about five minutes, returned a verdict for the defendants in both cases.

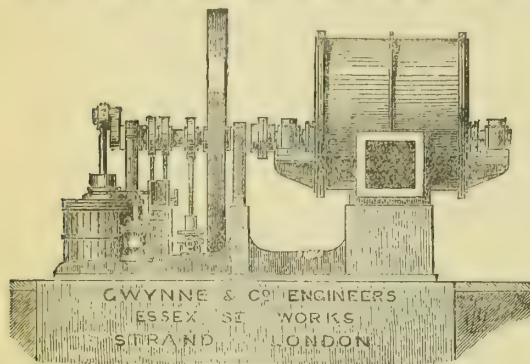
Lord COLERIDGE thereupon directed judgment to be entered for the defendants, and granted a certificate for a special jury.

ALDRINGTON ESTATE WATER COMPANY, LIMITED.—A Company with this title was registered on the 2nd inst., with a capital of £25,000, in £10 shares, to erect water-works and to supply fresh and sea water to the Aldrington Estate and neighbourhood, in the parishes of Aldrington and Portslade, in the county of Sussex.

CLEVEDON GAS COMPANY.—The annual meeting of this Company was held on Friday, the 11th inst.—Mr. J. Maynard in the chair. The report and balance-sheet were unanimously adopted, and a dividend was declared of 7 per cent. on the B shares, and 8 per cent. on the A shares, free of income-tax. Messrs. F. Gregory and J. Middle were re-elected Directors, and Mr. C. J. Ryland, of Bristol, Auditor.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

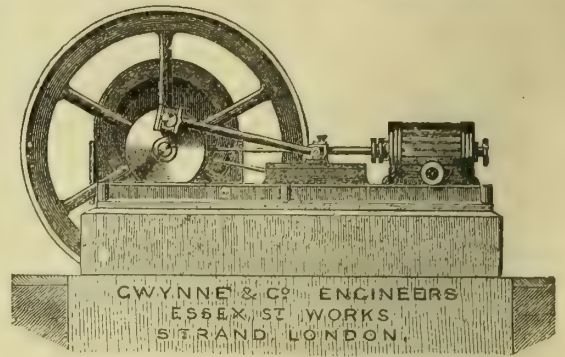
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship."

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce machinery of the very highest quality, and most approved design and workmanship. The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

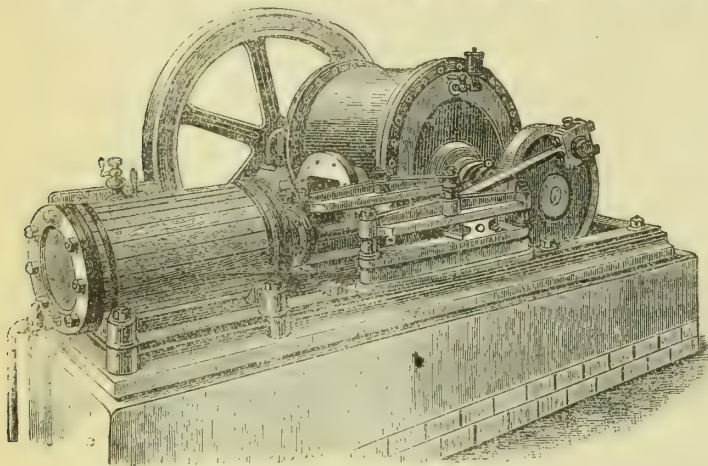
Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, **GWYNNE & CO.,** Hydraulic and Gas Engineers, **ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.**

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

BEALE'S IMPROVED PATENT GAS EXHAUSTERS,

WITH
Wrought-Iron Spindles and
ENGINES COMBINED.



SOLE MAKERS,

GEORGE WALLER & CO.

MAKERS OF ENGINES, EXHAUSTERS,
INDEX AND DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, AND OTHER PUMPS,
SCRUBBERS AND PURIFIERS,
CONDENSERS, BOILERS, &c.

G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

[SEE ALSO ADVERTISEMENT, PAGE 982.]

Phoenix Engineering Works:

HOLLAND STREET, SOUTHWARK, S.E.

WANTED, Readers of the NEW Edition, "Cooking & Heating by Gas;" on Burners, &c. Copies, by post, Threepence, direct from the Author, **MAGNUS OHREN, Assoc.M.I.C.E., Gas-Works, SYDENHAM.**

WANTED, by the Advertiser, a Situation as WORKING FOREMAN or in any place of trust. Has had every experience in Works making 80 million. First-class references. Address No. 668, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser, a Young Man aged 25, and Married, a Situation as MANAGER of a small Gas-Works. Applicant has a thorough knowledge of the Manufacture and Distribution of Gas in all its branches. Has had several years experience as Manager of a Works (make 15 millions). Has no objection to go Abroad. Satisfactory reasons for change. Address No. 668, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Advertiser requires a Situation as GAS-FITTER, MAIN and SERVICE LAYER. Accustomed to General Work on Gas-Works. Address No. 667, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

HOLYWOOD GAS COMPANY, LIMITED.
WANTED, a Manager for the above Works. He will be required, besides taking the general management of the Works under the Chairman and Directors, to take the indications of the Meters. He must be competent to Superintend the Setting of Retorts, Laying of Mains, &c. Security will be required for the due discharge of the duties of the situation. Salary not less than £90 a year, with house, fire, and light. Applications, with testimonials as to character, ability, and experience, to be forwarded to the Chairman of Directors on or before the 28th inst.
THOMAS HUNTER, Secretary.
Holywood, Belfast, June 10, 1880.

WANTED, a Working Stoker, to take charge of a small Gas-Works in a country town. Wages must be low. Apply to R. T., 3, Limes Villas, LEWISHAM.

WANTED, in a Suburban Gas Company's Office, a CLERK about 18 or 19. Must be a good Writer and quick at Figures. References required. Salary £50 per annum. Apply, by letter, to GAS SECRETARY, care of R. Clarke and Co., 3, White Hart Court, BISHOPS-GATE STREET, E.C.

BOROUGH OF ROCHDALE.

THE Corporation of Rochdale are prepared to receive APPLICATIONS for the Office of GAS MANAGER in that Borough at a salary of £400 per annum.

Candidates must have a thorough knowledge of the Manufacture and of the Distribution of Gas upon the most modern principles, and also be competent to Design and carry out such Extensions to the Gas-Works as may be required.

Applications, endorsed "Gas Manager," stating age and experience, together with testimonials, must be sent to me on or before the 29th of June inst.

By order,
ZACH. MELLOR, Town Clerk.
Town Hall, Rochdale, June 19, 1880.

GAS PLANT FOR SALE.

THE Committee of the Burton-on-Trent Corporation Gas Department have for Sale One Set of TWO PURIFIERS, 24 ft. by 10 ft., 3 ft. 9 in. deep, 12 in. Connections, and Two 12 in. Four-Way Dry Valves by Walker, Lifting Apparatus, &c. One Set of TWO PURIFIERS, 14 ft. by 14 ft., 3 ft. 9 in. deep, and Six 12-in. diameter Valves by Young, Lifting Apparatus. The above having been replaced by larger can be removed at once. Further particulars may be had on application to the undersigned.

JOHN MUDIE, Manager.
Gas-Works, Wetmore Road, June 5, 1880.

GAS-MAKING FROM WOOD AND NAPHTHA.

COMPETENT Person Wanted, to make Experiments with Iron Retorts. Apply, with full particulars of qualifications, to **WILLIAM BLEWS AND SONS, Gas Engineers, BIRMINGHAM.**

WANTED, the following Second-hand PLANT:-
A SCRUBBER, about 12 ft. high, 3 ft. 6 in. wide, with Water Tank and Distributing Apparatus, and 6-in. Connections and Four-Way Valve.
A PURIFIER, about 9 ft. by 6 ft., and 4 ft. deep, with Sieves, Lift, 6-in. Connection, and Four-Way Valve.
Price, &c., to be addressed to **GEO. WHITMAN, Company's Office, Aspley Guise, near WOBURN.**

ON SALE—The Cast-Iron Fire Doors, Mouthpieces, Ascension, H, and Dip Pipes, Hydraulic Mains, &c., belonging to six settings of six retorts; also One Station Meter to pass 8000 feet per hour (makers West and Gregson). The above are in capital condition, and can be seen at the Gas-Works, Guildford. No reasonable offer refused. Further particulars on application to **MR. LONGWORTH, Gas Offices, GUILDFORD.**

GAS APPARATUS FOR SALE.

THE Gas Committee of the Town Commissioners of Newry are desirous of receiving TENDERS for the Purchase of the following PLANT, which has been taken down to be replaced with apparatus of a larger size:—
8-in. Condensers, 20 pipes, and Tar Box with overflow-pipes complete.
Five 8-in. Back-Valves and 6-in. Connection Pipes and bends for Bye-pass complete.
Two Purifiers, 10 ft. by 12 ft. by 4 ft. deep.
Two Purifiers, 8 ft. by 8 ft. by 4 ft. deep.
8-in. Connections, Lift, Screws, and Travellers. One Hydraulic Centre-Valve suitable for four purifiers. Tenders to be forwarded to the undersigned.
JOHN KERNAGHAN, Secretary of Gas Committee.
Board-Room, 6, Marcus Square, June 9, 1880.

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TO CORRESPONDENTS.

M. W. P.—A map showing the districts of the London Water Companies can be obtained of Mr. Preston Davies, of 6, Victoria Street, Westminster.

W. SUGG.—We regret being obliged to hold over your letter, in reply to "Alex. M'Ivor," till next week.

M. O. T.—Will notice in an early number the information you have kindly furnished.

J. BARKER.—Letter received too late for notice in to-day's JOURNAL.

ERRATUM.—For "42,000 tons," in line 31 of column 2, page 1002 of last issue, read "2000 tons."

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 29, 1880.

Circular to Gas Companies.

THE Liverpool Lighting Act of last year is no longer, of its kind, a solitary legislative blossom, and the Corporation of Liverpool have ceased to stand alone in the possession of the powers which that Act conferred. The Hull Lighting Bill and the Preston Improvement Bill have respectively been passed by Committees of the House of Commons, and may be considered certain now to obtain the full sanction of the Legislature. These Bills are in effect identical with the Liverpool Act, and there are now consequently three Municipal Corporations enjoying parliamentary sanction and right to expend the money of the ratepayers upon experiments in electric lighting. We say "experiments" advisedly, because in each case it is admitted that the work proposed to be done is partial and tentative, and the Corporations are refused permission to reap a profit as the reward of their labours and expenditure. It is reasonable to suppose that Parliament has now done enough for the encouragement of scientific inquiry in this matter; and we are entitled to expect that some

really instructive and practical demonstrations will be made before further powers of a like character are either sought by, or granted to other Municipalities. It is unusual, and we think the practice in several ways open to very grave objection, for such Corporations to have authority granted them to spend money in speculative investigations. In this country, at any rate in recent years, there has been no lack of private enterprise or capital to examine, develop, and apply inventions or processes of a novel character which have given any promise of commercial success. The electric light is no longer a novelty; it has proved itself suitable to the work of illumination in several special applications, and its superiority over all others, where single centres of very great intensity are required, is generally accepted. We maintain, however, that this latter position of superiority is limited strictly to lighthouse purposes, and that for all other lights of any sufficient volume and power can be obtained from gas.

The success which has attended the introduction of several of the applications of electricity for lighting purposes, both on the Continent and in England, has been sufficient to encourage the formation of more than one Electric Light Company, and a Municipal Corporation or any other body or person desiring to spend money upon further experiments, will find no lack of enthusiastic helpers. What is more to our purpose, however, such a Corporation would also, we believe, find no difficulty in obtaining definite tenders from several responsible firms or companies ready to undertake any such duty as the lighting of "streets, parks, or places of public resort," in the same manner as the Société Générale d'Electricité has contracted with the Metropolitan Board for the lighting of the Thames Embankment, and this would, in our judgment, be the more prudent and legitimate method of procedure. The House of Commons Committee of last year reported: "It is desirable that Local Authorities should have power to give facilities to companies or private persons to conduct experiments," while they also reported that "if Corporations and other Local Authorities have not power under existing statutes to take up streets and lay wires for street lighting or other public uses of the electric light, your Committee think that ample power should be given them for this purpose." Yet the former quotation shows that it was rather with the view of enabling contractors to do the work for them than that the Corporations themselves should become traders in electric, as so many are, and so many others desire to be, in gas lighting.

We raise this point for the reason that we do not regard with unmixed satisfaction the condition laid upon Corporations supplying the electric light, that they shall derive no profit from its sale. The effect of this limitation is that perforce the new light must enter into competition with the old one at an unfair advantage, inasmuch as the comparison of expense will be between the first cost of the one and the commercial selling price of the other. We do not need to remind our readers how great is the difference between the two. In a town, for instance, where gas is being sold at 2s. 6d. per thousand cubic feet, not more than half that amount should be reckoned when making comparisons with the electric light under the conditions laid down for it at Hull and elsewhere; but this aspect of the question is persistently lost sight of by those who argue in favour of the economy of electric lighting. If the Corporations then had determined to grant concessions to private firms or companies to undertake the work as a matter of ordinary business, the public would have known what was a fair price for the new light comparatively with gas, because either the price charged would have been one sufficient to pay a fair profit to the contractors, or, if no profit resulted, it would be seen that the charge was too low. In any event, there would be no difficulty in arriving at a right conclusion as to what the price should be. As it is, the Gas Companies and their Engineers in the various towns where these experiments are being or are to be made, will do good service by watching closely, not only the experiments themselves, but also the figures that will be issued in reference to them; and the duty seems to devolve upon them of protecting the public, not only of their own towns but generally, from being misled by either ignorant or interested statements.

These considerations apart, we are glad of any movement which promises to lift the question of electric lighting, as competitive with gas lighting, nearer to the region of fact and demonstration, and away from that of mere tall talk, to which it has hitherto been so largely confined. Bearing in mind the character and position held by many of those who have been actively engaged in promoting electric lighting, and the many opportunities which have already been afforded for exhaustive

tests, it is surprising that trustworthy data as to its capabilities and cost are so very slight. The statements made even now before Parliamentary Committees are to a large extent unsupported by practical facts, and are often grossly extravagant. For instance, giving evidence before the Committee on the Preston Improvement Bill, Dr. Siemens stated "that he had already given evidence elsewhere that the cost of working of the electric light is about one-half of the cost of working the gaslights." Now, seeing that the cost of gas itself in one town may be, and is, less by more than one-half than the cost of gas in another town, the statement was not of much value, though it may have conveyed much to the Committee. Again, Dr. Siemens stated that a capital expenditure of £9000 must be made in Preston to give a gross light of about 80,000 candles, and he then proceeded, with perfect gravity, no doubt, to inform the Committee that the cost of maintaining a light of 6000 candles power would be 7d. per hour, and compared that with a charge of 1s. 1½d. for gas; so proving (!) that "the cost of gas is very nearly double." The charges against the Corporation for wear and tear and interest upon capital, which Dr. Siemens does not seem to regard as worth estimating, will considerably exceed the total he allowed to cover all charges. These are mistakes which will right themselves in actual practice; and, as we have already said, we hail any promise of a substitution of facts for mere affirmations.

There was, however, another statement made by Dr. Siemens which, while incorrect in itself, is calculated to exercise an injurious effect which it is very difficult to remove. He stated that "in a crowded room, when lighted by gas, about four-fifths of the oxygen is consumed by the gas to give light, and only one-fifth by the people present to sustain life." Such an assertion, when made by a scientist of Dr. Siemens's great and well-earned reputation, was naturally accepted by a Parliamentary Committee without question, and its influence upon their judgment could not but be great. And yet few of our readers will need to be reminded that the statement was entirely groundless, and contrary to fact. A crowded room was doubtless cited by Dr. Siemens because of the acknowledged difficulty of dealing with the question of ventilation in such circumstances. In an apartment under ordinary conditions, where three or four persons are sitting and as many gaslights burning, the proportions named would be about accurate; but no inconvenience whatever is there felt, or would be felt, if the destruction of oxygen were twice as great, because the ordinary and natural means of ventilation are sufficient to replace readily all that is required. In a crowded room, however—say, for instance, a lecture theatre or concert-room—the lights do not increase in anything like the same proportion as the occupants, and such a room would need to be lighted with gross extravagance if the gaslights required one-fourth as much oxygen for their support as would be needed by the audience. We regret having to call attention to an error of this kind; but though "evil is wrought by want of thought," it is none the less evil, and needs to be counteracted so far as is possible.

Returning, then, to the passing of these Bills, we shall watch with interest the outcome of them, and will keep our readers informed as to what is being done under the powers they convey. We feel entitled to expect that the money authorized will be spent not in mere fireworks, but in honest endeavours to do work which shall, if possible, be of a permanent character. We trust also that the reports and accounts of the Corporations will be prepared, not with a view to prove the wisdom of the course they adopted in obtaining these powers, but rather fairly to state the degree of success or otherwise which has attended their efforts, and the cost at which the results, whatever they may be, have been attained.

We welcome any evidence of continued present interest in the proposals for widening the operations of the British Association of Gas Managers, to which we have on several occasions lately directed attention. The letter which appeared in our last issue, bearing the characteristic signature of "Forward," is such an evidence. It states the case, from the writer's point of view, lucidly and vigorously, and we believe that the opinions expressed in it are shared by a large number of members.

It appears to us that there are now several distinct points of general interest to the Association which would amply repay the careful attention of the Committee. We may name—(1.) The enriching of the published proceedings with extracts from those of other kindred societies, and from the home and foreign technical journals. (2.) The obtaining of statistical information upon subjects agreed upon, and the

organizing by the Committee of joint investigations, on the part of members, into questions upon which there exists difference of opinion, practice, and experience. (3.) The proposal which "Forward" has stated of re-casting the Association, and advancing it from its present modest status to the dignity of a full-blown Institute. For our own part, we have already expressed our hope that the basis of the Association may be so broadened as to admit a class of persons at present excluded, and we believe that such an amendment of the constitution would not only benefit those gentlemen, but also, and that to a very large extent, the Association itself. Such a reconstruction, however, as our correspondent suggests will, we are sure, not be rightly understood. We express no opinion upon it, but it is desirable that the full importance of such a change should be clearly appreciated. At present the qualification for membership is sufficiently clearly laid down, and that of the second class would be capable of equally clear definition. If, however, the proposed alteration is effected, the Committee will have to take upon itself the duties of a technical examining board, and it is pretty certain that their conclusions would not always be acceptable to candidates. We do not know whether the alteration would confer the privilege of attaching initial letters to the names of members; but if it did, we feel sure that this aspect also of the change would be regarded with distaste by many. The Association has in the past been modest; it has also been useful, efficient, and respected. It is, according to the opinions of many who have the best means of judging, capable of greater things in the future than those it has yet accomplished, and the matter of immediate interest is that the Committee should consider the suggestions which have been made to that end, and such others as may occur to them, with a view to determine how far they can be adopted with advantage. If after such consideration the Committee recommend any radical alteration in the constitution of the Association, they will doubtless be able to support it by reasons acceptable to the members. It will be the cause for great regret, however, if the discussion of these more difficult and heroic propositions is allowed to bar the way of those generally desired improvements or advances which are clearly within the reach of the present organization of the Association.

In to-day's number we conclude our report of the proceedings at the recent meeting of the British Association of Gas Managers. The last four papers read equalled, even if they did not excel in interest, those we noticed last week, and we may again congratulate the Committee on the very varied programme they were this year enabled to place before the members.

Mr. G. Livesey did good service in bringing forward the instructive paper on Gasholder Tanks which bears his name. We learn as much, if not more, by failures than by successes; although the full statements by which the best information is afforded are in general as carefully suppressed in the one case as they are ostentatiously published in the other. Even with the latter, when narratives of triumph over difficulties are given to the world, it is seldom that the minor considerations, which, in the aggregate, make up the real conditions, on the due observance of which the final triumph or failure of the undertaking hinges, are brought into due prominence. The popular measure of an engineer, as of a general, is the success which he achieves; the imminent risks of failure which he has encountered are not known to those who extol his name, and it shows a true spirit of good-fellowship, and desire to serve his brethren, when he gives them a history of his past troubles as well as of his good fortune, and thus warns his hearers of pitfalls into which they might otherwise unwarily fall. It was good to hear on this, as on other occasions, how Mr. Livesey endeavoured to give honour wherever it was due, not omitting from his narrative of difficulties overcome, the humble instruments by whom the toil was shared, but who are too often forgotten when once the end has been compassed.

It may not be given to many to be placed in the same positions of difficulty of which Mr. Livesey made mention; but there were certain broad lines of caution indicated in his remarks, which we may be permitted to emphasize for the benefit of our readers. Foremost was the absolute necessity in all cases where gasholder-tanks are to be constructed, of making a most complete preliminary examination of the subsoil, by sinking a shaft or boring to some depth below that at which the foundations of the tank will be laid. The disposition of the strata thus revealed will indicate whether, if the tank is intended to be very large, any further exploration is needed. It cannot be too strongly laid down as a maxim,

that boring to the intended depth of the tank alone is frequently of more harm than good. In many localities when water is met with, the occurrence of running sand between the upper layers of clay, marl, or peat, and the gravel or rock on which the tank walls are to stand, is a source of much perplexity and danger, unless properly under-drained in the manner described by Mr. Livesey. This kind of sand formation, if pumped from direct, instead of from underneath, inevitably causes extensive settlement of the soil above it, sometimes over a surprisingly large area. Nothing is more stable than dry sand, while the same material when wet is about as firm as quicksilver.

Due notice should also be taken of Mr. Livesey's statement of the fundamental difference between the distribution of the disruptive force in tanks with internal cement rendering, and in those in which an exterior puddle wall is relied on for keeping in the water. The risk of failure from a misunderstanding of this law needs full and careful apprehension, in order that a method of construction, perfectly reliable in itself, should not be discredited on grounds which are nowise inherent in it. But before leaving the subject of cement concrete tanks, we may impress on any person who may propose to construct a tank of this description, especially if in a small town or by inexperienced contractors, the necessity that exists for special care in the selection of the cement to be used. A quick-setting cement, giving a strong seven days test, such as ordinary builders chiefly affect, is not the kind that should be employed for waterproof work; for, from the presence of free lime, it is apt to crack in a few months after it has set, and is then, of course, a source of great trouble. Cement can always be obtained, from any reputable maker, which is free from this tendency, but its special character should always be stipulated at the time of purchase. With these considerations, and those referred to by Mr. Livesey and others, kept well in view, there is no reason to suppose that concrete alone will prove anything but a satisfactory material for the construction of many tanks which a short time since would have been built, perhaps at great cost, of stone or brick with puddle.

Mr. Somerville's account of the means adopted at the South Metropolitan Gas-Works for preventing oscillation in the flow of gas from the retorts to the exhauster dealt with a subject—or we may say several subjects—upon which much controversy has taken place, and upon which there is considerable uncertainty and disagreement among gas managers at the present time, to be continued probably for some years to come. Mr. Somerville, in reality, does two things:—He does away with the dip in the hydraulic main, and he interposes a balanced holder, through which the gas passes on its way to the exhauster, with the further object of allowing the flow of gas to expand and lose its direct linear motion, and in this state of comparative quiescence to throw down the particles of tar which it might otherwise carry forward. We must refer our readers to the paper itself for a full description of the apparatus, and of the results which it is said to have achieved. Candidly, there are so many different points of chemistry and practical working included in the processes which take place between the retort and the exhauster, that it is extremely difficult to confine our remarks to the subject-matter of the paper. In distinguishing between the two kinds of tar obtained from the apparatus, Mr. Somerville rakes up the whole question of condensation, and the effect of the contact of gas with tar, in reference to which Mr. Greville Williams had a special word to say in his lecture. According to Mr. Somerville, contact with light tar does not at all prejudicially affect gas, while heavy tar is very active in lowering its illuminating power. Concerning this, however, Mr. Hunt very reasonably required further information as to the way in which light tar is made, since it appears reasonable to suppose that heavy tar may be rendered lighter by contact with gas.

Our old friend, or enemy, the stopped ascension-pipe, was heard of in the course of the subsequent discussion, as might have been expected. Stopped pipes and graphite deposits in retorts have, it appears, both ceased to be a source of trouble at the South Metropolitan Gas-Works since the apparatus in question has been in use; but Mr. Foulis denied that the latter effect was at all referable, according to his experience, to the diminution of oscillation in the current of gas. Contradictory opinions on this subject are, however, to be expected, as other causes, not specially mentioned at the time, may be held to enter largely into the elements of this particular problem. The effect of a frictional depositing apparatus in getting rid of suspended globules of tarry matter was not discussed in connection with the depositing chamber which

formed such an important feature of the arrangement Mr. Somerville described; but it would appear that such appliances offer a ready means of accomplishing most, if not all, of the duties which the latter apparatus is intended to perform. Not every gas manager has a disused holder which he can convert into a balanced depositing chamber; but a frictional tar depositor on the principle of the Pelouze and Audouin condenser should be within the reach of all; and something of this kind may become almost indispensable if tar is in future to be separated fractionally, offering, as it does, a possibility of eliminating, in a particularly neat manner, tar, the contact of which with gas, when spread over the interior of a settling chamber, might be objectionable. We need only say further that Mr. Somerville's method of dealing with the subject in his paper was eminently clear and practical, and he succeeded in making a valuable contribution towards the definite settlement of a very pressing difficulty.

Mr. F. W. Hartley's paper upon Photometrical Standards was a remarkable example of the power of research to convert a professor of experimental science to a complete acceptance and warm advocacy of views which he has at one time strenuously denied. Mr. Methven's statement to the effect that gaseous flames of similar character vary in illuminating power directly with their area, and that consequently a definite portion of such flames is of constant illuminating power, is sufficiently startling to render pardonable any reasonable doubt in the minds of those who may hear it for the first time. Mr. Hartley's doubts and objections, as advanced by him on the occasion of Mr. Methven's introduction of the subject during the London meeting of the Association in 1878, and immediately thereafter, must be fresh in the minds of our readers, and his conversion to the principles which he then condemned will, in itself, form a powerful argument in their favour, to many who have not his opportunities for experimentally proving their truth. In the course of his remarks, Mr. Hartley passed in review the candle, lamp, and Mr. Vernon Harcourt's pentane gas standards for the estimation of the illuminating power of gas, and had something to say in condemnation of them all. How the poor standard candle contrives to keep up its flame with anything like spirit, under the torrents of abuse which are poured upon it from all sides, is astonishing. Chemists and gas managers unite in giving it hard names, and except with one unimportant exception, it did not receive a good word in the present instance from Mr. Hartley or his critics. "What everybody says must be true," and the candle is perhaps doomed to be finally snuffed out; but it will die hard. Let us be just to an old servant, and give it as good a character as we can before parting with it. However troublesome it may be, it has the great merits of simplicity and intelligibility. The most unlearned can understand what is meant when a certain gas-flame is said to give a light equal to that of so many candles, and for this reason alone any fresh standard must be shown to possess superlative advantages, before Parliament can be expected to prefer it to the present one.

It must not be imagined that in fairly stating considerations such as these we are expressing our contentment with photometry on its present basis, or in any way prejudging the issue of the struggle to obtain a better standard, to which so many experimentalists have addressed themselves; but it appears to us that so long as the illuminating power of gas is expressed in terms of candle power, it will seem to many people only reasonable that actual candles should be used in its measurement, and the onus of disproving this assumption must rest with those who wish to introduce something else. Again, supposing a new standard—Methven's screen, pentane gas, or what not—is adopted, and the nomenclature of the present system retained, which it probably would be, how is the value of the standard in relation to candles to be determined? Will not the argument be raised, that if candles are unreliable for directly testing gas, they must also be equally unreliable as aids to the adjustment of a standard? And more particularly with reference to Mr. Methven's system, the difficulty which was called "more sentimental than anything else," of inducing general acceptance of the fairness of measuring a flame by a portion of another flame of similar constitution, which may be called tantamount to measuring a thing by itself, is not to be thought lightly of, especially when the measurement obtained is to be stated in terms of another thing altogether. These, and such as these, as it appears to us, will form the chief class of objections which the advocates of the proposed new standards will have to meet. We do not say that they are insurmountable, but they are certainly not to be despised,

and if they are to a great extent based on sentiment, that fact, so far from rendering them of less import, in reality renders them far more formidable, by bringing into the field of resistance an element of intangibility which experience has proved in other cases to be most difficult to deal with. If it be assumed that the screen standard can be implicitly trusted, its practical convenience must help to secure its general adoption. If the feeling of distrust regarding the measurement of a gas-flame by itself be once shaken, it will not be difficult to find reasons why such a principle should obtain distinct favour. The same conditions, known or unknown, which affect one flame will equally affect its fellow; and therefore, if the basis be once agreed upon, less causes of disturbance can affect the observed result than when the combustion of a gaseous material is compared with that of a solid as at present. For these and other reasons the proposed new standard promises well, and the more it is unofficially adopted and advocated during its present probationary existence, the sooner will it, if worthy, receive the stamp of legislative approval.

Mr. Foster's communication on the Chemistry of Spent Lime was a praiseworthy attempt to describe some of the properties and characteristics of a substance about which not nearly so much is known as taken for granted. Although in some measure incomplete, the paper was valuable as indicating the means by which a large saving may in many cases be effected in the consumption of lime for gas purification. Briefly stated, the gist of Mr. Foster's statements, and Mr. Harris's explanatory remarks, was that by merely spreading the lime, as it is taken from the purifiers, on a revivifying floor in the same way as oxide of iron is treated, a certain action takes place, whereby the particles of the mass become more thoroughly disintegrated than when the lime was first put into the purifiers, by which means fresh lime may be said to be caused to appear, and hence the whole may be returned to the sieves and used again. It is no chemical action that is stated as taking place under this treatment, other than may be held to cause the "unlocking of the particles" of which Mr. Harris spoke. According to this theory, it is only the outer surface of the lime particles upon which the foul gas seizes, and therefore as often as those particles can be turned inside out, fresh material is practically developed; but Mr. Harris limits his disintegrating process to one operation. Mr. Hislop, who spoke of having revived lime 150 times, works upon quite different principles. He depends entirely upon the chemical reaction which Mr. Harris specifically disclaims. The two processes are not strictly comparable, and belief in the utility of the one does not necessarily imply adherence to the other, although it may be urged on Mr. Hislop's behalf that if it is well to use a certain quantity of material twice over, it is better to use it a hundred times or more. The contention must, of course, be admitted if all other conditions are equal, for if material could be used any number of times with the same treatment as will enable it to be used twice, there could be no justification for not doing so. But when a number of fresh conditions have to be imposed, and a different procedure has to be adopted, before this extended utility can be secured, the case becomes less simple, and is resolved into a question of expediency only to be decided with reference to the circumstances of each particular instance. It may be, but we do not pretend to say it is or is not, better for Mr. Harris to use his lime twice, and for Mr. Hislop to do so very many times. Time, which tries all things, will show whether Mr. Hislop's process will or will not meet with the extended adoption which the elegance of the operation should, with otherwise favourable circumstances, secure for it. Meanwhile, Mr. Foster can do signal service by exhaustively examining the material which has already yielded him such hopeful results, in which connection we shall expect to hear something more of him in the future.

The Lancaster Gas Company will become extinct on the 1st proximo, when the Corporation will become vested with the whole of their property on terms which may be considered satisfactory to both parties. The transfer will be effected in accordance with the provisions of a Bill being promoted by the Corporation in the present session of Parliament, whereby, among other things, the purchase-money is to be made redeemable, principal and interest, in sixty-five years, instead of thirty, as stipulated in the Gas Company's Act of 1856. The cost of the acquisition to the Corporation, including the purchase of share interest, loan capital, stock, and contracts for extensions, is about £100,000; and, after deducting the annual repayments on account of this sum, it

is anticipated that there will be a surplus profit of about £1400 on the first year's working. It is to be noticed that had the undertaking remained in the possession of the Company a reduction would have been made this year in the selling price of gas. The Corporation will probably not venture on this course until they see how their purchase will meet their expectations; but it is to be hoped, in the interest of the new proprietors, as well as of the consumers, that the reduction will be granted with the least possible delay. The sum required to redeem the share capital—£80,000—has been subscribed for by the Shareholders of the Company, and Corporation stock, bearing four per cent. interest, has been issued to this amount. The financial arrangements are not quite settled, but a plenary Committee has been appointed to complete the formalities attending the transfer.

The annual report of the Dundee Gas Commission, recently presented, has given much satisfaction to the Board and also to the public. The past year's working has been more favourable than was anticipated, the reduction of threepence per thousand feet, with which the year was inaugurated, having led to an unexpected increase in consumption of over 13 million cubic feet. The reduction stated is equivalent to a remission of about £3580 on the income of the previous year; but the actual diminution in the amount of the cash balance was only about £1000, thanks to the increase of business above mentioned. The works have been in all respects well conducted. The percentage of leakage has been reduced, and the revenue from residuals has increased. Both in the financial and manufacturing departments the Commission are excellently well served by the officials who are mainly responsible for the favourable state of the gas business, and this fact was duly recognized by the Board. There can be little doubt that if the present rate of development of the Dundee undertaking continues, respecting which there can be little doubt, a further reduction in price will be made at no distant date.

The Bedford Town Council appear determined to bring the local Gas Company to book, and have appointed a Committee, who, as we are informed, have visited the gas-works, and had the gas tested in their presence, with all of which they have expressed their satisfaction. There is, however, no agreement between the Council and the Company respecting the method by which the gas shall be tested, and there is also some dispute as to the accounts which the Company are required to furnish. The two contending parties, in fact, do not stand on the same ground. The Council wish to impose the provisions of the Gas-Works Clauses Act of 1871 upon the Company, who, in turn, contend that they must regulate their proceedings only in accordance with their own private and prior Act of Parliament. There was something not altogether satisfactory to the Committee in the testing for illuminating power, which could only have been for the reason just indicated, in respect of the means employed, as they formally recorded their satisfaction with the results obtained. But we would suggest that a "scratch" Committee of a representative body are not properly qualified to judge such a matter as this, which should be confided to professional hands. The unsatisfactory nature of the proceedings in this case is very evident. The Committee first reported that they were satisfied with the result of a test which they afterwards denounced as improperly conducted. After this, the best course the Council can pursue, is to make up their minds as to the mode in which the tests for illuminating power are to be made, and then confide the whole matter to some one who is duly qualified to give a report upon the subject. They will then, at least, know what they are doing, and both sides will have the advantage of dealing with facts instead of with merely ideas and suspicions as at present.

The programme of the forthcoming Glasgow Exhibition of Apparatus illustrative of Artificial Lighting indicates that the intention of the Committee concerned with making the necessary arrangements is that the affair shall surpass anything of the kind that has ever been held. There is a wide range of subjects stated in the prospectus as eligible for illustration, commencing with Coal Gas, in its manufacture, treatment, and use, including all the residual products, and terminating with miners safety-lamps, and gas-lighted buoys; Electricity, Oils, Oil Gases, Candles, Hydraulic Appliances, Ventilation, and Architecture; in fact, everything that can be construed into connection with the production and utilization of light or heat will find place in this most comprehensive show, which may be characterized as a praiseworthy attempt to enable the public to take a bird's-eye view of the whole scope of the utility of gas, showing at the same time how it is best made and used, and the nature and qualifications of all those methods of illumination which can be described as its

rivals. This last is one of the most useful, as it promises to be a most interesting feature of the exhibition. The advocates of gas lighting have nothing to fear, something to learn, and much to gain by seeing the utmost efforts of their rivals displayed side by side with their own productions, and the benefits of such free competition may well be shared by all. The exhibition will be open from Tuesday, the 28th of September, to Monday, the 25th of October next, and we may expect to see some brilliant effects produced in the hall by the aid of the twenty-six candle Glasgow gas, which will be supplied gratis by the Corporation. Electric lamps may sputter and flicker, and modest dips may plead for notice there; but it will be an eternal disgrace to our gas-burner and lamp manufacturers if they do not carry all before them in the estimation of the public, with such good material as they will have at their disposal.

The report which we publish to-day of proceedings before the Edmonton magistrates against Mr. Brickwell, the Chairman of the Tottenham and Edmonton Gas Company, will be read with surprise and pain by many of our readers. Mr. Brickwell has been honourably connected with Gas Companies for many years, and the very circumstance upon which the present charge against him is founded illustrates the active character of the service he has rendered. For years he acted as the Manager rather than as a Director of the Tottenham Company, and a supply of gas was granted to him, according to the evidence of the Secretary of the Company, as a recognition of the special character of his services to it. For ourselves, we dislike the system of perquisites and extras in all cases, and this prosecution will doubtless do much to discourage them; at the same time, we cannot but express our sympathy with Mr. Brickwell, and our regret that, in the face of such avowals as were elicited from the prosecutors, the Bench should have felt it necessary to remit the charge for the judgment of a jury; especially as the Chairman admitted that they entertained grave doubts as to the propriety of such a course.

The Committee of the West of Scotland Gas Managers Association have deserved well of their professional brethren by their examination and report upon Mr. G. R. Hislop's process of lime revivification, details of which will be found in another column. Something was heard of this process at the recent meeting of the British Association of Gas Managers, as we have elsewhere remarked. We commend the figures of Dr. Wallace's analysis to the earnest attention of our readers, as it appears from them that the chief difference between fresh lime and lime after the hundredth restoration, is that the original 77·82 per cent. of hydrate of lime is reduced to 69·73 per cent., the remaining inert constituents, such as sulphate of lime, silica, and alumina, being correspondingly increased. Thus the revived article is very little inferior to the original substance as regards purifying power, and as the revivification costs only about 9s. 6d. per ton, including all labour to prepare it for the purifiers, it is evident that wherever lime is dear, Mr. Hislop's process offers means for effecting a great economy.

The nineteenth annual general meeting of the members of the North British Association of Gas Managers will be held at Perth on the 8th and 9th of next month, under the presidency of James Robb, Esq., when a full programme of papers will be read and discussed, some of which promise to be of much interest. Our brethren of North Britain support their Associations well, and seldom fail to provide good mental entertainment at their gatherings.

Mr. Field is so well known as the Grand Inquisitor of Metropolitan Gas Companies affairs, and his annual Analysis of their accounts is of such acknowledged usefulness, that we need do no more in this place than call attention to the fact that another of these yearly statements has been issued. The number of Mr. Field's entries is becoming smaller as the process of amalgamation goes on. In last year's accounts the affairs of the Surrey-side Companies are shown in their transition state—first independently, and again as amalgamated; the total number of the accounts between which Mr. Field draws comparison being, therefore, seven, which in another year will be reduced to four. Sufficient will, however, then remain to furnish grounds for instructive comparative criticism. The business of all the Companies included in the returns is progressing satisfactorily; no better proof as to which need be looked for than the steady diminution observable during the past five years, in all cases, in the amount of capital employed per 1000 cubic feet of gas sold. Thus, to take the highest first, The Gaslight and Coke Company in 1875 had 18s. 1d. of capital per 1000 feet, which in 1879 was reduced to 15s. 11d.; while the South Metropolitan

Company, being the lowest, employed 10s. 5d. of capital per 1000 feet in the former year, reducing to 9s. 11d. during last year. The great difference between the circumstances of these two Companies is readily explicable by their history, and therefore, as long as they remain distinct representatives of widely different original conditions, the opportunity for observing the most striking contrast in the circumstances of the Metropolitan Gas Supply will still exist.

Water and Sanitary Notes.

THE Select Committee appointed by the House of Commons to investigate the subject of the London Water Supply continued the examination of Mr. E. J. Smith, the Government valuer, on Tuesday and Friday last. On Tuesday, the Chairman, Sir W. Harcourt, completed his queries, and some few questions were asked by members of the Committee. On Friday, Mr. Michael, Q.C., commenced to examine the witness on behalf of the Corporation of the City of London, and was followed by Mr. Philbrick, Q.C., the leading Counsel for the Metropolitan Board of Works. On Tuesday, Mr. Smith adverted at some length to the amount of purchase-money given in the cases of the Stockton and Middlesbrough and the Birmingham Water-Works purchases. At this stage an important avowal was made by the Chairman, as follows:—"I venture to say this Committee will not decide this case upon what was given in the Middlesbrough case; that I think I can confidently state. We are ourselves arbitrators upon this very case, and we imagine ourselves competent to judge upon the merits of it." Further on, Sir W. Harcourt observed, with regard to the Middlesbrough arbitration, "My impression, and I may be right or wrong, is that that was a very extravagant award." Mr. Michael interposed with an explanation that the Middlesbrough award was the only instance of an arbitration for the purchase of a Water Company, the Birmingham purchase having been "settled between the parties."

A statement handed in by Mr. Smith showed that whereas, in negotiating for the purchase of the Metropolitan Water-Works, he had allowed £3,443,540 for back dividends, it was possible for the Companies to make payments of this kind to their Shareholders to the extent of £19,882,463. Of this "possible" sum, £15,000,000 occurred in respect to the New River Company, while the East London Company figured for £1,250,000, and the Kent Company for £1,000,000. These were the highest, the lowest "possible" being that of the Grand Junction Company, amounting to £381,788. For the East London, as well as the Chelsea and the Lambeth Companies, Mr. Smith had not allowed anything in the shape of back dividends. For the New River Company he had allowed £2,141,540, and for the Kent Company £474,000. These statements had reference to the ordinary capital, amounting to £9,034,728, of which a sum of £2,019,958 appertains to the New River Company. The Chairman questioned the witness closely with regard to this statement. "You say," inquired Sir William, "that the Companies might go on making over and above 10 per cent., until they had liquidated a sum amounting to the figure which you have named, before they reduced the water-rents?" "Yes, that is so," replied Mr. Smith.

A question over which there was, for a time, some little confusion of words, had reference to the debt of the Companies. The immediate payment, in the form of water stock bearing three and a half per cent., is £22,098,700. Future payments, also in water stock, are discounted at £6,851,300. Thus there is a total of £28,950,000. But the Companies are in debt to the extent of £3,284,555, as represented by preference capital, debentures, mortgages, and bonds. The Chairman inquired whether this debt was to be added to the previous amount. Mr. Smith explained that there was on occasion to convert the debt into stock. The interest, amounting to £144,000 a year, was already provided for in the income. Mr. Chamberlain put the question thus: "The position would be this, would it not, that the Water Trust, in order that they might obtain the full possession of the property unencumbered by any debts, would have to pay £3,284,555, in addition to the £28,950,000 that is stated here, and in the meantime they would pay the interest?" To this explicit question Mr. Smith replied in the affirmative, Mr. Pemberton assisting by the interrogation: "Still, in the meantime, the interest is provided for out of the income?" to which Mr. Smith also assented. In defending his preference for a purchase by agreement instead of attempting it by compulsion, Mr. Smith remarked that the latter process would take considerable time, which was itself

a matter of importance as affecting the final cost. "The income of the Companies divisible amongst the Shareholders," said the witness, "is increasing at the rate of about £100 a day; the fee is about £3000 a day; the cost, at 3½ per cent. on the stock, is increasing at the pace of about £3000 a day." Another point consisted in a statement handed in by Mr. Smith, showing that the transfer of the water-works would provide for a saving of £172,000 a year. Of this amount £23,000 had reference to engine charges, and £5000 to engineers. Supposing the Southwark Company to be dispensed with, and their land to be sold, Mr. Smith computed that a capital sum of about £500,000 would thus be obtained. In the case of other Companies there would also be some gain of this description.

A paper handed in to the Committee by Sir John Lambert shows the statutory powers of the Metropolitan Water Companies in respect to dividends. It is not quite clear that the conclusions arrived at are beyond dispute, but we may say that they are probably correct. Some technical difficulties present themselves, owing to the indefinite character of the legislation in certain cases. Ten per cent. is the maximum in regard to all the Companies, and portions of the capital bear a lesser rate. The power of paying back dividends is set forth in Mr. Smith's evidence, and he appears to have had good information at his disposal for the purpose of ascertaining the truth.

In the examination to which Mr. Smith was subjected on Friday, Mr. Michael endeavoured to extract from the witness such admissions as would show that due care had not been taken in estimating the value of the undertakings. In reply to Mr. Philbrick, it was acknowledged that the price agreed upon with the Southwark and Vauxhall Company was more than should have been adopted had the Company stood alone. But Mr. Smith sought to buy up eight Companies as cheaply as he could, and the Southwark Company came last. To secure this Company was to complete the transaction, which otherwise would have fallen through. So far Mr. Smith appeared in his dealings with the Southwark Company to justify the satirical remark of Sir W. Harcourt, "Last come best served."

At the close of Friday's proceedings a discussion took place with respect to the state of the Companies works. Mr. Philbrick proposed that Sir Joseph Bazalgette and Mr. Bramwell should be allowed to see the pumping-stations of the Companies. An application had been made for this purpose, and the Solicitors to the associated Companies had responded by saying that they would immediately comply with any directions which the Committee might see fit to give. Mr. Pope, Q.C., told the Committee that the Companies could not concede the right of the Metropolitan Board, as such, "to send engineers or anybody else," but whoever was sent by the Committee would be welcome. The Chairman, however, did not see that the Committee could give instructions of this kind, and went on to say: "I have always felt it a very weak part of this case that there has never been an engineering examination of the works of the Companies. I do not think I am doing Colonel Bolton injustice in saying that he is not a professional engineer. Therefore, these purchases have been made without any professional investigation of the state of the works. That is a defective part of the case." Whether the Committee are really in the dilemma described by Sir W. Harcourt is perhaps a point not yet demonstrated.

At the half-yearly meeting of the Chelsea Water-Works Company on Thursday last, the Chairman—Mr. John Deedes—called attention to some very satisfactory features in the progress of the Company. There was an increase in the revenue, and a decrease in the charges for maintenance and management. Considerable economy in the supply had also been effected, a result which the Directors attributed to the successful working of the staff of waste inspectors. The balance-sheet showed a water-rental for the half year of £49,141, and the dividend declared was at the rate of six and a half per cent. per annum. The absence of complaint on the part of the consumers, as to the quantity and quality of the water supplied to them, was mentioned in the report as a matter for congratulation, as also the progressive increase of the Company's income.

The accounts of the Oldham Corporation Water-Works show an expenditure of £56,170 on the capital account during the year ending March last, making the total £664,899. The water-rental for the year, including meter hire, was £33,011. Water-rents for domestic purposes had risen £160, but there was a decrease to the extent of £278 where the water was supplied by meter for trade purposes. On the whole, therefore, a slight decline was apparent.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

BRITISH ASSOCIATION OF GAS MANAGERS.

SIR,—At the recent meeting of the British Association of Gas Managers, and during the reading of the excellent paper by Mr. J. Somerville on Mr. Livesey's compensating chamber or apparatus for preventing the oscillation caused by the exhauster,* I felt a strong desire to call attention to the value of such a chamber in which to treat the gas with ammonia at this early stage of its manufacture, and so prevent many of the complex combinations of impure gases that cause so much trouble and expense to remove later on, when the gas is cold. Practical experiments on the use of ammonia as a purifying agent, when the coal gas is both hot and cold, warrant me in saying that if Mr. Livesey can introduce with the gas flowing in at the inlet of the said chamber a spray of liquid ammonia, by means of a jet of steam, he will find that this alkaline reaction will cause a precipitation of tarry matters, and an absorption of carbonic acid and sulphuretted hydrogen and other impurities, to at least 50 per cent. of the total volume of impurities present in the coal gas. There will also be a gain in illuminating power with a reduction of the sulphur compounds to a minimum, and a total prevention of naphthalene deposits.

The results obtained by an experiment of the kind I have intimated will well repay the small amount of trouble to carry it out.

Gas-Works, Lewes, June 12, 1880.

JOHN HAMMOND.

SIR,—If your correspondent, "Forward," refers to the JOURNAL, Aug. 25, 1863, he will find that my idea was to form an association of gas engineers, as in the following words:—"A British Association of Gas Engineers will not lack supporters." I lay no claim to prophetic power, therefore I may now say these words appear to have cast their shadow before.

The quotation will be found to be in italics in the original.

South Shields, June 25, 1880.

W. J. WARNER.

SIR,—In your issue of the 22nd inst., Mr. G. Livesey, when discussing the paper read by Mr. G. E. Stevenson, of Peterborough, on Statistics of Working Results, is reported to have said that a friend had told him of a real case where a manager of gas-works made 11,700 feet of gas per ton of coal, and sold nearly 11,000 feet, and that he used for fuel nearly 35 per cent. of the coke made, the result being that the retorts were burnt out in an incredibly short space of time, that a very large percentage of rich cannel was used, and the gas supplied to the consumers was cut down to the lowest point in quality. In the first three points, Mr. Livesey is very definite in his statement—namely, the gas made, sold, and fuel used; but in the last three—namely, incredibly short space of time, very large percentage of cannel, and the gas cut down in quality to the lowest point—he is very indefinite. Now, Sir, I should like to know what duration of time, in reference to gas-retorts in use, Mr. Livesey considers *incredibly short*—whether it is weeks, months, or years; what, in his opinion, constitutes a *very large percentage* of cannel; and when *gas reaches its lowest point in quality*. Mr. Livesey may not consider it of the least importance to be particular in these details; but when statements like the above are made before an assembly such as met at 25, Great George Street, I think the utmost minuteness of facts should be recorded.

But, even if the case Mr. Livesey brought forward is absolutely correct in all its points, that is no reason why other gas managers, making over 11,000 feet of gas per ton of coal, should incur the same chapter of horrors, which is quite unnecessary; as, for instance, I know of a gas-works where the make is 11,400 feet per ton, the quantity of coke used for fuel is a little over 25 per cent. of that made; the consumption of cannel, 3½ per cent.; and the gas supplied to the public, as recorded by the public gas examiner, is from 1 to 2 candles above the standard required by the Act of Parliament. At this present time they are replacing four beds of retorts, that have been in use for three years; and I believe they have not as yet found they are paying "too dear for their whistle." I do not know the size of the works referred to by Mr. Livesey; but I can tell him of one very small concern which uses about 4000 tons of coal a year, with a capital of nearly £30,000, the manager of which makes 10,600 feet per ton; and although his district is a very wide and straggling one, and with all the difficulties which the managers of small gas-works have to encounter, he has always paid his 10 per cent. dividend.

June 25, 1880.

R. W.

MR. HARTLEY'S CRITIQUE OF MR. NIVEN'S PAPER ON CORRECTIONS FOR TEMPERATURE AND PRESSURE.

SIR,—In my paper on Barometric and Thermometric Calculations, I took a passing notice of the "Manuals" of Messrs. Wright and Hartley, not for the purpose of finding fault, but that there might be an occasion for explanation. The reply of Mr. Hartley, in your issue of the 8th inst., has attained the object I had in view. I feel obliged to him for the high praise he has given me in saying that I understand the subject well, and that he admires the ingenuity of my paper. Such statements are of great value, for they are from one of our most eminent scientific photometrists, and whose text-books are deservedly of authority and weight in all matters pertaining to photometry. I may here state that whatever credit is due to the paper, not a little of it belongs to Mr. G. R. Hislop, F.C.S., F.R.S.S.A., of Paisley, one of the first coal analysts of the day, as I had the good fortune to be beside him, and he has been always ready to contribute to my little stock of knowledge. I, however, having written the paper the night before the meeting, had no opportunity of showing it to any one for criticism, and, under the circumstances, I thought I would take no counsel in entering into this controversy, and thus facing the giant alone.

Mr. Hartley was apparently somewhat puzzled at the strangeness of some of my expressions—such as the term "factor 480," instead of the

term "coefficient 480." Now, I freely state that every coefficient is a factor, and, as logicians would say, the converse is not always true; but in this case I know that the context would determine clearly the meaning, and, therefore, to avoid repeating technicalities, I used the term "factor." In regard to the coefficient 480 in the formula for temperature, upon which was based the table of Mr. Wright, Mr. Hartley says that it was then accepted as correct. Granted; but the "Manual" I have published under the editorship of Mr. Hartley himself in 1862, that is, five years after the publication of Bunsen's "Gasometry" in English, by Roscoe, which had the correct coefficient as finally fixed by Regnault; and it is at least considered part of the duty of an editor of a work to correct misstatements of fact or principle, and, therefore, there is an apparent omission of duty by Mr. Hartley in not showing in a note the progress of chemical physics in the doctrine of the expansion of gases. But possibly Mr. Hartley might say that it was of so little practical importance that he did not think it necessary. To illustrate what I mean, I quote his own words:—"Taking extremes, 28 inches and 31 inches Bar., and 32° and 84° Ther., the numbers in Mr. Wright's table are 988 and 987; while in the new table they are 998 and 967;" and, "in correcting for volume, where illuminating power is concerned," the difference would be thus: Suppose the illuminating power to be 17.5 candles, then

(1) Mr. Wright's table would be 17.71 candles.
The new table would be 17.53 "

Difference 0.18 candle.

Supposing we continue Mr. Hartley's calculations in the other case:

(2) Mr. Wright's table would be 17.73 candles.
The new table would be 18.09 "

Difference 0.36 candle.

Let us continue the same calculations to 30-candle gas; then

(1) Mr. Wright's table would be 30.36 candles.
The new table would be 30.06 "

Difference 0.30 candle.

(2) Mr. Wright's table would be 30.39 candles.
The new table would be 31.02 "

Difference 0.63 candle.

Now, if it be true that our coal and gas analysts publish their illuminating results to the hundredth part of a candle—and I submit that, in practice, they do—then the foregoing calculations prove that the difference of the tables is of some practical importance, both in regard to illuminating power and the volume, and that it is high time that one of them became obsolete. It becomes a parody on arithmetical form and accuracy to state candle power in parts of 100, while the operator knows well that it is a formal falsehood. I think it is mere waste of time to endeavour to frame an apologetic excuse for such tables, for they have served their day, and the knell of their dissolution is tolled.

In regard to Mr. Hartley's "Manual"—and I would here advise all managers to get it—I said that there were apparent mistakes in his tables, for it was difficult to conceive of an intermittent factor. I find, however, in reconsidering the matter, that the tension of aqueous vapour has an intermittent factor. Of course, on this point my reasoning was hypothetical rather than categorical; but Mr. Hartley has given a formula by which he says his tables have been re-calculated. Thus: $N = 17.64 (h - A) \div 460 + t$. (Explanation: h = height of barometer in inches; t = temperature in degrees Fahr.; A = tension of aqueous vapour at t °.)

It will be observed that the above formula is in a final form. The process, I presume, by which he arrived at such a result was as follows:—Gas at 30 in. Bar. and 60° Ther. is said to have its volume at unity. Now the standard thermometric temperature may be expressed thus:

$$\frac{460 + t^{60}}{492 + 28} = \frac{460 + 60}{520} = 1$$

The standard barometric pressure thus:

$$\frac{30 - .5178}{h - A} = \frac{29.4822}{30 - .5178} = 1$$

But unity multiplied by unity is unity ($1 \times 1 = 1$); wherefore—

$$\frac{460 + t}{492 + 28} \times \frac{30 - .5178}{h - A} = \frac{460 + t}{17.64 (h - A)} = 1 \therefore \frac{17.64 (h - A)}{460 + t} = 1$$

(Explanation: The decimal .5178 is the tension of aqueous vapour at 60° Ther.; but aqueous vapour acts according to Boyle's law; therefore it is deducted from h —that is, the height of the barometer; and as t , h , and A vary, so is the number unity or parts of unity.) Try this formula, and it will be found the key to Mr. Hartley's tables; but Mr. Hartley's formula is impossible, for it will be noticed that his degrees of temperature are multiplied into 460, and I am unaware of any fact or principle in chemical physics that should empower him to do such a thing. Not only so, but his formula could not be the basis of the re-calculations of his tables, or else it certainly requires an explanation. I am taking for granted that no printer's devil has been poking fun with the formula, for in purchasing the "Manual" I had with it a slip containing the *errata*, and there was nothing about the formula. If, after all, I am correct when I say the formula is incorrect, whatever be the reason for it, then, to quote the figure of speech of Mr. Hartley, my straining at the gnats of small errors has prevented me from swallowing the camel of a graver one.

I believe that it would be a great boon to the gas world if Mr. Hartley would kindly publish in pamphlet form, for easy reference, his "Appendix" of rules under the head of "Photometry," and his "Table C;" for not only would doubts then be allayed, but also uniform results in calculation attained.

I hope my remarks have shown nothing but what I feel, and that is the highest respect for Mr. Hartley.

Gas-Works, Dunoon, June 13, 1880.

D. COATS NIVEN.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, JUNE 21.

GAS AND WATER ORDERS CONFIRMATION BILL.—This Bill, brought from the Commons, was read the first time, and referred to the Examiners.

FRIDAY, JUNE 25.

LOCAL GOVERNMENT (GAS) PROVISIONAL ORDER BILL.—This Bill was read a second time, and committed.

HOUSE OF COMMONS.

MONDAY, JUNE 21.

A petition against alterations in the Liverpool Corporation Water Bill was presented from Warrington Water-Works Company; while the following petitions against the Bill were withdrawn:—(1) Great Western Railway Company, (2) Midland Railway Company, (3) Sharpness New Docks and Gloucester and Birmingham Navigation Company, (4) Staffordshire and Worcestershire Canal Navigation, (5) Lord Harlech. The petitions of (1) Henry Savile and (2) Corporation of Halifax, against the Wakefield Corporation Water Bill (Lords) were also withdrawn.

WEDNESDAY, JUNE 23.

The petition of the Trustees of the River Weaver Navigation against the Liverpool Corporation Water Bill was withdrawn.

Mr. DANIEL GRANT gave notice that, on Thursday next, he will ask the First Commissioner of Works whether he will take into his consideration the advisability of substituting the electric light for the purpose of illuminating the House in place of the gas as now used in the roof.

FRIDAY, JUNE 25.

The petition of the Commissioners of the Severn Fishery District against the Liverpool Corporation Water Bill was withdrawn.

THE LOWER THAMES VALLEY DRAINAGE.

On the motion of Lord GEORGE HAMILTON, an address was agreed to for "returns of the various applications made to the Secretary of State for the Home Department, or to the Local Government Board, for draining any urban or rural sanitary districts within the district of the Lower Thames Valley Main Sewerage Board in respect of which inquiries have been held by the Inspectors of the Home Office or of the Local Government Board during the last 14 years, with the results of these applications; and of the expenses incurred, so far as they can be ascertained, in respect of each application by the local authorities, and paid by them."

HOUSE OF COMMONS COMMITTEE.

FRIDAY, JUNE 11.

(Before Lord EUSTACE CECIL, Chairman; Mr. W. C. CARTWRIGHT, Mr. BRODBICK, and Mr. GRAFTON.)

HYDE GAS BILL.

Mr. MICHAEL, Q.C., and Mr. L. M. ASPLAND appeared for the promoters; Mr. POPE, Q.C., and Mr. BALFOUR BROWNE for the Hyde Local Board, petitioners against the Bill.

Mr. MICHAEL, in opening the case, said the Bill was a very ordinary one, its object being to decrease the price of gas, and to purchase a small plot of ground about 4 acres in extent. The Company supplied a district having many manufactories in it, and the increase of business would be observed from the fact that the quantity of gas supplied in 1867 was 13,151,000 feet, which had been increased fivefold, for last year the amount was 69,676,000 feet. In 1867 the Company had 2550 consumers, and last year 4559. The Company was established by persons living in the neighbourhood, for the purpose of supplying themselves with gas, and the persons who represented the Company were in reality the largest consumers of gas in the district. The capital authorized by the old Act was £25,000, and, in accordance with the provisions of the Gas-Works Clauses Act, 1847, the Shareholders were entitled to a dividend of 10 per cent. They had also had additional powers given to them to raise £11,000; but, in accordance with modern legislation, the dividend on that capital was limited to 7½ per cent., and there were further borrowing powers amounting to £9000. The maximum price authorized was 6s. per 1000 feet, but the price charged was very much below this amount. The town and district numbered about 40,000 inhabitants, having doubled itself in about 20 years. The existing gas-works stood on about 2 acres of ground, but there was not enough room for storage at this spot. The proposed works, covering an area of 4 acres, would be most convenient for the reception of raw materials, and for carrying away the residual products. The present storage room was only 250,000 cubic feet, whereas the maximum daily supply was nearly half a million feet, and the storage should be as nearly as possible equal to the supply. The Bill proposed that the maximum price should be reduced from 6s. to 5s. 6d. per 1000 feet. The price, however, actually charged to small consumers was 4s. 2d.—or 4s. 6d. in the outlying districts—with a discount of 5d., which reduced the price to 3s. 9d. and 4s. The number of lamps lighted by the Company was 466. There were 29 miles of mains, which only earned a rental of £395 per mile, whereas in other towns close by the gas-mains earned £700 per mile; and in London as much as £7000 was earned. The amount of capital applied for by the present Bill was £56,000, with the usual borrowing powers of £14,000. The petitioners were composed of members of the Local Board and some gas consumers of the district. The learned Counsel then commented on the petitions against the Bill, and concluded by stating that the evidence would show that the proposed works, which could not, by law, create a nuisance, would be in a place where nuisances were gathered together, and the Committee would judge whether there was any likelihood of a fresh nuisance being created there. As to the capital, the proposed amount would only cover the increased requirements of the district for a certain time, and the power of dealing in heating apparatus would be a great boon to consumers. The whole gist of the petition of the Local Board was in the clause asking that the Company should be required to sell their undertaking to the petitioners, either by agreement or on such terms as should be settled by arbitration; but this was a thing that had never before been done. It was, therefore, on the whole, contended that there was good ground why the prayer of the promoters should be granted.

The following evidence was then called:—

Mr. John Cheetham, examined by Mr. ASPLAND.

I have been a Director of the Hyde Gas Company since May, 1864, and am now Vice-Chairman. The land we propose to purchase is near the existing site of the works, but on the opposite side of the canal. Myself and the other Directors feel confident it is the most advantageous we could choose. I have never perceived any nuisance from the gas-works, nor heard of any complaint from the neighbours. The proposed site is surrounded by boiler and chemical works, factories, brickfields, &c. The Act of the Company was obtained in 1855, the original capital being £25,000,

which has been increased by £11,000, making £36,000. There was also power to borrow £9000, which has been exercised, and of this amount £9990 has recently been converted into share capital under the provisions of the Companies Clauses Consolidation Act, 1845. The district is very straggling, and in many cases we have to carry our pipes for a considerable distance without a customer. Before the Company obtained their Act, gas was supplied by various private manufacturers; but since 1855 the Company have done their best to provide for the wants of the locality, and have given satisfaction to the consumers. There are at present, I think, only two manufacturers who make their own gas.

Cross-examined by Mr. Brooks (Solicitor, in the absence of Counsel): Previous to 1855 a few of the public lamps were supplied by a Mr. Booth, but his were very small works. I am aware that a petition has been signed against the proposed site, but I have not seen it. There is a place of recreation, called the Gentlemen's Club, within a short distance, but I do not know that the members, as a body, object to the site. The conversion of the borrowed money into capital was decided upon on the recommendation of Mr. Newbigging. The reason for such a course being taken was that there had been a small treaty with the Local Board for the purchase of the works, and we thought it would be better for the Shareholders. The last dividend we declared was 10 per cent. on the original capital of £25,000; $7\frac{1}{2}$ per cent. on £11,000; and 5 per cent. on the original shares towards arrears of interest. We could have divided more last year, but we did not like to divide every penny.

Re-examined by Mr. MICHAEL: For a great number of years we paid a very much smaller sum than we were entitled to receive.

Mr. Thomas Newbigging, examined by Mr. MICHAEL.

I am a Gas Engineer, and an adviser of gas companies and local authorities owning gas-works. I have made myself acquainted with the clauses of the Bill before the Committee, and have also perused the petition of the Local Board. I have known the town of Hyde for about 20 years, during which time the population has doubled itself, and at present it is close upon 40,000. The particular trade of the district is cotton manufacture, but there are also hat manufactories, iron foundries, and chemical works. The present site is a most excellent one, but it is too small. I never saw gas-works better managed; the entire absence of nuisance is something remarkable. The area is about two acres, which is not large enough to meet the requirements of the district, and even at the present time they are very much in want of storage room. The new site is about 4 acres in extent. It is immediately adjacent to the old site, and, if anything, is better situated, because a siding could be carried into the works for the purpose of delivering coal; so that, in addition to the canal facilities, the Company will be able to receive their coal by rail, and there will be no carting of the coal through the town. The quantity of gas produced last year was close upon 70 million cubic feet, and the consumption usually doubles itself in about nine years. The Company have two holders upon the site, and they are capable of storing a quarter of a million cubic feet. In manufacturing districts such as this we invariably stipulate for storage for one day's make, which would be half a million. The bulk of the winter consumption takes place between the hours of half-past three and seven o'clock, and therefore it is necessary to have a considerable supply of gas ready at half-past three, in order to carry the consumers through the busy working hours till seven o'clock. There is always danger that the supply of gas will be cut off if the storage is not sufficient; and experience has proved that it is absolutely necessary, particularly in Lancashire, that we should have one day's storage for one day's make. On the present site the manufacturing power could be increased, but not the storage. I think the quantity of land proposed to be taken is reasonable, considering the rapid rate at which the manufacture grows. The level of the new site is somewhat above the old one; in one place not more than 7 or 8 feet, but on an average 15 feet, which will be rather an advantage, because the gas will be manufactured at the old works and then sent up to the holder. We have already a 10-inch main under the canal, and there would be no difficulty in laying down others, but this would not be necessary at present. It is not intended that the new works shall all be made immediately; extensions will be made as required. There will not be any manufacturing on the new site probably for four or five years. Of course, it is not always desirable to have gas-works immediately adjoining one's property, but such things cannot always be regulated, and certainly the district is not a residential one by any means. I believe that about three-fifths of the petitioners against the Bill already live within 300 yards of the boundary of the old site, and I have never heard any complaints of nuisance. I recommended the Company to convert their loan into share capital, as that would be an advantage to the Shareholders, who bought their shares with that contingency. It is not an exceptional thing to be done, and I think the Directors would have neglected a very evident duty if they had not taken my advice. I do not think a graduated scale of charges for gas to be objectionable, provided it is a reasonable one. Small consumers are charged 4s. 2d., with a reduction of 5d. for prompt payment, bringing it to 3s. 9d. Larger consumers are charged, when the quarterly consumption is less than 200,000 cubic feet, 3s. 9d.; 200,000 and under 300,000, 3s. 7d.; under 400,000, 3s. 5d.; under 500,000, 3s. 3d.; under 1 million, 3s. 2d.; from 1 to 2 millions, 3s. 1d.; 2 millions and upwards, 3s. The Local Board are charged at almost the lowest rate—viz., 3s. 1d.—although theirs is a very small consumption, comparatively speaking, for the public lamps. I think the maximum price of 5s. 6d. proposed by the Bill is a reasonable one, because coal and iron fluctuate in price, and it is necessary there should be a reasonable margin fixed, so that in case of a coal famine, or anything of that kind, the price might be able to be increased. At the present time those articles are lower than they have ever been within my experience. The Company have 40 miles of mains, producing a rental of £346 per mile, which is very little. The population per mile of main is only 1300, while it is usually 2000 in small provincial towns. At Haslingden the maximum price is 5s. 9d., and the illuminating power is fixed at 12 candles; Heywood, 6s. 6d. and 14 candles; Atherton, 6s. and 14 candles; Westleigh, 6s. and 14 candles; Widnes (which is a larger town considerably) and Padiham, near Burnley, the same; and Radcliffe and Pilkington, 5s. 6d. and 14 candles. The amount of share capital asked for in the present Bill is £56,000, which is a very moderate amount, taking into consideration the rapid growth of the Company's business. I estimate that this capital will last for 14 years. Before the auction clauses were introduced it was usual to obtain sufficient capital to last for about 10 years, but since the introduction of those clauses the time has been extended in almost every case. Within a short time a gasholder will have to be erected, at an expenditure of about £6000. A number of new mains will also require to be laid, and some of the old ones replaced, and this will cost £2250. New offices are required and a dwelling-house for the Manager, at a cost of probably £2500. Then there will be the expenses connected with this Bill, bringing the total up to about £15,000, or at least £13,000. In the course of twelve months or so it would also be advisable to make preparation for extending the manufacturing plant. It is quite evident that the Company have been exceedingly careful in expending their capital, because the amount per million feet is lower than the average over the country, which is £700 or £800 per mile of Main, while in the present case it works out to a little over £600, and there is no better

test of the economical working of a company. The quality of the gas is regulated by the Gas-Works Clauses Act, 1871, and it has to be absolutely free from sulphuretted hydrogen. I think an illuminating power of 14 candles is a reasonable one for the district, which means practically 15 $\frac{1}{2}$ or 16 candles. With respect to the clause to be inserted for the hire and sale of stoves and other things, I think it is to the public interest that it should be inserted, and it has been usual in the last few sessions of Parliament for such a course to be adopted.

[The cross-examination of this witness was postponed.]

Mr. John Aleock, examined by Mr. ASPLAND.

I am a Director of the Hyde Gas Company, and a member of the firm of Ashton, Brothers, and Co., whose consumption of gas is more than one-fourteenth part of the whole of that manufactured by the Company; the quantity last year being 5,281,000 cubic feet. We formerly manufactured our own gas, but gave it up. In my opinion the land proposed to be taken is the most suitable that could be obtained. There was an idea at one time of purchasing some land adjoining the present works, but this was abandoned, because the ground was at an inconvenient level, requiring a retaining wall to support the premises. It was very narrow and confined, and also had a price per yard which would have brought the annual payment to nearly the same as a larger and more convenient plot. It would not have adjoined the railway nor yet the canal. I do not think the proposed site is likely to be used for residential purposes by persons who inhabit houses of an expensive character. The Local Board, who are opposing the Bill, were in treaty for the purchase of the undertaking, but the negotiations have fallen through. The Board have a considerable site which they have been compelled to purchase for sewage purposes. I have not heard anything authentic about a suggestion that part of it might be used for extending the works, but it would be exceedingly unsuitable and very costly. It is also very much farther from the railway and the canal.

Cross-examined by Mr. POPE: We do not propose to charge the maximum price mentioned in the Bill. We only ask for power to do so if it requires an increase to get our parliamentary dividends.

Mr. William Smith, examined by Mr. ASPLAND.

I am Secretary and Manager of the Company, having been appointed to the former office in 1863, and to the latter in 1879. During the last 28 years the population of the town has about doubled. I have prepared a statement showing in each year from 1863 to 1879 the number of consumers and the quantity of gas made and sold, and the percentage of loss. The statement shows that there were nearly 70 million cubic feet of gas produced last year. When I became Manager the price was 5s., but in June, 1864, it was reduced 6d. per 1000 feet, and in June, 1871, there was a further reduction of 6d. We have found practical inconvenience from our limited storage capacity, and no increase can be provided upon the present site. Mr. Newbigging and I went round the district, and we came to the conclusion that the proposed site was the only one suitable for the purpose, taking into consideration the railway siding, and all other matters. The general level of Hyde is higher than either the old or the new site. I do not consider the erection of the works would practically injure the neighbourhood at all.

Cross-examined by Mr. BALFOUR BROWNE: A portion of the site is considered one of the best districts about Hyde, and it is not usual in constructing gas-works to choose the best districts. We consulted Mr. Stevenson after we had chosen the site, and asked him to approve of it. Our present works are conveniently situated as regards the canal, but the collieries we are having coal from now are not connected with the canal. We get our supply from Barnsley, because it makes a good saleable coke. It would take about five minutes, walking fast, to go from the existing works round by the bridge to the proposed site. Our present holders are too small for telescoping; we should have them blown to the ground, because they are 30 feet deep at present, single lift. We were advised by Mr. Stevenson that we could not erect another holder on our present land. The site we have chosen belongs to Mrs. Hyde Clarke, and the arrangement, made with her is that, if we do not obtain our Bill this session, the agreement will be void. The last two years have been exceptional ones, trade having been very bad; but the increase during that time amounted to 4 millions. In 1878 we made 70 millions, and in 1879 we only made 69 millions, but that was owing to the bad cotton trade, one mill having stopped altogether. Our gas is tested by the Sugg-Letheby photometer, but the record of the tests is not here. We also test for sulphuretted hydrogen, but I did not think the test books would be required. When we turned our loan capital of £9000 into share capital we were paying 4 $\frac{1}{2}$ per cent. upon the former, but now intend to distribute 7 $\frac{1}{2}$ per cent. among our Shareholders, which will make a difference of £269 14s., without deducting income-tax. The rebates we allow are much higher than those of any of the neighbouring gas-works. Those rebates were fixed by Parliament on the discussion on the Dukinfield Gas Bill.

MONDAY, JUNE 14.

Mr. Newbigging recalled, and cross-examined by Mr. POPE.

I was first consulted with regard to the proposed site for the gas-works in September last. I believe that if we do not obtain the Bill the contract for the land will be off, but I do not give a decided opinion upon that point, as it is more a lawyer's question. Any way we were bound *bona fide* to lay the matter before a Committee. A portion of the ground that is marked as a brickfield upon the map is now a gentleman's lawn, but the plan of the district was copied from the Ordnance map. The portion marked as a nightsoil depot is used for that purpose; there is a considerable tip, and it goes on increasing. The canal is about 15 feet above the level of the existing works, and this is an economical arrangement because it enables us to unload our coals upon the higher level, and let them fall by a hopper into a lower level.

Mr. POPE: You say an average of 15 feet. Mr. Spice, who has been there, says it amounts to a practical increase of 35 feet in the height?

Witness: That is not so. Upon the new site there are large mounds of sand which can be disposed of profitably for building purposes in the town. The foundations would be gradually excavated, and the site would be lowered. At one corner it would be 35 feet above the level, but at the wider part the large proportion of it is below the level of the canal. The connection between the proposed and the existing works would depend on our pipes being laid along the public street. If the road is not public at present, it will be made so, and without going along the road we could not pass under the canal. We should have to get leave of the Canal Company, but I should not anticipate the least difficulty about that. We are in immediate want of fresh capital, because our productive power is largely in excess of our storing power. We also need to provide for an increased consumption. A number of the mains are too small, and if we were to begin to enlarge them immediately it would be worth our while, but it would take several thousands of pounds to do so. Coal at the present time is cheaper than it has ever been within my experience, and residual products are higher; but there can be no doubt that immediately trade improves, the price of coal, iron, and labour will be unquestionably increased, and the sooner we have an increase in the price of coal the better.

Mr. POPE: You know 1s. margin is quite as much as Parliament is in

the habit of granting for purposes of elasticity, but you want 2s. 6d. Why will not 1s. satisfy you?

Witness: No; I think we only want about 1s. 4d.

You charge 8s. to 9s. 9d., and you want 6s. 6d. as your maximum price?—Our present price is 4s. 2d., subject to discount.

We need not discuss the discount; but can you give any particular reason applicable to Hyde, why you should have a larger margin than other places generally?—If the Hyde Gas Company had not been exceptionally well managed the prices would have been higher than they are now, because the district is exceedingly straggling and very thinly populated. If the management had not been so excellent, the price would probably have been 4s. 6d.

Cross-examination continued: There is no gas coal at Hyde. There is a pit of canal two miles away, but it is only a single one, and I believe is flooded at the present time.

Mr. POPE: Can you tell me any case within the last 6 or 8 years in which anything like a margin of 2s. 3d. has been allowed by Parliament between the maximum and the price actually charged?

Witness: I do not know of any instance of 2s. 3d., but we do not ask for such a margin.

Excuse me; 8s. 9d. and 5s. 6d.?—Yes; but our price is 4s. 2d.

No; there is discount?—But at any time we could alter that discount.

The CHAIRMAN remarked that he thought the learned Counsel's arithmetic was a little at fault in the last question.

Mr. POPE: 5s. 6d. is the maximum price asked, and 8s. 9d. is the price charged?

Witness: Yes; that is 1s. 9d.

You are quite right in the figures 8s. 9d. and 8s., but taking the quantities, can you tell me what is the actual average charge. I am told by Mr. Spice that it works out at 8s. 4d.?—No; it works out at 3s. 7½d. actually received all round.

Re-examined by Mr. ASPLAND: I think it is frivolous to raise any objection as to the communication between the proposed site and the old works, because there would be no difficulty at all. With regard to the public road which has been mentioned, I forgot that the Gas Company have purchased half the street conditionally upon the Bill being passed. A standard price which has been fixed where the sliding scale has been applied has nothing in common with the maximum price where the sliding scale is not applied; the two things are quite different.

By the COMMITTEE: Discount is only allowed off the highest price—4s. 2d.; all other prices are net. Supposing we went up to 5s. 6d. in consequence of increased prices for coal and iron, we should still take the discount off. The Radcliffe and Pilkington Gas Company, with a capital of £115,000 expended, obtained a Bill in 1878 with a maximum price of 5s. 6d., and that Company is more than double the size of the Hyde Company. At Padham, in Lancashire, a maximum of 6s. was granted in 1876. The average reaches to about 8s. 8d., because the small consumers are much in excess of the large ones. At the low price of 8s. I believe there is only one consumer—the Railway Company.

Mr. George Wilson Stevenson, examined by Mr. ASPLAND.

In the early part of March last I visited Hyde for the purpose of examining the works of the Gas Company. I have heard the evidence of Mr. Newbigging, and agree generally with it. The Company ought to begin immediately to construct new works in addition to those they have at present, but primarily they ought to erect another holder. Their storage room is only half what it ought to be, and the reason is obvious. A gas company go on making gas all through the 24 hours, and if the storage is not equal to the make, they have to keep the retorts in use in order to supply the district during the time of large consumption, that is to say, when the mills are going. The present site is inconveniently occupied, and it is only by having sufficient space that nuisance can be kept down. The fact that the consumption of gas last year was slightly smaller than in the previous year does not affect my judgment as to the necessity for commencing new works, because during the last nine years the consumption has doubled. It is no use taking one year with another; you must take an average. The consumption of gas is a very accurate barometer of the state of trade. When trade is good, the consumption goes up, and when trade is bad it goes down. Apart from the storage, the other works are not adequate. In my judgment, the additional capital proposed by the Bill will enable the Company to go on for twelve years; but as the capital is to be raised by public auction, it does not matter what it is. No company would raise more than they were compelled. The maximum price in the Company's present Act ought not to have been altered, and why they suggest 5s. 6d. instead of 6s. I do not know. I do not consider it would be safe for them to accept a lower maximum than 5s. 6d., because circumstances might arise—for instance, the enhanced price of coal, iron, and labour—which would make it impossible for them to issue capital at par unless they had a considerable margin between the actual present selling price and the maximum price to which they could go. A maximum price is a totally different thing to a standard price. The latter is something which is calculated to afford the Company their maximum dividend, and with varying circumstances as to cost of materials, and so on, they can put the price up and suffer a diminution of dividend, or they can put the price down and get an increased dividend. It is an inducement to good care and management. When a company apply to Parliament they prefer the old legislation, which secures 10 per cent., rather than seek to get a larger dividend, and so excite the anger and animosity of the consumers. I am persuaded that the public will complain loudly about any gas company dividing 11, 11½, and 12 per cent., and so on; it is more than a reasonable profit upon the investment of capital. In the Queenstown Gas Bill of last session the maximum price was fixed at 6s. 6d. per 1000 feet, and the Company were obtaining a trifle less than 4s. I was a witness against the Company in that case, and I said, "Let them have any maximum they please; it does not matter what the maximum price is, because if the Gas-Works Clauses Act of 1847 is properly worked, that alone regulates the selling price of gas." I think the site proposed is the best the Company could obtain, and I examined all the adjacent land. With regard to the residential character of the neighbourhood, the people who occupy the best houses are connected with the Gas Company, and do not object to the works. The land is bound to be occupied by manufacturers of some kind or other, and I would much rather live near gas-works than boiler-works, because of the noise of riveting by machinery. An illuminating power of 14 candles is the usual standard inserted in Acts of Parliament; but in order to preserve themselves from penalties, companies under such restriction must make about 16-candle gas.

Cross-examined by Mr. POPE: A closely-built place enables a company to supply a higher illuminating power at a lower price. We do not want to have 16 or 20 candles put upon us, or we must have a higher rate of charge. I do not consider the land immediately adjoining the existing works better than that across the canal, because it is only fit for gas-holders, and we want to construct additional manufacturing plant. Mr. Newbigging has said we should not require this plant for 12 months, but that is a very short time in the life of a gas company, and they must look forward to the future.

Mr. POPE: If you built your gasholders large enough on the site adjoining

your works, could you not use your existing site for manufacturing operations?

Witness: It would be very wasteful indeed to abolish the gasholders which are very good for practical purposes for many years to come. I think it an economical thing for the Company to build new works on the other side of the canal. They would begin with a gasholder, and proceed in time to the manufacturing and purifying plant. I am sure if Mr. Spice had to do the work he would act thus.

Mr. ASPLAND said this was the case on behalf of the promoters.

Mr. POPE said he would call his witnesses before addressing the Committee.

Mr. Robert Paulson Spice, examined by Mr. POPE.

I have inspected the Hyde Gas-Works once, and have been in the district twice. I do not think the works could be better situated than they are, and I am decidedly of opinion that the proposed site should not be authorized for the extension of the works. I inquired whether there was not land to be had other than that which had been selected by the Company, and I was informed that a portion of the property, called Mill-wood Mill was available, which immediately adjoins the existing site. Regarding the objections I have to the proposed site, as a principle I say that coals should not be lifted into a store, where they cannot be allowed to fall, because there would necessarily be required an amount of power—which means money—in raising the article. A small amount per ton tells up in the year's accounts, and it is contrary to sound policy so to arrange works; but if you can have your coals delivered from the top of the store, falling from the canal or railway, is the most economical arrangement. In this case the canal runs past the works, and the coals are taken out of the barges on a level with about the top of the coal store, and they then drop down, which is about the most economical arrangement. If, on the contrary, the new site is adopted, there will be a raising process, or the reverse of that which now exists. I do not care whether it is a few feet more or less, but the coal must be raised out of the barges and put into the store so that it may fall, and if this is done it will necessitate what is called trimming, shovelling, and lifting the coals up into a heap, which means cost. Added to this, my objection to the new site, on the ground of its unnecessary cost, is founded on the fact that the site of the next mill would be less than half that which is proposed to be taken, and the difference would be a burden for ever upon the undertaking. There is also another site just across the street, adjoining the gas-works, available. There is no immediate necessity for them to obtain this Bill, nor get the proposed site. My opinion is that a new gasholder could be erected upon the adjoining land at once, and then the old works would do for two generations—that is to say, with extensions; but, of course, the Company would require capital for whatever extensions were requisite. The amount of capital I do not care about; they may have as much as Parliament likes to give, within reasonable limits, of course. I think the maximum price suggested is very unreasonable; it amounts to a margin of something like 1s. 9d., and is about twice as much as is usual. I am concerned in a Bill with Mr. Stevenson, I believe, in which we are only asking 9d. above the price which is now being charged. I believe we shall have a hard fight to get it, but that is all we ask for.

By the COMMITTEE: I refer to the Maidstone Bill. The price last year was 3s. 3d., and we have inserted 4s. in the Bill.

Examination resumed: I think that 4s. 6d. would be a very liberal price as a maximum, and I think that it would amply provide for all contingencies. The proposed site is unusually objectionable on account of the difference in the level of the residential property which I have seen. There are two or three good houses in the neighbourhood which are higher than the proposed gas-works would be, and the noxious vapours would rise and go in at the windows. I think the circumstance of the difference in level telling against the inhabitants would be very hard.

Cross-examined by Mr. MICHAEL: I am not aware that there is some very valuable sand to be removed from the proposed site, which will be sold in the district. I saw some excavations going on close by, which were not sand, but clay. I believe an abundant supply of good coal at a moderate price can be had by the canal. When I am asked if they can get a portion of their coals by rail, when we are considering the interest of the Gas Company, I think the advantage would be purchased at too dear a price. There is 3d. a ton way-leave, as I understand, which will have to be paid to some one, and the expense of sidings, and the interest on the capital for the sidings; and this and the 3d. a ton would counterbalance any presumable advantages conferred by the railway. A new gasholder is wanted at once; there is no doubt about that, and I should be happy to undertake the work at once, in the face of its being a dangerous thing to sink one in the vicinity of large buildings. There is so much space between the ground that is marked off and the mill as to be quite sufficient to relieve one's mind from the idea of any risk. Unusual circumstances crop up where people have contractors who do not know their business; but I have seen the site, and should not be afraid of sinking for gasholder-tanks 30 feet deep.

Mr. John Thornley, examined by Mr. POPE.

I am Manager for Messrs. Ashton, Brothers, and Co., who are the largest consumers of gas in the district. I have been a member of the Hyde Local Board from its commencement, and also Chairman of the Board; and previous to that I was a member of the Local Authority. Prior to 1871 we made our own gas, but since then we have taken it from the Company. The quality was very unsatisfactory up to just before the application for this Bill.

Mr. ASPLAND said there was no allegation of this sort in the petition.

Mr. POPE said he would not press the question.

Examination continued: For some years it has been the wish of the Local Authority to assume the responsibility of the local gas supply, and in 1875 overtures were made to the Gas Company, but no arrangement was entered into. The Public Health Act of 1875 gives local authorities the power to agree for the purchase of gas undertakings, but the Hyde Gas Company cover rather a larger district than that under the Hyde Local Board, and therefore we must have special powers to enable us to supply gas beyond our limit. There is a strong feeling on the matter if we could agree with the Gas Company on suitable terms.

Mr. ASPLAND said there was no objection to the insertion of a clause enabling the Local Board to acquire the undertaking upon terms to be agreed upon.

Examination resumed: In my opinion the proposed site is too near the populous part of the town, and it is objected to by the inhabitants generally, as bringing the works more into the centre of the town. Our Local Board have been put to very great expense in former times in the way of lawsuits with public companies against nuisances. On the easterly side of the railway the houses are comparatively new, and there has been a very large amount of money spent on residential property in that part of the town. On the other side, where it is marked on the map "brickfield," there is a gentleman's house, with a bowling green, orchard, and garden. I saw a few bricks there, but I think it is all worked out now. The Local Board do not desire that the agreement shall be confirmed. Even if we purchased the gas-works, we would rather go farther off, because if we had the proposed site we should be liable to the people in the neighbour-

hood objecting to the nuisance; and we, as a Local Board, would be obliged to listen to complaints even where the Gas Company themselves are not. The Company are now paying a dividend of 15 per cent., but I am informed that on what they are now charging they have enough to pay 25 per cent. I agree with Mr. Spice that a price of 4s. 6d. would be sufficient to protect the Company.

Cross-examined by Mr. ASPLAND: I do not agree with our principal partner, Mr. Alcock, in reference to this matter; but he is a director of the Gas Company, and I am a member of the Local Board. The north-west wind, which is very prevalent, would bring more of the fumes of gas from the new site into the densely populated part of the town than is at present the case. I think it is very undesirable for the Company to go across the canal, but I consider their present position to be as good as they could have. I was not aware of the fact that the land which Mr. Spice recommended close to the Millwood Mills would cost £1500 per acre, while that which the Company propose to take will cost only £480 an acre. There is a difference of opinion in the Local Board about this opposition, but then there are shareholders and non-shareholders. Apart from the question of purchase, the Local Board would have opposed the Bill, because it is our duty, in the first place, to see that the illuminating power is kept up, and the Company are undoubtedly two candles lower than the old Act.

Mr. ASPLAND: You are mistaken; there is no limit in the existing Act.

Witness: I had always understood that there was.

Cross-examination continued: The mouth of our main sewer is not close to the proposed site. It may be within 70 yards, but I have not measured it. I cannot say whether a cotton mill would be more offensive on the site than the gas-works would be.

Re-examined by Mr. BALFOUR BROWNE: I say that the public have no right to object to a cotton mill being placed there, even if it were undesirable, but they have a right to object in Parliament to gas-works being erected, and this right they take advantage of. I do not think it desirable that the Company should be allowed to raise such a large capital as £56,000, but it does not much matter, having regard to the auction clauses. I also contend that the price is too high.

Mr. Thomas Beely, examined by Mr. BALFOUR BROWNE.

I am Chairman of the Hyde Local Board, who do not approve of the position of the site proposed by the Company, for the reason that it is surrounded by good and new property, on which there has been a large expenditure of money. Every one who has houses there objects to the site, excepting a gentleman who was examined here on Friday, and who is Deputy-Chairman of the Company. The proposed site is likewise unsuitable from its level, and from its distance by road from the present works. I consider the Company are seeking to acquire too much land for the purpose of the undertaking. It would be three-quarters of a mile by road from one of the works to the other, and a new bridge would be very expensive to construct. If the Company were to take to the Millwood Mill property, on the other side of the road, there would be less objection, because the wind would blow the vapours on to a less populous part altogether. It cannot be expected, under any circumstances known at present, that the increased demand for gas will continue. That demand has recently increased, because mills which had previously made their own gas have been added to the list of customers; but such mills are now all supplied, and it is not likely that the continued requirement will go on. It is the opinion of the Local Board that the gas undertaking should be in the hands of the public authority, and this is also the feeling of the inhabitants generally. A public meeting has been held on the subject, at which the opposition to the Bill was unanimously agreed to. I consider the price sought to be charged is excessive. Our district abounds with good coal for gas making, and supposing it was worked on the same principle, I do not see that while in such a place as Walsall they can produce and sell gas at 1s. 10d., we should have the maximum price of 5s. 6d. I also consider that the illuminating power should not be less than 16 candles.

Cross-examined by Mr. MICHAEL: If we had the supply in our hands, we should be more likely to produce a better quality of gas than that supplied by the Gas Company. I cannot say how much we should save, because it would be a matter of trial. If there is a bridge to build, and works to extend, and expenses such as we consider are incident to the present Bill, we think we shall be losers by it considerably. I should not think the bridge could be made for less than £1000, because, if they conduct their works on the principles stated, they will want more than a foot-bridge.

Re-examined by Mr. BALFOUR BROWNE: Any expense the Company were put to by the construction of a bridge and other things would be a dead loss to the consumers. According to the time of year, the Local Board could borrow money at $3\frac{1}{2}$ or $3\frac{3}{4}$ per cent., and at 4 per cent. from private individuals. It is especially one of the instructions of the Local Board that the Bill should be opposed on the ground of its seeking to renew the powers for drawing upon a portion of a succeeding year's profits to pay for past deficiencies. At present the Company are paying dividends that were lost 25 years ago.

The CHAIRMAN: A former witness spoke of the site of the existing gas-works being sufficient for two generations. Are you of that opinion?

Witness: As I understand, that was with the addition of two gasholders at Millwood Mill, which it is necessary for them to have.

Mr. John Smith, a wholesale boot and shoemaker, examined by Mr. BALFOUR BROWNE, gave corroborative evidence.

In cross-examination by Mr. MICHAEL, witness said he did not suffer any inconvenience from the existing gas-works. He lived about 350 or 400 yards from them.

Mr. Harrison Veevers, examined by Mr. BALFOUR BROWNE.

I am Gas Engineer to the Dukinfield, Denton, and Haughton Local Boards. I consider the land proposed to be purchased very unsuitable for the erection of gas-works, and I think there are many better sites on the north and north-west. I object because of the division of the works by the canal, and also on account of its elevation above the level both of the canal and the railway; the best sites for gas-works being always below those levels. Another decided disadvantage is that the site is near a good locality in the town of Hyde. I consider the maximum of 5s. 6d. to be excessive, and the illuminating power too low. At Dukinfield, which adjoins the district of the Hyde Gas Company, we are bound to give 15 candles, and at Ashton-under-Lyne it is 16 candles.

Cross-examined by Mr. MICHAEL: If the works were badly managed the price might make a difference, especially when there is a limitation to dividend to be derived out of profits. I do not say the works are badly managed at present, but they cannot have the same management for ever. [Witness was examined as to the levels of the works, the canal, and the railway, as given in the Ordinance Survey.] I do not think it would cost £1000 to make a bridge over the canal.

Re-examined by Mr. BALFOUR BROWNE: If a time of bad management should arrive, it would be important, in the interest of the consumers, to have the maximum price low enough to enable the Company to pay dividends, and not high enough to encourage bad management.

Mr. Joseph Mitchell, examined by Mr. BALFOUR BROWNE, said he was the Surveyor to the Hyde Local Board, and had taken the level of the pro-

posed site. He also produced a number of photographs showing the position of the same, and also of the present gas-works.

In cross-examination by Mr. MICHAEL, witness said the Gas Company had to keep the streets in repair after they had taken them up, the Local Board charging them at the rate of so much per yard. He did not suppose that mansion houses would be erected on the proposed site. Supposing a nuisance to arise from the gas-works it would not come under his notice, but under that of the Inspector of Nuisances. He had, however, never heard of any complaint being made.

In re-examination by Mr. BALFOUR BROWNE, witness said he found the level of the new site, on an average, was 9 feet above the level of the canal. The rise from the Company's present site to that proposed was about 26 feet. Coal was a very difficult thing to handle when it had to be raised from a low level to a high one. The Company had to open up streets that had been relaid; and it would, therefore, be better that the whole management of those streets, both as regarded cutting up and relaying, should be in the hands of the Local Board and their Surveyor.

Mr. BALFOUR BROWNE then addressed the Committee on behalf of the opponents of the Bill. In doing so he said it was a rule that those who went to equity must go with clean hands, and that those who asked the assistance of equity should be equitable. He would not go into questions of complaint as to whether the gas had been bad upon various occasions, because those complaints were very frequently made in opposition to Gas Bills, and the answer was that grumblers could always be obtained to say that the gas was bad. He would not say that the works had not been well managed, and he only wished that they would continue the future works in the same way, in which case he would not have been there to object on the part of the Local Board of Hyde, whose duty it was to protect the inhabitants of their district. Mr. Newbigging had stated that the Company were the trustees for their Shareholders; but he had forgotten another fiduciary relation which they held—viz., that they were the trustees, under the sanction of Parliament, for the public, and he (Mr. Browne) contended that the Directors had disregarded that trusteeship and had regarded only their own pockets, because their capital had been raised in contravention of the spirit of the Act of Parliament. They had converted their loan capital into shares, with the result that, instead of paying, as formerly, $4\frac{1}{2}$ per cent., the consumers would have to pay 7 per cent. on £9000 that had been borrowed. He submitted that the evidence showed that the Company were asking far too high a maximum price for their gas, which they were manufacturing at a very much lower rate. At the present time their charge was 3s. 7 $\frac{3}{4}$ d. all round for the gas that was consumed, and yet they were paying the maximum dividends, and even arrears of dividend. The question, therefore, arose, if they could pay 15 per cent., whilst they were receiving only 3s. 7 $\frac{3}{4}$ d., why should they ask Parliament to sanction 5s. 6d.? Was it not simply to protect their mismanagement in the future, as they wanted to be protected by the Committee sanctioning an illuminating power of only 14 candles. At Ashton-under-Lyne the illuminating power as fixed by an Act, which was passed only in 1877, was 16 candles, and at Dukinfield 15 candles. The difference of a candle was calculated to be equal to 1d. per 1000 feet out of the consumers' pockets, which would go into the pocket of the Company; and therefore the Company would receive 1d. more than the Dukinfield works, and 2d. more than the Ashton works for every 1000 feet of gas sold, which he did not think the Committee would approve of. After commenting on the question of rebates, the learned Counsel contended that there was no absolute necessity for the Bill at present. There was evidence that the consumption was going down—the year before last it was 70 million, and last year it was a million feet less—and yet the Company chose this time to apply to Parliament for further powers of extension. He therefore would not address himself to particular clauses of the Bill, but would ask the Committee to reject it altogether.

Mr. MICHAEL, in replying upon the whole case, said he was amused at the way in which his friend had presented the facts to the Committee, after the evidence which had been produced. The chief witness for the opponents—Mr. Spice—had admitted it was essential that storage power was needed, but this storage power could not be provided out of the present land of the Company. They had no funds whatever out of which any such provision could be made, and therefore what was the use of the flourish with which his learned friend asked the Committee to reject the Bill, and to come next year with "clean hands," and all that nonsense? The Committee ought to be reminded that every expense incurred by the Gas Company in reality came out of the pockets of the gas consumers; it was a charge upon capital, and what his learned friend really asked the Committee was to tax the consumers with all the expense that had been incurred in opposing the Bill. Referring in detail to the objections made to the Bill, he (Mr. Michael) said that the head and front of the Company's offence was that they would not consent to part with their undertaking. The position of the Gas Company was that, owing to the enormous increase in their business—although there had been certainly a slight diminution last year, owing to the great depression of trade—they had expended all their capital, and were unable to fulfil their parliamentary obligations. They, therefore, applied to the body which imposed those obligations, and said, "We are now in circumstances in which we find it impossible to carry out your behests; give us the power to raise capital, in order that we may do so." Even if the undertaking were taken over by the Local Board, the money for extensions would have to be raised, and they could not do it on better terms than the Gas Company. They would have to pay 4 per cent. for the money they borrowed, and if they borrowed it for a certain number of years they would have to start a sinking-fund of 1 per cent., or rather more, which would raise the sum to be paid annually by the Local Board for 30 years to 5 per cent. Referring to the question of the proposed new site, and to the objection urged by the petitioners, the learned Counsel said it was absurd to talk of residential property, when they had witnesses to say that it was a rugged, barren piece of land, covered with broken-down old fences and a lot of debris. As to illuminating power, 14 candles practically meant 16, and if they were to take all the gas companies in England, they would find that about two-thirds had an illuminating power of 14 candles, or something below that, and he did not see why the quality of gas supplied for two-thirds of England was not sufficient for the purposes of Hyde. He believed the Committee would pass the preamble of the Bill, having been convinced that the proposals of the Gas Company would, if carried out, work for the benefit of every gas consumer in Hyde.

The committee-room was then cleared. On the Counsel and parties being called in,

The CHAIRMAN said the Committee were of opinion that the preamble was not proved.

The Council of the Society of Arts have awarded medals to Major-General H. Y. D. Scott, C.B., F.R.S., for his paper, read during the session which is just over, on "Suggestions for Dealing with the Sewage of London;" and to Mr. Thomas Fletcher, for his paper on "Recent Improvements in Gas Furnaces for Domestic and Laboratory Purposes."

PRIVATE BILLS RELATING TO GAS, WATER, ETC.

SESSION 1880.

PROGRESS MADE TO SATURDAY, JUNE 26.

Title of Bill.		Petition for Bill Presented.	Bill Read the First Time.	Bill Read a Second Time.	Bill Reported.	Bill Read the Third Time.	Bill Received Royal Assent.
Ackworth, Featherstone, Purston, and Sharlston Gas Bill	Lords	Comms. Bill Feb. 9	June 25 Feb. 10				
Birkenhead Borough " " "	Lords	Bill with-	drawn.	March 8	June 15	June 24	..
British "Gaslight Company, Limited (Staffordshire Potteries), Bill	Commons	Feb. 10	Feb. 10	Feb. 23	June 17	June 22	..
Burton-upon-Trent Corporation Bill	Lords	Lords Bill.	June 24	..	..	..	..
Cardiff Water Bill " " "	Commons	Comms. Bill	May 27	June 4	..	..	..
Chester "Gas Bill.	Lords	Feb. 9	Feb. 10	Feb. 16	March 11	May 25	..
Cork Gas Bill.	Commons	Feb. 10	Feb. 10	Feb. 20	March 8	March 11	..
Cork Improvement Bill	Lords	Lords Bill.	March 11	May 31	June 11	June 15	..
Dagenham and District Farmers (Optional) Sewage Utili- zation Bill	Commons	Comms. Bill	March 12	March 19	June 4	June 8	..
Dartford Gas Bill	Lords	Feb. 9	Feb. 10	Feb. 24	March 2	March 11	..
Dearne Valley Water Bill	Commons	Feb. 9	Feb. 10	March 1	June 18	..	..
Denton and Haughton Gas Bill	Lords	Comms. Bill	June 25	Feb. 16	June 15	June 24	..
Doncaster Corporation Water Bill	Commons	Feb. 9	Feb. 10	Feb. 17	June 15	..	..
Eastbourne Gas Bill " " "	Lords	Feb. 9	Feb. 10	March 15	..	..	..
Edinburgh and District Water Bill	Commons	Feb. 10	Feb. 10	Feb. 16	March 16	May 25	..
Exmouth and District Water Bill	Lords	Lords Bill.	May 28	June 15	June 22	June 22	..
Gaslight and Coke, Commercial Gas, and South Metropolitan Gaslight and Coke Companies Bill	Commons	Comms. Bill	June 1	June 10	June 18	June 22	..
Great Yarmouth Water Bill	Lords	Feb. 9	Feb. 10	Feb. 16	March 17	May 31	..
Hinckley "Local Board" Gas Bill	Commons	Feb. 10	Feb. 10	Feb. 16	March 16	May 25	..
Huddersfield Tramways and Improvement Bill	Lords	Lords Bill.	May 28	June 8	June 22	June 25	..
Hull Lighting Bill " " "	Commons	Comms. Bill	May 27	June 8	June 24	..	..
Hyde Gas Bill	Lords	Feb. 9	Feb. 10	Feb. 25	March 12	May 25	..
King's Lynn Corporation Bill	Commons	Feb. 10	Feb. 10	Feb. 16	Feb. 26	March 2	..
Lancashire County Justices (Water, &c.) Bill	Lords	Lords Bill.	March 5	March 15	June 1	June 10	} June 14
Lancaster Corporation Bill	Commons	Comms. Bill	June 25	Feb. 23	June 11	June 24	..
Lincoln "Gas Bill " " "	Lords	Feb. 9	Feb. 10	Feb. 17	..	..	..
Liverpool Corporation Water Bill	Commons	Feb. 9	Feb. 10	March 1	June 25	..	..
Liverpool United Gas Bill	Lords	Feb. 9	Feb. 10	March 8	..	..	..
London "Gaslight Company Bill	Commons	Comms. Bill	June 25	Feb. 16	June 14	June 24	..
Maidstone "Gas Bill " " "	Lords	Feb. 9	Feb. 10	Feb. 16	June 11	..	..
Malton "Gas Bill " " "	Commons	Feb. 9	Feb. 10	Feb. 23	June 14	Preamble	not proved.
Oldham Improvement Bill	Lords	Feb. 9	Feb. 10	Feb. 16	June 11	..	..
Phoenix "Gaslight and Coke Company Bill	Commons	Feb. 9	Feb. 10	Feb. 16	June 9	..	..
Portmadoc Water Bill " " "	Lords	Feb. 10	Feb. 10	Feb. 16	June 9	..	..
Prescot "Gas Bill " " "	Commons	Feb. 10	Feb. 10	Feb. 16	March 11	March 13	..
Preston Improvement Bill	Lords	Lords Bill.	March 16	June 7	June 15	June 24	..
Rathmines and Rathgar Township (Vartry Water Supply) Bill	Commons	Comms. Bill	June 18	Feb. 16	March 12	June 18	..
Rathmines and Rathgar Township Water Bill	Lords	Comms. Bill	June 22	March 12	June 8	June 21	..
Reading "Gas Bill " " "	Commons	Feb. 9	Feb. 10	Feb. 24	..	..	..
Rochester Corporation Bill	Lords	Comms. Bill	May 28	June 7	March 12	May 27	..
Sea Water Supply to London Bill	Commons	Feb. 9	Feb. 10	Feb. 24	March 12	May 27	..
Sligo Borough Water Bill " " "	Lords	Feb. 9	Feb. 10	Feb. 24	March 12	May 27	..
South Metropolitan "Gas Company Bill	Commons	Feb. 9	Feb. 10	Feb. 24	March 12	May 27	..
Southwark and Vauxhall Water Bill	Lords	Feb. 9	Feb. 10	Feb. 24	March 12	May 27	..
Stafford "Borough Bill " " "	Commons	Feb. 9	Feb. 10	Feb. 24	March 12	May 27	..
Wakefield Corporation Water Bill	Lords	Comms. Bill	June 3	Feb. 23	March 17	June 1	..
Wandsworth and Putney Gas Bill	Commons	Feb. 9	Feb. 10	Feb. 16	March 11	March 16	..
Wigan Improvement Bill " " "	Lords	Feb. 10	Feb. 10	Feb. 16	June 7	..	..
Wrexham Water Bill " " "	Commons	Feb. 9	Feb. 10	Feb. 16	June 7	..	..
Yeadon and Guiseley Gas Bill	Lords	Comms. Bill	June 25	March 4	June 11	June 21	..
" " " " "	Commons	Feb. 9	Feb. 10	March 10	June 11	June 22	..

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

SATURDAY, JUNE 12.

(Before the MASTER of the ROLLS.)

In re THE TOPSHAM, WOODBURY, and LYMPTONE WATER-WORKS COMPANY.

Mr. LLOYD appeared to support a petition by a judgment creditor, asking for the winding-up of the above-named Company, which was formed in 1868 for the purpose of supplying water to the parishes of Topsham, Woodbury, and Lymptone, in Devonshire. The capital is £8000, in 800 shares of £10 each. The petitioner holds 15 fully paid-up shares in the Company, and he also recovered a judgment against the Company in June, 1878, for £570 1s. 8d.

The MASTER of the ROLLS granted the prayer of the petition, and made the usual order.

EDMONTON PETTY SESSIONS.—MONDAY, JUNE 21.

(Before Messrs. JAMES ABBISS, Chairman; H. NASH, J. HOWARD, and J. BOLTON DOE.)

EXTRAORDINARY CHARGE AGAINST A DIRECTOR OF A GAS COMPANY.

Mr. James Brickwell, Chairman of the Tottenham and Edmonton Gas Company, was charged upon three separate summonses, obtained at the instance of Mr. Wm. Bellingham, first, that he did on or about Jan. 1, 1862, and on divers days between that day and April 10, 1880, then being a Director of the Tottenham and Edmonton Gaslight and Coke Company, unlawfully and fraudulently take and apply a large quantity of gas—to wit 900,000 feet or thereabouts—the property of such public Company; secondly, that being a Director of such Company, he did unlawfully, with intent to defraud, omit and concur in omitting certain material particulars in the book or books of account—to wit, the gas consumers ledger or ledgers—belonging to the said Company; thirdly, that being a member of a certain co-partnership and the joint beneficial owner of the gas manufactured by the said Company, he did feloniously as such member and joint beneficial owner steal, take, and carry away a large quantity of gas belonging to the said co-partnership.

Mr. BESLEY appeared for the prosecution; and Mr. WEBSTER, Q.C., for the defendant.

Mr. BESLEY, in opening the case, said it was his duty to appear on the part of the prosecution, and inasmuch as the defendant was a gentleman occupying a good position, of course it was an arduous matter to appear to charge him with such offences as were contained in the summonses; but he was relieved considerably from all anxiety when he recollected that the law of England had no respect to a man's position. If a person was found breaking the law which had been passed in recent years, he ought just as much to be brought before a jury to have his conduct investigated, as a costermonger who had stolen a bunch of greens. The charge against Mr. Brickwell was made under the Act which came into operation from the 1st of January, 1862. The section of the Act which it was important to notice stated that if any director, member, or public officer of any body corporate or public company should fraudulently take or apply to his own use or benefit, or any use or purpose other than for the use of the body corporate, any of the property of the company, the same should be held to be a misdemeanour; and the not keeping the necessary books or documents was also made a misdemeanour by another section. The legislation against directors of public companies had been put in force in many cases since the year 1862, and it was a very salutary principle that gentlemen who took upon themselves the office of directors, and therefore the office of trustees for a large body of fluctuating individuals, should fulfil the obligations put upon them by the statute, and that no reproach in the conduct of the affairs of the company should be possible against them. In the year 1863, at the instance of the late Recorder of London, an Act was passed by the Legislature, the preamble of which stated that it was necessary, for the further protection of members of co-partnerships, that persons should not escape from the legal consequences of crime simply by being able to say that the property they took was property in which they had a small interest, and a great many other people had a small interest; and that, being a joint member or owner with the others, therefore the law had not been violated. The statute, after declaring how important it was that there should be further protection, provided that if any person, being a member of a co-partnership, should steal or embezzle any money belonging to the co-partnership, every such person should be liable to be dealt with, tried, convicted, and punished the same as if the person was not a member of the co-partnership or one of the beneficial owners. The date of this Act was 1863, and therefore with regard to matters occurring previous to 1863 it would not have been competent to have charged Mr. Brickwell with a theft prior to this time. He might state, having given the dates of the Acts of Parliament (1862 and 1863), that he had authority, for the purpose of satisfying the Bench as to their discretion, in the case of *The Queen v. Frith*, where it was held that a continuous abstraction of gas, even though the gas was turned off and not alight, was a continuous taking for any number of years. Therefore the frame of the summons contemplated the putting in force of that which was declared by this case to be the law—namely, that a continuous taking arose when there had been a continuous stealing of gas. Chief Justice Bovill, in giving judgment, said that the real question in the case was whether there was a series of takings during the whole number of years during which the gas was used, or only one continuous taking, and he allowed three different takings to be proved, and then left the matter to the jury. This case showed that the Bench might have before them a charge of larceny being a continued larceny for a continuous number of years, but in the present case it was limited by the Acts of 1862 and 1863. He (Mr. Besley) thought the Bench would like to know whether the matter of stealing gas had been before any Court, and for this purpose he had brought with him a case which had been tried in September, 1875, reported in the "Central Criminal Reports." There a person named Sanderson was charged with stealing during four years 600,000 cubic feet of gas, and the question submitted to the jury was whether a licensed victualler, in warming his cellar with gas which did not pass through the meter, was ignorant of the fact that the gas so being consumed direct from the pipes did not go through the meter. It appeared that the defendant in the present case had been for many years the Chairman of the Board of Directors of the Tottenham and Edmonton Gaslight and Coke Company, which Company was incorporated, in a sense, from the 23rd of December, 1847, but was not incorporated by Act of Parliament until the 1st of August, 1859. The Company had gone through the usual history of gas undertakings. There had been a great deal of parliamentary interference, but at the same time they had progressed in prosperity, for after paying at first a small dividend, they had improved, and had paid maximum dividends for some years past. Mr. Bellingham, for whom he appeared (and the public would, no doubt, be greatly indebted to him for having brought about this inquiry) was the largest Shareholder in the Company, having bought his shares when they were at the maximum price. It appeared that Mr. Brickwell occupied a large house at a distance of two miles from the place of the manufacture of gas, and during the whole of the period from January, 1862, down to

some time in the month of May this year, he had had gas passing into his premises without going through a meter, and he had burned it for lighting and cooking purposes. The amount of gas thus consumed could only be estimated by hundreds of thousands of cubic feet, and £20 a year would be a very small payment for the gas consumed. The present charge against the defendant was a charge of stealing gas from 1868, and of fraudulently applying for his own purposes the gas, the property of the Company, from the year 1862. No doubt the Bench would be pleased to have authority to show that they need not enter upon the question of the guilt or innocence of the defendant. It was not a matter which entered into consideration in a preliminary inquiry, and the authority he cited for this was at page 362 of the last edition of "Archbold's Criminal Cases," where it was stated that in all cases of larceny the question whether the defendant took the goods knowingly or by mistake was a question entirely for the consideration of the jury, to be determined by them upon a view of the particular facts of the case. This authority relieved the Bench from the necessity of expressing any opinion upon the matter. The trial before the jury was distinct from the preliminary inquiry, and he thought he should have the assent of all the magistrates to its being a just and proper course not to express an opinion, but to leave the case to be submitted to a jury. The way the matter was discovered was this: At a meeting of the Shareholders of the Company, held on April 10 this year, searching questions were put to the defendant upon the subject, and he admitted it was true that he had had the property of the Company. Therefore there had been a taking away of the property of the Company by a gentleman in the highest position in the Company—one who had the duty of protecting the interests of all with whom he was connected. No doubt a suggestion would be made—although perhaps the Court would not enter upon it, but still it would be as well to meet it at once—that, for the purposes of the Company, the gas had to be taken two miles from the place where it was manufactured in order to test it as to its pressure; but he might ridicule this idea at once, because it was well known that every company measured the pressure of their gas at the nearest possible point from the place of manufacture. It was tested on the works and in the public lamps, and therefore nothing was more ridiculous than to imagine that it was taken two miles for this purpose. There was nothing to prevent Mr. Brickwell, if he desired to act honestly to the Shareholders, having a meter in his house, so that the gas might pass through it, without taking gas all these years without paying a single farthing for it. It was absurd to suppose there could be any claim of right by a chairman to abstract property for this purpose, even if it were true. It might as well be said that the chairman of a co-operative store could claim a right to take home groceries for the use of his family, or that the chairman of a water company might claim a right to have for nothing a lake and fountain in his grounds. The statute to which he (the learned Counsel) had referred, placed a peremptory obligation upon the man who took upon himself a trust, to properly carry out the trust in the interests of the shareholders; and if persons so far forgot themselves as to take some pettifogging advantage to themselves, they would no doubt wake up and find that the law was quite as much directed against them as it was against the lowest subject of the Queen. With these remarks he would proceed to call witnesses, and should then ask the Bench to commit Mr. Brickwell for trial.

Mr. James Randall, examined by Mr. BESLEY, said: I am the Secretary of the Tottenham and Edmonton Gas Company, and have been so since the year 1857. When I first became Secretary, the Company was worked under a deed of settlement. It was afterwards incorporated by Act of Parliament on the 1st of August, 1859. Mr. Black was Chairman of the Company when I became Secretary. Mr. James Brickwell became Chairman on the 11th of November, 1876. There were 222 Shareholders on the register on the 10th of April, 1880. Mr. Brickwell's name appears on the register. He is the holder of 200 fully paid-up shares, and 50 shares with £6 paid. Mr. Bellingham holds 501 45 shares, and 122 shares with £6 paid, making a total capital of £3237. Mr. Brickwell has held shares in the Company since its formation.

By Mr. HOWARD: A Director's qualification is by 100 fully paid-up shares of £5 each.

Examination continued: I produce the consumers ledger, showing the names of persons taking gas from the 1st of January, 1862. I cannot tell from the book how many consumers there were at that time, but I should think about 1300 or 1400. We allowed the consumers to supply their own meters; but notice requiring fixture had to be given to the then Manager of the works. If the Company supplied the meter a rental would be charged; but, whether supplied by the Company or the consumer, no pipe could be attached to the meter except under the supervision of the officers of the Company. Mr. Brickwell's name does not appear in the book as a consumer of gas. I produce the gas consumers ledgers from 1862 to April, 1880. Mr. Brickwell's name does not appear in them. A record is kept of the meters supplied by the Company and by the consumers. This record is not kept by me, but by the inspector. The state of the meters is taken every quarter by him, and a charge is made for the number of feet of gas registered. Mr. Brickwell resides at Mountford House, The Green, Tottenham, and Mr. John Clark has been collector for that district for about seven years. I have frequently been to Mr. Brickwell's house since January, 1862; perhaps four or five times a week. My visits would usually be in the morning and evening. In the winter time I have found gas burning there. I have seen gas burning in the dining-room and in the hall. There is a 3-light chandelier in the dining-room; but I have only seen one burner alight. I have only been once or twice into any other room of the house. I have been in the drawing-room and there seen gas-burners alight, but cannot say how many. It is a larger room than the dining-room, but I do not know whether there were more burners than in the dining-room. I have not been into any other room. The house consists of a basement, ground floor, and two floors above. I could not see whether gas was burning in the kitchen, because the shutters were closed. Very probably it was burning. I have seen rays of light through the shutters. On approaching the house in the evening, I have noticed a light in the windows of the upper part of the house, but I could not say whether it was gaslight. The house is semi-detached, having a frontage of 50 feet. I know there is a gas-stove in the house—men have been sent to clean out the pipes of it occasionally. Mr. Broadberry is at present Manager to the Company. I know of my own knowledge that men were sent in the late Manager's time to clear the pipes of the gas-stove. The Company's accounts are audited four times a year. The Auditors in 1862 were Mr. R. J. Laing and Mr. John Nicholl; but both these gentlemen are now dead. The present Auditors are the Rev. Hugh Hercus and Mr. Alexander Nicol. They vouch the expenditure and the revenue by what is shown to them.

By the CHAIRMAN: The Auditors do not look to see whether the account of the meter-taker is correct. They take the accounts which are posted by me in the ledger from the inspector's books.

Examination continued: Mr. Brickwell's name does not appear in the accounts, and there is no return of any meter being in his house. I have not brought the attendance-book of the Directors, as it is not in my subpoena; but I produce four minute-books, commencing in 1855 up to the

SUPPLEMENT

TO THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XXXV.

LONDON, JUNE 29, 1880.

No. 894.

BRITISH ASSOCIATION OF GAS MANAGERS.

SEVENTEENTH ANNUAL MEETING.

PAPERS READ.

(VII.)

GASHOLDER-TANKS: DIFFICULTIES AND MISTAKES IN THEIR CONSTRUCTION.

By Mr. GEORGE LIVESSEY, of London.

The object of this paper is not an ambitious one, though it deals with perhaps the most important of purely engineering works with which we have to do. It is, however, simply an account of some of the difficulties that have been met with, and the mistakes that have been made, in the experience of the writer.

In 1857 a tank 112 feet diameter and 25 feet deep was constructed in a dock or basin of the Surrey Canal in the Old Kent Road. This dock was a square piece of water, a trifle larger than the tank, in full communication with the canal. The contractor began his work by forming a dam consisting of two rows of short piles, with a space between filled with clay, to cut off the dock from the canal, the water being about 6 feet deep. He then excavated the tank in the usual way, supporting the trench with timber struts, whalings, and runners, the latter being 9-inch deals pitched closed together. The soil consisted of gravel and sand full of water; but ample pumping power being provided, all went well until the puddle under the wall, together with the footings and about a foot in height of the wall itself, were got in. When the time came to draw the runners, which process in such a loose soil necessarily results in a small portion falling in from behind them to fill up the space which they occupied (there is no harm in this in ordinary circumstances, as the only result is a slight settlement of the surrounding ground); but they were drawn at that part of the tank nearest to the dam, which was only about 6 or 8 feet distant, this very slight settlement was sufficient to disturb the dam, and about eight o'clock one evening the timber began to move, then to crack ominously, and in less than five minutes the tank was once more converted into a dock full of water, the dam being entirely swept away. The rush of water from the canal made a hole so deep that the next dam had to be made with whole timber piles 30 feet long. This disaster would certainly not have happened had the contractor left in the runners at the back of the tank wall for a distance of about 30 feet at the point where the tank was close to the dam, and thus the attempt to save about £10 worth of timber involved a loss of from £2000 to £3000.

This tank, after being successfully completed and at work for some four or five years, again came to grief, in consequence of the construction of the main sewer in the adjoining road. The sump for draining the ground tapped a stratum of fine sand which underlies the gravel on which the foundation of the tank was laid. This sand was pumped up with the water in large quantities, and being drawn from under the tank the puddled bottom gave way, and caused so great a leak that the tank had to be emptied, and repaired at great expense and trouble; but it was never again made perfectly sound. There is always this danger when a tank having sand full of water below its foundation, has another and deeper excavation made in its near neighbourhood.

In 1862 another tank was built, 112 feet diameter and 30 feet deep. In this case two mistakes were made. In

the first place, the trench was set out of smaller diameter by 2 feet than the footings required, intending to cut away the earth—which was sand and gravel full of water—under and behind the bottom row of runners, in order to make room for the footings. This could not be done, and as a consequence the puddle at the back of the wall at the bottom was reduced to only 1 foot in thickness, which probably accounts for some of the leakage that for a long time took place in this tank. The other mistake in carrying out the work was the failure to sink the sump deep enough, and to provide sufficient pumping power. Had the sump been 3 feet deeper, it would have been in the chalk, and the pumps would have had to deal with clear water. Instead of this the suction were in a bed of running sand, and, as a consequence, an immense quantity of sand was brought up, resulting in the falling-in of the bottom of a small adjoining tank, in the cracking and settlement of the wall of a large coal store, in the creation of great cavities in the earth in various directions, one being in a garden from 80 to 100 yards from the sump, and another in a public roadway about 40 yards distant. This last was made known by the weight of a passing cart breaking the crust of the road, when the cart dropped in, fortunately without any serious consequences, beyond frightening the contractor and the directors of the Company, and causing the excavation for the tank to stop 5 feet short of the proper depth, which brought the tank 5 feet higher than was intended. From the comparative shallowness of the sump and the deficiency of pumping power, the excavation was never properly cleared from water. Puddle was therefore put in under very unfavourable conditions. The tank could not be made tight; but it has been emptied two or three times for the purpose of trying to stop the leaks, and on the last occasion, in 1872, ten years after it was constructed, the leakage was reduced to a mere trifle, at which it has stood ever since. When this tank was made, the nature of the ground beyond 30 feet in depth was unknown. Had a boring been put down, the chalk would have been discovered a few feet lower, and some at least of these difficulties would have been avoided.

In the case of the next tank, constructed in 1867, this precaution was taken. The tank is 35 feet deep, and the sump, with ample pumping power in duplicate, was carried well into the chalk. The work was done to time—whereas the two tanks previously mentioned were a year behind—and when filled with water was quite sound. After a short time, however, a leakage took place. A diver went down to examine the puddled bottom, and he found in the puddle a clear round hole, into which he could thrust his arm. This he filled with lumps of clay rolled up in coarse canvas, which were well rammed into the hole, and the tank from that day to this has remained perfectly tight. How the hole was caused is not clearly known. It was not supposed to be made by a pole being thrust into the clay, or the falling of a crow-bar or a "dolly," but rather by the pressure of the water itself finding a weak place and making its way through. That 25-feet head of water can do this in puddled tanks has been fully proved by more recent experience, conclusive evidence in the next case having shown that holes, in form and appearance like rat-holes, have been made in this way.

The next case is a tank of brickwork and puddle, like those already referred to, begun in 1869, of 100 feet diameter by 30 feet deep. It is in a rather loose sandstone

rock with numerous joints and fissures, but containing very little water. The whole interior of the tank was excavated, and there being no necessity for timber framing to support the sides, it appeared a very simple piece of work. The puddle on which the wall was to stand was put in, the wall was built and backed with puddle 2 feet thick, the space between the back of the puddle and the face of the excavation being filled in with material consisting of pieces of sandstone rock, sand, and earth from the excavation. The bottom of the tank was excavated to a slope of 4 to 1, the fissures filled up with pieces of rock and sand from the excavation, and the whole covered with puddle. The work was apparently finished satisfactorily, and the gasholder erected. Water was put into the tank with the intention of bringing the gasholder at once into use; but when nearly filled a leakage occurred. On taking out the water some weak places were found in the puddle at the foot of the wall; these were stopped, and another attempt was made to fill the tank, which failed as the first had done. This process was three times repeated, and always with the same result, until the Company took the work out of the hands of the local contractor, and employed another of very large experience in this class of work—one who had sent in a tender in the first instance, but, being somewhat higher than that of the local man, it had not been accepted. The puddle under the wall, for a distance of 18 inches from the face, was, after several vain attempts to stop the leakage, all taken out and replaced with new puddle of the best kind, but in vain. The water always forced a passage through it. When success seemed nearly on the point of being attained, the puddle on the cone in the interior of the tank gave way; the clay was forced into the fissures that had been filled with stones and sand, and the water consequently made its way through in these places. Eleven times, in addition to the three above mentioned, was this tank tested. It would stand until within a foot or in some cases 6 inches of being full, and then all at once it would begin to leak. The pressure of the water forced—one might almost say punched—through the puddle over one or other of the before-named fissures a round hole large enough to receive a man's arm. One such hole only was usually made, because directly the water found vent the pressure on the top of the puddle was neutralized by an equilibrium, to some extent, being established. At last the bottom was made sound by removing all the puddle—the inner lift of the gasholder was in the tank during the whole 18 months—as far under the wall as possible, and all over the cone, which was then concreted, and on this thoroughly sound bottom the puddle was laid for the last time. The pressure of the water had no further effect upon it, and henceforth the bottom was sound. Then a leakage took place through the wall; the puddle at the back of the wall being forced into the backing. The bottom of the tank over the puddle near the wall was therefore concreted and rendered, and the wall itself was also rendered; but even then, on filling the tank, there was still a considerable leakage, which took place through cracks in the wall and rendering; a rendered tank, be it remembered, throws a strain on the wall which is entirely absent in an ordinary tank. The ordinary tank wall is pervious to water; the pressure of the water is, therefore, on the puddle backing; in a rendered tank, on the contrary, the pressure is on the face of the tank; and although this is counteracted by the backing of earth, it is extremely difficult to make filled-in earth absolutely solid. When the pressure comes upon it there will be, unless extraordinary precautions be taken, a slight giving way, and the wall will crack slightly, but quite sufficiently to cause disagreeable leakage, and this allowing the water to find its way to the back of the wall, the pressure on the face is counterbalanced, and the cracks do not extend farther. This is what took place with the tank in question. Complete success was finally attained by the very able, painstaking, and persevering foreman in charge of the work—who, by the way, is now principal foreman at the South Metropolitan Gas-Works—going down in a diving dress, the tank being kept quite full of water, and caulking these cracks in the rendering with fine yarn and tallow. The tank was made tight, and has so remained to this day.

The writer cannot pass from the narrative referring to this tank without saying that throughout the whole of this exceedingly anxious and troublesome business, to which he was Engineer, the Gas Company, through their Manager and Secretary, acted in the kindest and most considerate manner, their confidence never being withdrawn, notwithstanding the heavy loss sustained. The original contractor's men worked early and late, and although a clerk of works was employed, it was afterwards discovered that some of the puddle in the bottom

was put in by the men, who were not experienced in this class of work, in a hurried manner very early in the summer mornings, before either the foreman in charge or the clerk of the works had arrived. Whether this was the cause of the disaster or not, it is quite clear that if puddle is to resist great pressure it must have beneath and at the back of it a perfectly solid foundation. If puddle is used and the bottom is not solid, concrete is absolutely necessary. If this tank had to be erected with our present knowledge and experience, it would be one of the easiest and simplest possible. A mere excavation in the rock, lined with concrete about 18 inches thick and 9 inches on the bottom, and rendered, would make a perfect tank at probably half the cost of the old-fashioned brick and puddled tank.

The next case is one in which the writer was called upon to advise after a disaster resulting from the inexperience of the contractor. A large tank was constructed in the soft clay or ooze near the mouth of a river, this clay being of the consistence of ordinary clay puddle, and of great depth. There was no fault to be found with the design of the tank, the wall was of sufficient thickness, and was built of concrete, and suitable footings were specified and shown on the drawing. With the soft foundation good broad footings were especially necessary; but the contractor actually built the wall without any footings whatever, the bottom of the wall being about 4 feet thick. It was his intention to put in sham footings after the interior was excavated; and at the back of the wall the absence of footings was compensated for by a set-off the wrong way at the height of 5 or 6 feet, where the thickness of the wall was considerably increased, and higher up another set-off was made, thus further increasing the thickness of the wall at the back. When the wall had been carried up about 15 feet all round, the interior was excavated, and another incredible mistake was made. The contractor attempted to make the excavation complete all round before beginning to put in the footings and the concrete bottom. Had he done this work in short lengths, the so-called footings and the concrete bottom would at least have strengthened the toe of the wall, and have better enabled it to resist the pressure behind it. The wall, which, being made of blast-furnace slag, was a fine piece of concrete work, stood without any support until two-thirds of it was exposed, when one night, after the men had left the work, it succumbed to the pressure, and the whole of the unsupported part gave way, and was forced forward into the tank to the extent, in the worst place, of some 6 feet. Though much broken, the wall fairly maintained the upright position, thus so far facilitating the construction of a somewhat smaller tank within the original, which has been successfully completed.

The last case to be mentioned relates to a disaster that happened last year to a cast-iron tank, about 60 feet in diameter, standing some 20 feet above ground. The plates were rather thin, but quite strong enough if the tank had been properly hooped. The hoops were composed of bars of flat iron, $\frac{1}{2}$ -inch and $\frac{3}{4}$ -inch thick, varying in width from 4 to 5 inches. There was a clause in the specification expressly providing that all joints in these bands should be of greater section than the band itself; and at the three forged joints in each band this stipulation was fully complied with, but there were other joints. The hoops were made up of simple bars of iron about 12 feet or 15 feet long, which were butted together and secured by a cover strip, of the same section as the band, by means of bolts only. Four $\frac{1}{2}$ -inch holes were punched in these bars of flat iron to receive the $\frac{3}{4}$ -inch bolts. These holes were in couples and in line, and had the effect of cutting out $1\frac{1}{2}$ inches from the width of the band, thus reducing a 4-inch band to $2\frac{1}{4}$ inches, and one 5 inches wide to about 3 inches. A short time after the tank was filled with water the hoops gave way, and the whole of the tank above the level of the ground was thrown down. The hoops were light, certainly, but would have stood had their full section been maintained. This, however, being by the punched bolt-holes reduced by about one-half, failure was inevitable. The contractor, to his credit, undertook to restore the work, and has no doubt taken care that the hoops shall be strong enough to sustain the whole pressure of the water, without depending at all on the cast-iron plates, which should be regarded as if they were so many staves of a cask held together entirely by the hoops.

If this record of some of the difficulties and mistakes in tank construction which have come within the writer's experience should be the means of saving some of his brethren from similar anxieties, he will feel that the paper has not been read in vain.

Discussion.

Mr. R. MORTON (London) said he did not think there was much to discuss in this paper. They were very much obliged

to Mr. Livesey for having pointed out certain errors in tank construction; and it was for them all to think well over the subject, and endeavour not to repeat them when making tanks themselves.

Mr. W. FOULIS (Glasgow) asked Mr. Livesey what was the width of the fissures in the tank.

Mr. LIVESEY said they were not very great; but in places pieces of the rock were torn out by blasting, and instead of being filled in with concrete they were filled in with fragments and sand.

Mr. FOULIS said there was one important thing to note. Mr. Livesey had pointed out that a puddle tank built with brick or concrete depended on the puddle for soundness, and the weight of water was thrown on the inside of the puddle. This showed the great necessity in puddle tanks of ramming the earth hard outside the puddle; as, if this were not done, however well the tank might be built, it would not be water-tight.

Mr. W. J. WARNER (South Shields) said the only remark he had to make was that these instances showed the necessity of boring to see really what base the superstructure had to rest upon.

Mr. H. WOODALL (Leeds) said extraordinary as it might appear to build a wall upside down, as was the case in one of the illustrations given, something almost analogous to it was not unfrequently done until late years. At Leeds there were a number of gasholder-tanks, the piers of which only started half up the depth of the tank instead of being built from the bottom. The effect of this had been that in three holders, having 36 columns, not less than 50 per cent. of them were broken. In one case, out of 12 columns, only 2 of them were sound, so that the holders were now dependent on about six $\frac{3}{4}$ -inch bolts to each column. As a matter of course, all the framing of the holder would have to be pulled out, and wrought iron substituted for it, on account of this very stupid error.

Mr. R. O. PATERSON (Cheltenham) said he had been much struck with one remark in the paper, where Mr. Livesey said it should be remembered that a tank rendered with a coating of cement must have a strength in the wall sufficient in itself to resist the pressure of the water inside. He would grant this; but if it were a tank built without puddle, did not that militate against the theory of dispensing with puddle? because if the stability or tightness of a tank built with a rendering of cement on the face of it, and having no puddle behind, depended on the stability and strength of the wall, was it not, as matter of ordinary precaution, advisable to put puddle behind it?

Mr. S. RUTTER (Brampton) asked Mr. Livesey whether, in the 1862 tank, with a little gasholder by the side of it, there was not some 5 feet of water left in the small tank?

Mr. LIVESEY said that was so.

Mr. RUTTER said that a tank his Company made was built in the chalk without any puddle; though tanks in the North were generally built with puddle. His were built in brick-work, and then rendered over with cement, and they were quite sound without puddle.

Mr. C. GANDON (Sydenham) thought Mr. Livesey could hardly have meant that the walls of a cemented tank ought to be built sufficiently thick to support the pressure of the water inside it, supposing they were unsupported by the weight of the backing. The earth backing in the tank without puddle had the same duty to perform as with puddle; the only difference being that the pressure of the water was all inside the tank in one case, whereas it passed through the wall in the other, and was exerted on the puddle. If the earth were well rammed in behind the tank, even without puddle, it would perform a considerable office in resisting the pressure of the water.

Mr. PATERSON said he feared he had not made himself quite understood. Having a puddle backing there was a yielding surface which, if the wall did open a bit, would be sufficiently elastic to enable it to give without opening sufficiently for the water to pass through; but, in the case of a concrete or brick-built tank rendered with cement, one crack was fatal to the tightness of the tank.

Mr. CORBET WOODALL (London) said he did not think it was to be regretted that the experience of many of those present did not enable them to cap the illustrations Mr. Livesey had given, and to recount more examples of things to be avoided. He was struck with the point to which Mr. Paterson had drawn attention—whether, a tank being rendered, its soundness was dependent on the rendering, or whether, backed by puddle in each case, the putting in of backing behind was of equal importance. The pressure of the water came to the backing in either case, and in either case it should be attended to

most carefully. One other point which also struck him was the reference made to a practice too common, of making the excavation too small for the footings. He had known many cases where the contractor had done his utmost to leave the trench as much smaller as the footing represented, in order that at the end he might undercut the backing, and put the footing in that way. A more objectionable practice could hardly be, whatever the character of the ground in which the work was carried out. A further point was as to the withdrawal of the runners. Mr. Livesey said that when they were withdrawn there was a space left behind, which was sometimes not filled in, and which was liable to leave weak places behind the wall. But this need not be the case if proper care were used. The runners should only be withdrawn very gradually and as the backing was put in. The operation should be carefully watched. On the other hand, it was very undesirable to leave either runners, poling boards, or anything else, in the excavation, if it could be avoided. He was amused at the illustration his brother had furnished of what might be done in the matter of framing. It hardly came into the discussion on this paper, but if it was found that a not too strong gasholder framing with 12 columns, 10 of which were broken, would stand, did it not suggest rather wild ideas as to what might be done in the way of very light framing?

Mr. MORTON said the trenches ought to be wide enough on the inside to do everything required; but in the case of excavating in clay, for instance, where there was to be a puddle tank with a concrete wall, he thought the outer diameter of the trench ought to be exactly the outer diameter of the wall, and there was no objection whatever to carefully cutting a toe in the solid clay about 18 inches or 2 feet, to give a base to the wall. It was much better than cutting the trench out all that much larger, at an extra expense, and the risk of not getting the backing in perfectly solid at the lowest part, where the greatest pressure was. With regard to Mr. Henry Woodall's mention of the walls being made with the piers carried up as off-sets, he did not know that it was very objectionable if done with care. At the present moment he was constructing a concrete tank, the wall of which at the bottom was 5 feet thick. The trench was excavated to the exact size, filled in with solid concrete in the clay, and the piers for the standards were 6 ft. 6 in. wide, which was a projection of 18 inches from the 5 feet. He did not anticipate that the slightest harm would come to the tank from so doing.

Mr. G. B. IRONS (Gosport) desired to thank Mr. Livesey for having given the members of the Association the benefit of the mistakes he had described. As to the question of the withdrawal of the runners and the width of the excavation, he (Mr. Irons) thought that the engineer of the works should always maintain absolute control over the whole proceedings of the contractor, so that he might be able to cause him to excavate to whatever width he thought necessary, and to withdraw the runners gradually or leave them in; though no doubt it was very objectionable to leave timber in the ground where it might rot, and subsequently cause subsidence of the soil. He should like to know what particular kind of clay was used, as a great deal depended on the quality of the clay employed.

Mr. CORBET WOODALL wished to add a word of explanation, as he did not think Mr. Morton quite followed his point. He was only referring to putting in the backing. He was at the present time constructing a tank where he really followed Mr. Morton's advice. At the Kennington Lane Gas-Works the outer diameter of the trench was the outer diameter of the wall; but where backing was to be put in, it was there, in his opinion, that it was advisable to dig the trench out the whole width of the outside of the footings of the puddle.

Mr. WARNER said his practice had been the same as Mr. Morton's. He only excavated to the outside of the outer wall, and then cut away for the footings.

Mr. LIVESEY, in reply to the remarks that had been made, said, with regard to rendered tanks, the tank he first constructed at the South Metropolitan Gas-Works, which had no clay puddle at all, had cracked in five or six places. He attributed this to the earth backing; for, although it was put in as solidly as possible, still it yielded sufficiently to allow the tank to open to a very slight extent. In the tank just built they had put in a number of iron bands $3\frac{1}{2}$ inches by $\frac{1}{2}$ -inch, the wall was rather thicker, and great attention had been paid to the backing; and he had good hope that it would not give way at all. The concrete was filled in solid to the height of 20 feet, to avoid the necessity of backing. In this he agreed with Mr. Morton. He also agreed with him that it was best to cut under for the footings, where it could be done, as in the London clay, but certainly not in sand or

gravel. In his own case, on chalk, no footings were required, the chalk being perfectly solid. Mr. Rutter's remark about tanks in chalk was quite correct. In chalk or rock there was something solid, and all that had to be done was to make the excavation, put in the concrete up to the chalk, and render it. The chalk could not give way. With regard to the puddle backing, it should be remembered that if there was puddle behind the tank wall it was not, perhaps, so important to fill in the backing in quite so solid a manner, because the puddle itself was a semi-fluid, and its own weight and pressure would close up cavities. The spaces behind the runners, as Mr. Woodall had said, ought to be filled up, but where there were runners in something like solid clay, it stood when they were withdrawn. But the tank he first referred to, where the great disaster happened, was in loose gravel, and the instant the runners were withdrawn the gravel fell in. The clay in the Old Kent Road was the best he had ever seen—the Peckham clay; not the blue London clay, but very strong yellow clay. Where they had to build tanks in the London or other clay, he should say let them be puddled; but where they had to purchase the puddle, reckoning the expense of it in the first instance, and the trouble involved in putting it in, and the risk of its not being sound at last, there was quite sufficient to decide him to do without it.

The PRESIDENT said they would all agree that the paper Mr. Livesey had read was one of the most valuable contributions the Association had ever had. It was said that people learnt more from failure than success. As Mr. Morton had remarked, it was for the members to take such lessons to heart, and avoid the disasters that had been pointed out, which arose in some cases from mismanagement, and in others from unfortunate circumstances.

(VIII.)

A NEW ARRANGEMENT FOR CONDENSATION, AND PREVENTING OSCILLATION CAUSED BY THE EXHAUSTER.

By Mr. J. SOMERVILLE, of London.

A quarter of a century ago it was thought quite right to prolong the contact of the gas with the tar from the point of distillation to the end of the condenser, or until the gas had attained the same temperature as that of the atmosphere. It was also thought that the gas absorbed a portion of the lighter or more volatile hydrocarbons contained in the tar, and so added to its illuminating power. Probably this was the result of the contact for the first quarter of the time; but for the rest, or after the temperature went down to about 90° Fahr., the heavier portions of the tar re-absorbed the light-giving constituents of the gas.

In more recent practice the tar has been taken off as soon as possible after leaving the hydraulic main, allowing only the gas and ammoniacal liquor to travel together; thus preventing the tar from having any influence on the gas, but allowing the liquor, flowing in contact with the gas, to absorb a percentage of the sulphur compounds, consequently reducing the amount of lime generally used. Modern arrangements have been proposed to allow the tar to fall into a separate vessel near the hydraulic main, and, by means of heat, to vapourize the most volatile of the hydrocarbons, and allow these vapours to pass along with the gas, while the heavier portion of the tar runs off to the tar-well.

While this complication of apparatus and the necessarily increased attention required in the carbonizing department are undesirable, there can be no doubt about the advantages of separating the tar from the gas as soon as practicable, for it is now well known that the cold tar has a very destructive influence on the olefiant series, or light-giving constituents of the gas, and that it is well to separate the lighter from the heavier tars; that is to say, as soon as possible remove the tars having a density—according to the admirable table of the late Dr. Letheby—of over .900 specific gravity, and a boiling-point of 180° Fahr., and allow the lighter vapours below .900 specific gravity, and a boiling-point as low as 130° Fahr., to pass with the gas. The lighter hydrocarbon vapours give up their illuminating properties, and so enrich the gas by prolonged contact with it.

The object of this paper is to describe a new, simple, yet effectual arrangement for this purpose designed by Mr. Livesey, and erected last year at the Old Kent Road works of the South Metropolitan Gas Company. The arrangement is shown in transverse section in the accompanying engraving (Fig. 1), where, as the gas issues from the retorts, it passes up the ascension and bridge pipes, but instead of entering a hydraulic main by a dip-pipe, as in the usual manner, it still further ascends by a second ascension-pipe, while the heavy

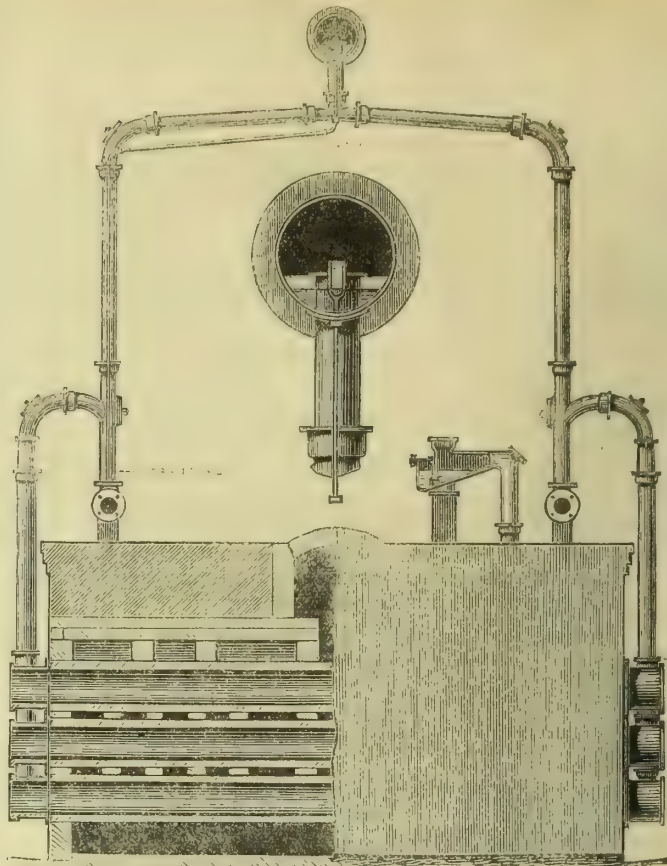


Fig. 1.

tar, from the point where condensation commences—viz., the turn of the bridge-pipe—is received into a 6-inch pipe, which occupies the usual place of the hydraulic main. This tar-pipe also receives the heavy tar from the second ascension-pipe, and each pipe being sealed about 6 inches prevents the gas passing from one retort to another. The tar flows off to the tank, while the gas goes on to a receiving main, and the ascension-pipes uniting in the centre, enter this main at the bottom by a 4-inch pipe. The receiving main is made of light wrought iron, in convenient lengths, 18 inches in diameter, and is continuous throughout the length of the retort-house. The 4-inch pipes from each retort project 4 inches into it, and are each fitted with a light faced valve, balanced on the turned edge of the pipe, and kept in place by a forked bolt, through which the tail of the valve passes, thus dispensing with hinges or spindles, which are liable to clog. The valve has a rim 1 inch deep, which, when closed, dips $\frac{3}{4}$ inch into the liquor contained in the main, and ensures a perfect seal, while the retorts are being charged. A by-pass throttle-valve, actuated by a small gasholder, is provided to regulate the vacuum in the receiving main. This is found indispensable when working with and without dip-pipes. The gas and ammoniacal liquor pass together along this main, descending by the foul main to the condenser. To ensure that an inch of ammoniacal liquor shall always separate the tar from the gas in the receiving main, an overflow-pipe is provided every 10 feet, by which the tar is drawn off from the bottom into the tar-main. We have thus an arrangement of fractional condensation. The temperature at the bridge-pipe being about 150° Fahr., half way up the second ascension pipe it is 130° Fahr., half way along the horizontal pipe it is 110° Fahr., and on the top of the receiving main it is from 92° Fahr. to 95° Fahr.; at the inlet to the condenser it is 80° Fahr., and at the outlet the gas is the same temperature as the atmosphere. The tar collected in the 6-inch tar-main has a specific gravity of 1.275, and that in the receiving main 1.150, or $1\frac{1}{4}$ lbs. per gallon lighter.

In connection with the condenser is a balanced gasholder, situated between the outlet of the condenser and the inlet of the exhaustor, to prevent the oscillation caused by the exhaustor from affecting the retorts, and at the same time providing a large chamber for the repose of the gas, so that it may further deposit any tarry matter, which it does to a considerable extent. The illustration (Fig. 2) of this balanced and compensating gasholder (drawn partly in section and partly in elevation) shows the arrangement. It is an annular wrought-iron tank 30 feet in diameter and 15 feet deep, erected over a concrete tank 30 feet in diameter and 15 feet deep, sunk in the ground, and both divided into two compartments, the lower one by a concrete wall, and the annular one

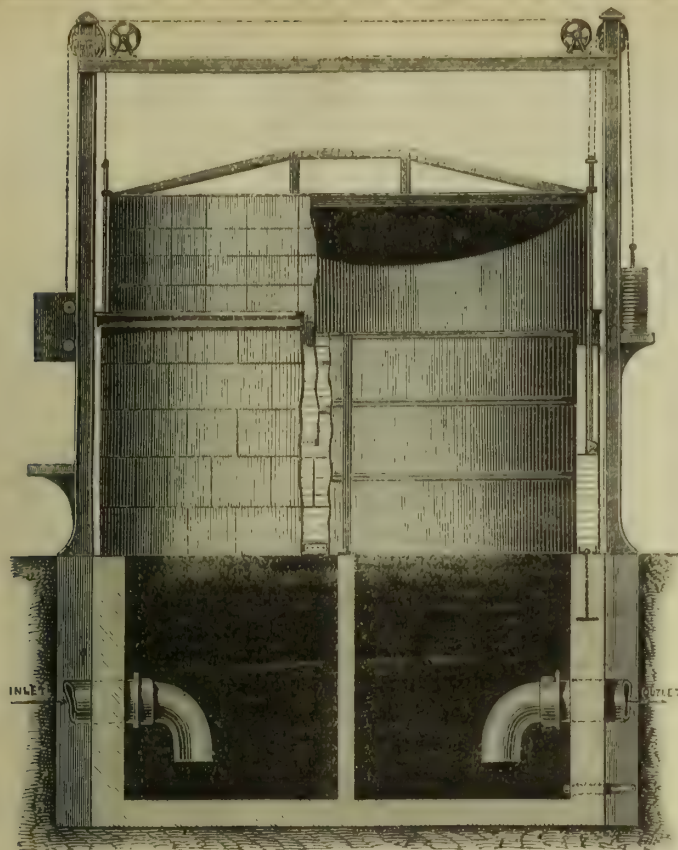


FIG. 2.

by a sheet-iron division-plate or diaphragm; the height of the iron tank making two chambers, each 30 feet high, and an area of 350 square feet. The gas entering at the bottom from the outlet of the condenser, through a 30-inch main, equal to an area of 5 square feet, slowly ascends, and passing over the division-plate, descends to the bottom of the second chamber, and makes its exit through a 30-inch main to the exhaustor. We have thus a very complete arrangement for condensation.

The balanced gasholder works freely in the annular tank, its normal position being adjusted about half way. The adjusting weight is a tank of water, which may be added to or drawn off, thus allowing of the greatest facility in regulating the required vacuum; and when a number of retorts are slacked out at one time, the holder compensates at once for the difference, until the exhaustor governor feels it, and reduces or increases speed, thus preventing the usual racing. Should the exhaustor break down or stop from any cause, the holder slowly rises, maintaining the vacuum for about 9 minutes, thus allowing sufficient time for a man to open any valves, &c. When the holder reaches the stops against the top girders, the balance-weights ground at the same time; the pressure then increases up to 18 inches, when it blows at the bottom, thus preventing undue pressure on the retorts, and acting as a safety-valve. When the exhaustor is again started, the holder slowly descends to its normal position of half way in the tank.

It is found by this arrangement that no oscillation takes place beyond that which is due to the dips in the hydraulic main. The holder absorbing and compensating for the action of the exhaustor, allows of a free flow of gas from the retorts without the usual fluctuating pressure and periods of pulsation, which go far to cause the formation of carbon on the retorts, and other disadvantages.

The apparatus has not been sufficiently long in operation to allow of any authoritative statement of results to be obtained, or any comparisons to be made of the benefits derived from its use, beyond the fact that oscillation is prevented, and that there is an increased condensing power obtained, both for tar and ammoniacal liquor. The liquor taken from the large chambers of the tank is 30 oz. strength, and has a specific gravity of 1.075.

I trust that my brief description of this new arrangement may prove of interest to the members of the Association, and that the benefits derived from its use may be appreciated.

Discussion.

Mr. G. E. STEVENSON (Peterborough) said that at the commencement of the paper Mr. Somerville stated that the contact of tar with gas prolonged in the foul main or condenser tended to absorb gases of the olefiant series; but it seemed

to him there must be a mistake here. It would no doubt absorb the lighter vapours of the benzole series, but he should like to know the opinion of some one better acquainted with the subject than himself as to the question of the olefiant gas, which it seemed to him could hardly be absorbed at all by the tar. In the distillation of tar they did not find any gases of that series developed.

Mr. J. ELDRIDGE (Richmond) asked if there were any check against stopped pipes.

Mr. S. HUNTER (Salford) said there were certain subjects uppermost in the minds of gas managers, as mentioned in the President's Inaugural Address, and one of these was no doubt this very subject of condensing and carburetting gas. It appeared to him (Mr. Hunter) that if they went fully into the merits of the paper just read, they would introduce a great deal of matter which might be interesting to them for some hours to come, because it evidently bore on a great many things recently introduced to their notice, of which perhaps the most important was the analyzing process of Aitken and Young. It seemed to him that on some points they were agreed, but that on others they were in considerable doubt, and there remained matters for further investigation. If it were possible for them to carry the analysis of their own minds to the extent they did some of the mechanical contrivances, they might be able to separate the points on which they were agreed from those which required further consideration. If he gathered aright the tone of the meeting, and the tone which prevailed in the correspondence and articles in the JOURNAL during the past few months, they were agreed that there was a point at which the tar liquor and gas ought to be separated, but the doubt was at what temperature this separation was to be effected. Mr. Somerville had introduced Mr. Livesey's mode, and it indicated the temperature at which gas was taken away from the retorts and the point at which it was separated from the tar liquor, as well as the process of doing it. He thought the principle was pretty much the same that was followed in other modes he had been referring to; but one point which struck him—a point which had been put foremost in the articles in the JOURNAL, written by Mr. R. H. Patterson—was the separation of the heavy oils and "sooty" or carbonaceous matter from the gas. If he understood this process aright, one object in view was the separation of what Scotchmen called the "soot" and the heavy oils from the gas. Until this was settled there was a certain point of weakness in these processes, and he did not clearly gather that in the arrangement shown there was any mode of bringing about this end. It appeared to him that it was an admirable arrangement for separating liquid matter from the gas, but did not go beyond this, and did not seem to effect the separation of the tarry or "sooty" matter which was suspended in the gas. They certainly wanted a method for preventing oscillation on the exhaust, but the plan suggested was not one they could all adopt. All managers could not put down a 30 feet by 15 feet holder; but wherever it could be adopted, if the exhaustor could have a mass of gas like that to pull from, there must be a great equalization in the exhaust. In his own works he had adopted an arrangement which, though not efficient, had the same object in view. He had put down a large cylinder, and thus allowed the exhaustors to pull from a very large volume of gas. The apparatus shown by Mr. Somerville went beyond this, because it was capable of movement under varying conditions, and this no doubt reduced the oscillation to a minimum. They still required, however, a more perfect separation of the heavy oily or tarry matters from the gas. He understood Pelouze and Audouin's patent to be designed for this purpose; but the Aitken and Young process was better still, for it not only separated the heavy oils, but presented to the gas the light oils, which, when the heavier ones were removed, the gas was more capable of retaining. As this was evidently a matter uppermost in all their minds, it was possible that by their next annual gathering he might be able to detail some actual results.

Mr. D. B. PEEBLES (Edinburgh) said he should like to know whether there was any lessening of the deposit of carbon in the retorts since this plan was adopted. He asked this because some years ago, at Alloa, a Mr. Boyd adopted the plan of taking away the seal from the dip-pipes in the hydraulic main, and worked with some of his retorts unsealed and others with a seal. He then found that the oscillation produced by the ebullition of the gas through the watery tar in these retorts gave very much more carbon deposit than in the other ones. He mentioned this to Mr. Young, and he immediately, in the usually quick, ready way with which he laid hold of any new theory, went home, and in a small experimental apparatus produced oscillation which

led to a deposit of carbon in very large quantities. The appliance described in the paper seemed the first practical method of entirely taking away this oscillation, and he should like to know whether there had been any lessened deposit of carbon in the retorts in consequence.

Mr. FRANK LIVESEY (London) said he might give a little further explanation on the subject. There was a small main running on the top of the retort-benches, and connected with the two ascension-pipes shown in the drawing, and which received the very heavy and thick tars only—so heavy that it was somewhat difficult for them to flow. In the upper main was again collected tar which was thin and fluid, and floating upon this was always kept a certain quantity of liquor by the arrangement explained by Mr. Somerville. The plan was not thoroughly complete, because this thin tar, according to present ideas, should be exposed to some higher temperature, and what vapours could be obtained from it should be put into the gas. Still the arrangement was so far complete, and was capable of adaptation to further improvements. The thick tar which could be of no further use was taken away at once, and the thin tar could be conveyed into another main and subjected to heat, by means of steam or otherwise, and the vapours driven off into the gas.

Mr. W. CARR (Halifax) said this matter brought them face to face with the question of the contact of gas with tar; and the paper just read was a valuable contribution on the subject. But his object in rising was not so much to discuss the paper as to ask a question with reference to the lecture of the previous evening. He wished to know the specific gravity of the tar experimented upon in the series of experiments described by the lecturer, and by which the somewhat surprising results then detailed had been obtained. If Mr. Morton could give them this information, it would be a valuable addition to the discussion of the subject, and would add to the usefulness of the information laid before them the previous evening. With regard to the paper itself, he had the pleasure of going through the South Metropolitan Gas-Works a short time ago, and of seeing the apparatus just described; when the question struck him as to the stoppage of the ascension-pipes, because if they did stop at all they would be rather awkward pipes to clean out. He was very much troubled with the stopping of the ascension-pipes in his works, partly from the friable nature of the coal used, and the peculiar manner in which the gas came off in carbonizing. He was afraid that at Halifax with pipes like those they would have great difficulty in keeping them clear.

Mr. R. MORTON (London) said it appeared by the drawing that there were two ascension-pipes to each retort, but he believed to a great extent this was being done away with. He should like to know whether the diagram was correct; and, if so, whether it was found that the seal being done away with, the gas went up the two ascension-pipes in anything like equal proportion, or whether it went sometimes one way and sometimes another. With two ascension-pipes to each retort and a seal at each end, they often found the gas went up sometimes on one side and sometimes on the other. It was thought that this arose from a little inequality in the seals. The subject of the contact of gas with the tar was dealt with in this apparatus; but it appeared to him that in the large vessel there was considerable contact of the gas with the tar through the sides of the gasholder, which at this point was supposed to be cool, and might deteriorate the quality of the gas. Mr. Livesey had had these large cylinders in use without a compensating arrangement; but he (Mr. Morton) did not think they were put up with any idea of affording compensation to the oscillation of the exhauster, but to give the gas a rest on the way, and allow it to deposit some of the solid particles left in it. He did not think Mr. Hunter could have expected to find any difference in the oscillation by simply putting in the cylinder without a compensating arrangement, for he did not find that cylinders of any size between the retorts and the exhauster made any difference in this respect. As to Mr. Carr's question, he could not tell him the exact specific gravity of the tar; but what Mr. Greville Williams brought before them the previous evening was only part of a series of experiments he was conducting, which he hoped at some future time to be able to lay before the Association with all the details. He believed they would be very interesting, and would determine some of the points which were at present not very clear. What he had done as yet was simply to ascertain by an excessive contact of gas with tar what the difference in illuminating power of the former really was, and this was explained the previous evening as something like 2 candles. The tar used was simply taken from the store tank.

Mr. GEORGE LIVESEY said there was one point that Mr.

Somerville had omitted. He should have said that this was a joint business—for his brother, Mr. Somerville, himself, and the foreman had all had to do with it. The question had been raised about the pipes stopping up. He might say that when they were working great heats, as they did with their new furnaces, the pipes stopped very much indeed, but the stoppage all took place in the ordinary position, below and at the first bend. The upright pipes above the arch-pipes did not stop at all. They were now going to try another plan of dealing with the tar. In the tar-main, as shown, the tar was so viscid that it would not flow at all freely; but the whole thing was experimental, and merely put forward for what it was worth. Their last idea was to put in place of the bridge-pipe a large pipe sloping downwards, with an opening at the bottom, connecting it with a trough for the tar. This would not be absolutely air-tight, but would be covered over with plates, so that in case the exhauster stopped at any time an outflow of the tar would be prevented. Mr. Morton was quite right. His (Mr. Livesey's) object in introducing the large 4-feet tubes was to have the thicker part of the tar deposited before reaching the exhauster, and the balanced gasholder was an amplification of the old idea.

Mr. W. FOULIS (Glasgow) said there had been a great deal done in Scotland in carburetting gas, and the object had been to take away the heavy tars, which, no doubt, did dissolve the benzole vapours at such a temperature as would leave these vapours in the gas. But the great difficulty in his mind, and the great question to be considered, was, after the gas had been saturated with these vapours, was the gas perfect? On this point there was still a doubt left in his mind, for it seemed to him that it was more like charging atmospheric air with the heavy vapour, which was deposited on the first change of temperature. With regard to preventing oscillation in the retorts causing a small deposit of carbon, he tried a few experiments some time ago. They had two settings of seven retorts each working alongside of each other. In the one bench they had the ordinary dip-pipes, and in the other they had dip-pipes with small holes round about, in order to give the same average pressure, yet so as to prevent oscillation. They kept these two settings working for several months, and at the end of the time the retorts in each setting were in the same condition with regard to carbon; so that, whatever might be the cause of the deposit of carbon, he was inclined to think that oscillation or pulsation of the gas in the retorts had not a great deal to do with it.

Mr. R. MITCHELL (Coatbridge) said he could confirm what had been said about oscillation. Two years ago he made experiments with reference to the dip-pipe, following the plan Mr. Foulis had mentioned, and the oscillation in the retorts was scarcely perceptible on the pressure-gauge, but he was still as much troubled with deposits of carbon as before.

Mr. SOMERVILLE, in reply, said he always thought it was the olefant gases which afforded the light-giving properties to gas, and he found by experiments with the thick heavy tar Mr. Carr had mentioned, from the 6-inch main, that it was of a specific gravity of 1.275, or 12 $\frac{3}{4}$ lbs. The very heavy thick tar was taken off first, and in passing 16.5-candle gas through three washings of it, the gas was reduced to 12.5 candles. He had also experimented on it by passing gas through the tar collected in the receiving main, which had a specific gravity of 1.150, or 1 $\frac{1}{4}$ lbs. lighter, and it had no effect upon the light-giving constituents of the gas. The previous evening Mr. Greville Williams touched on a similar subject, and he (Mr. Somerville) should have liked to ask him what kind of tar he used, as he expected it was ordinary tar taken from the tar-well. He had an unfortunate experience in Dublin with reference to the carbonizing of the Mackenzie's mixtures of oils and tars, and he would advise his brother managers to be very cautious how they heated tars and then passed the gas through them. His experience was that although they passed the condenser and the station-meter, they separated, and would deposit again underground the hydrocarbons taken up, and would not carry them forward to the consumers burners. He had lost as much as from 3 to 4 candles in three-quarters of a mile of 36-inch main between the works and the testing-station with these oils, which were of similar specific gravity to the tar. As Mr. Livesey had explained, they were going step by step, and if they found by-and-by that the vapours were likely to add some light-giving property to the gas, it would be a very easy matter to arrange the apparatus for it. At present what they wanted to do was to get rid of what had been described as their "nasty, dirty, heavy tars," and keep them from coming into contact with good gas, as he was of the opinion that "evil communications corrupt good manners." They had had some stopped ascension-pipes, but not very many, and

not until they had generator furnaces. Then they had to get water-jackets, and tried several things, and were now putting up a little different arrangement. With regard to the compensating holder for reducing oscillation, the retorts they lighted up last year had not shown the slightest appearance of carbon on them, and had not been scurfed once. This was a different experience from that of Mr. Mitchell, and he could not understand how it was that that gentleman still had the same amount of carbon on his retorts after the oscillation was reduced. Mr. Morton said, "Would not the gas in the holder come in contact with the tar?" but he (Mr. Somerville) must remind him that it made all the difference what the specific gravity of the tar was. It did not matter about the tar of light specific gravity coming in contact with the gas. At the same time the tar in the holder was partly covered over with liquor which was nearly of the same specific gravity as the tar.

The PRESIDENT said it was very evident that the plan that had been described to them was a step in the right direction; but it was also apparent that more remained to be done. It had been pointed out by one speaker that what they had to aim at was to establish contact with the gas and tar under certain conditions of temperature, but also—which was of no small importance—to determine when this contact should cease, and to separate the heavier portions of the tar as soon as possible. This latter was partially effected by Mr. Livesey's arrangement, as proved by the specific gravity of the tar drawn from the first receiving main; but it was evident that the process required to be carried a little farther. Mr. Morton had pointed out the undesirability of contact as promoted in the balanced gasholder, when the tar was comparatively cool. Mr. Somerville had answered this by saying that contact with tar of such light specific gravity would not injure the gas. He (the President) thought, however, that the question most naturally arose, how was this tar made? Was it not by union of the heavy particles carried forward with the lighter naphthas, the presence of which, could it be secured, would materially enrich the gas? Their aim should be to promote the separation, at as high a temperature as possible, of as much as practicable of the heavy carbon particles of the tar. To a certain extent this was done by the arrangement before the meeting, but more remained to be effected.

(IX.)

STANDARDS FOR ESTIMATING ILLUMINATING POWER.

By Mr. F. W. HARTLEY, A.I.C.E., of London.

The subject to which I request your attention on this occasion is an old one, but one which is of as much importance and interest now as it ever was; indeed, it may be said to be now of greater importance than in the distant past; inasmuch as testings for illuminating power are more general throughout the kingdom, are made in a more stringent and more refined manner, and, if statutory obligations are not met, entail penalties, dissatisfaction among consumers, and bickerings between gas companies and corporate bodies; causing discomfort to directors, and more especially, perhaps, to their engineers and managers.

That the method by which the illuminating power of coal gas is ascertained should possess, as far as is possible, the characteristics of accuracy and of constancy in indication of values, no one will dispute, and that such should be the case is of the highest importance to gas companies, for so long as the method pursued is one which is liable to fluctuations, which sometimes cause the value of the gas to be under-estimated, and on occasions to be over-estimated, so long it will continue to be a necessity for companies to make gas of 1 or $1\frac{1}{2}$ -candles greater illuminating power than mere legal obligation requires. This necessity in many instances involves the use of a considerable percentage of cannel coal, which might probably be dispensed with if the tests were made under conditions of a more certain and absolute nature.

I do not wish it to be supposed for a moment that I am an advocate for the reduction of the illuminating power of coal gas to the lowest statutory limit in any case; for companies best serve their own interests as well as those of the public by supplying gas of the highest quality which is consistent with possibilities and the rights of the shareholders. It is usual to do so now; but this is very different from being compelled to supply gas of superior quality in order to overcome and neutralize the evils which might arise under the present uncertain state of matters.

The estimation of illuminating power can only, in my belief, be satisfactorily arrived at by visual, or photometric

comparisons between the light of flames, one of which is adopted as a standard. Upon this point, Mr. Vernon Harcourt observed in a paper "On a New Unit of Light for Photometry," which he read before the Physical and Chemical Sections of the British Association in 1877, "that since the value of an illuminant depends solely upon such parts of the total force radiating from a flame as affect the human eye, no test of illuminating power can be satisfactory which does not depend upon vision; at least until it has been proved that some other effect of radiation . . . is for all flames in direct proportion to the effect upon the optic nerve—a relation which seems very improbable, and which cannot be established until some exact mode of measuring the visual effect has first been found."

At the time when the foregoing extract was read, the radiometer was still attracting a good deal of attention, and some scientific men, accepting too readily the theory that with this instrument light was the sole operating force, jumped rather hastily to the conclusion that the radiometer was capable of being used for estimating illuminating power. As, however, the instruments were made more delicately, and especially as their chambers were more perfectly exhausted by the aid of the most improved form of the Sprengel pump, it became manifest that heat rays operated as powerfully as light rays in producing the rotation of the vanes. I have a radiometer which is so sensitive to heat rays that its vanes will revolve with considerable speed if the hands are placed round, but at an inch distance from the instrument. This rotation has been produced by the warmth from the hands, even when they have felt cold if applied to the face.

The selenium photometer also excited the attention of scientists for a time, but all interest in it seems to have died out. With this instrument an electrical current of regulated strength was caused to pass through a piece of crystallized selenium, which was shielded from light in a closed box. The current then traversed a reflecting galvanometer, which was so adjusted that under the conditions specified the spot of light produced by the reflection of a ray from a burner fell upon the zero of the scale. The box was then opened, and the selenium exposed for ten seconds to rays of light, which caused a diminution of the resistance offered by the selenium to the electric force and consequent motion of the galvanometer. The extent of motion or throw of the galvanometer appeared to be inversely proportionate to the distance of the source of light, or as the square root of the illuminating power, and therefore analogous to the indications of an ordinary photometer. This was a very interesting instrument, as it served for one thing to show that crystallized selenium was an exception to the well-known law of electrical science, that the power of an electrical conductor diminishes as its temperature increases.

The jet photometer and the durability test are both admirable instruments by which, with due care in using, to obtain approximate indications of illuminating power; but both fail, it appears to me, to satisfy the conditions which are essential in a standard test. Some reasons why they must so fail will be found in my observations on the jet photometer in the paper entitled "Remarks on Photometry" which I had the honour to read before the Association in 1870.

The visual determination of the relations in strength of light from flames which are contrasted with each other seems, then, to be the only method which can at present be deemed satisfactory, and in order that results may be expressed in terms which may be generally understood, a standard is required. As you are all aware, the sperm candle burning (nominally) at the rate of 120 grains of sperm per hour has long been, and is now, the photometric standard in this country as well as in some others. This standard has been tolerably well denounced, and, to a certain extent, deservedly so, for it is uncertain in value, as the light it affords varies greatly under conditions which appear identical, and with the slightest disturbance of the surrounding atmosphere, while its lighting power bears no known ratio to the rate at which the sperm is consumed. Nevertheless, and with full experience on the matter, I have spoken and written in favour of the sperm candle as a standard; and although I shall presently bring something under your notice which appears to be greatly superior, I am not prepared to propose the immediate abolition of the candle standard. It will be needful to retain the candle for some time, certainly until scientific men and Parliament are satisfied as to the constancy and convenience of any proposed substitute. The candle standard is a troublesome one, because, unless candles are tried, examined, and the imperfectly burning ones rejected, grave discrepancies may arise. Even when all these things have been done, the results obtained from one pair are not to

be relied upon as indicative of what we must be content with—namely, average value.

In the long series of experiments which I have lately made, the extreme difference in the indicated power of an absolute 5 cubic feet per hour flame of 15-candle gas tested against 7 pairs of candles consecutively was 1.1 candles, but the extreme difference between 6 of these pairs was less than half a candle. On occasions when 3, 4, 5, and 6 pairs were consecutively used, the difference ranged from 1-10th to 6-10ths. In Table II. [see p. 1058] the error is greater, being 1.348 candles. These differences as given were existent after correction for rate. An important objection is that candles which burn near to the standard rate cannot always be obtained. I have had a batch of several hundredweight, in which the candles were almost perfection, while these have been succeeded by others quite useless for photometric purposes under any such limitation as a 10-grain divergence from the standard rate. I cannot resist remarking that it has been a subject of some amusement to me to find photometrists sending hither and thither for sperm candles to supposed makers, in order to find the best producer; in ignorance the while that the candles they obtain, if of pure sperm, were made by the same person as those which caused dissatisfaction. I only know of one maker of true sperm candles in London, and he takes almost a scientific interest in the production of such as are fit for photometry; for, commercially, the matter is far too small to be of any interest to him. That gentleman is Mr. Miller, of Westminster, and it is but justice to him to say that I am indebted to him for his willing aid in making samples when I have sought to produce satisfactory candles. Doubtless there are others who are under similar obligations. I would long since have had moulds made and candles 12 to the pound produced, but for the absurd stipulation in Acts of Parliament that the candles are to be 6 to the pound. Twelves could have their wicks more truly centred, would taper less, and might be more equal in density, for "head" in the mould would be obtained by very simple means.

Among the standards which have been proposed are—a mixture of hydrogen and olefant gases in certain proportions; the Carcel lamp of France (with which colza oil is burned); the sperm oil lamp of Mr. Keates; Mr. Vernou Harcourt's pentane gas; and the standard of Mr. Methven.

The original idea of a gas standard is revived by Mr. Harcourt, but in a new and better way. It is, so far as my experience with it goes, superior to the sperm candle; but notwithstanding my admiration for Mr. Harcourt, both as a gentleman and as a scientific man, and the respectful esteem which I entertain towards him, I am compelled by honest conviction to say reluctantly that I am not in love with his proposed standard. A new standard should entail little, if any, extra cost; should be portable, require little preparation, and demand the least possible time and trouble. To use again the expression I employed in 1870, I say: "Whatever be the future system of testing the illuminating power of coal gas, it must, in order to serve the interests of the consumers generally, be quite as facile in application as the present system, and be of a simple character, so as to render the test available, not only in the large towns and cities, but even in the smallest village in the United Kingdom in which gas is used."

It appears to me that Mr. Harcourt's standard fails to satisfy such conditions. In addition to the usual photometric apparatus, a 5 or 6 cubic feet gasholder is needed, besides an extra and delicate meter of very small capacity, an extra governor, and a special burner; these must be fitted up with a perfection, as regards soundness of pipes and joints, such as is rarely attained. Cost is therefore greatly increased, while portability is not, in a reasonable sense, possible. Three or four hours before a test can be made the pentane gas must be prepared—an operation occupying from 10 to 15 minutes, and involving an observation of barometric pressure and of temperature, and a calculation of the bulk of air to which a measured volume of pentane is to be added. When so prepared, the quantity of gas which results will, however, suffice for about a week's daily testing.

In respect to lamp standards, I am bound to say that the very large number of trials which I made with the Carcel lamp in the year 1867 indisposes me to put faith in any lamp with which fatty oils are burned. I say fatty oils, because some recent trials with lamps burning paraffin oil were indicative of great steadiness and of uniformity of lighting power. I have not had time, however, to make extended tests. The objections which I have to such lamp standards as have been used are that they require too much time and attention devoted to them; they must be kept in a state of perfect cleanliness; the wick must be renewed very frequently, if not on

every occasion of using (this last I deem essential with the Carcel); the wick must be trimmed with extreme care, and it and the chimney adjusted to the utmost nicety of exactness; and when all has been done there is no certainty that the rate at which the oil burns will not be greatly in excess of a standard rate. The variation in rate would be of no consequence were it not that, as my experiments show, the amount of light yielded increases sometimes in a much greater ratio than the consumption of oil. It is difficult to keep the consumption of the Carcel lamp so low as the standard rate of 648 grains per hour. Only on one occasion did I get the rate below—i.e., to 644 grains. Calculated to 648, the lighting power of the lamp was equal to 8.21 sperm candles. Increased rates of consumption gave different values when duly calculated for 648 grains—thus 10 per cent. increase in consumption gave 8.999 candles, or 9.5 per cent. increase in light; while 12 per cent. increased consumption gave 20.1 per cent. more light, or 9.86 candles power. In some few cases there was a marked reduction in light. In one case with 6 per cent. excess in consumption the value of the lamp was under 8 sperm candles. On every occasion the greatest possible care was exercised in trimming, adjusting, and using the lamps; for, although I have used the word lamp in the singular, I operated with two.

Sperm oil is unquestionably better than colza, as the former can be obtained of almost uniform quality, and does not thicken and become viscid, while the lamp devised by Mr. Keates possesses characteristics which tend to render combustion perfect, maintain the oil supply regular, and, as a consequence, the light emitted uniform in power; but whether this lamp would bear the test of severe crucial trial I cannot say, as it has never been in my possession.

Having stated what I deem to be the needful characteristics of a photometrical standard, and called your attention to the imperfections of the existing one, and also to the defects or inconveniences associated with others, I now come to that proposed by Mr. John Methven in the paper which he read before the Association two years since. Some of the members will possibly remember that at that meeting, and afterwards in letters to the JOURNAL OF GAS LIGHTING, I disputed the possible correctness of Mr. Methven's assertion that "portions of the flames of gases of varying qualities, ranging in illuminating power between 15 and 35 candles, consumed so as to effect perfect combustion by similar burners, are equal in illuminating power." My reasonings were correct in principle, and so, of course, remain, but their weakness consisted in the fact that they were based upon an exaggerated idea of the differences in power of the light emitted by the various parts of an Argand flame; and although I carefully read Mr. Methven's paper, it failed to alter my impression. When I tried the instrument with rich and poor gas, I was convinced, and admitted my errors in a published letter.

After operating many months with this proposed standard, I am now able to speak about it with the confidence due to experience, and as at first I was its most active opponent, and, further, as it is always my desire, in matters relating to science and practice, to be right rather than by specious argument to attempt to show that I am right, I concluded that, in justice to Mr. Methven, I was bound on this occasion to come before you as an advocate for that which I at first condemned. I put myself, as it were, into a sort of moral pillory, and am content that you should, as I hope you will, assail me with all the missiles of argument which you can find, feeling as I do quite sure that in this Association I shall be safe from the rotten eggs of offensive expressions.

Mr. Methven's proposed standard consists of an upright screen with a "London" Argand burner fixed at a certain distance behind it, the screen having an opening or slot at a determined height above the level of the top of the burner. When in use the screen is made to coincide with the terminal point of the photometer-bar, taking up the position which the candles generally occupy. When properly applied the only rays which can impinge on the disc are those which pass from the flame of the burner through the slot in the screen. The slot may be varied in size so as to permit the passage of quantities of light varying from 1 to about 2.5 candles power; but I prefer at present that it should be of such dimensions as will allow of the passage of as many rays as are equal to the light of two average sperm candles—viz., nearly 1 inch long and $\frac{1}{4}$ -inch wide. This seems to be the size which best suits the burner. Provision is made for the ready use of candles as well as of the screen.

Having made and worked with a number of screens of different sizes, and with gases of different qualities, I fixed upon the screen indicated as F as most suitable. The slot in this is 9-32nds inch wide, and $\frac{1}{4}$ -inch long. This screen was

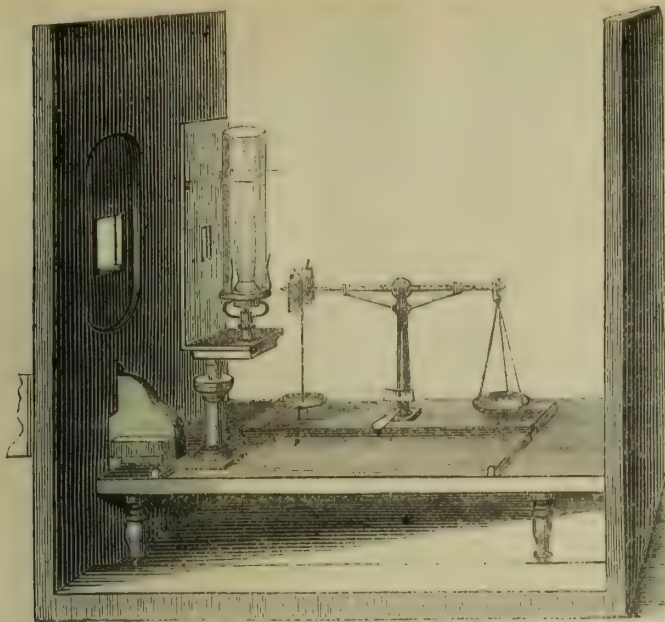


ILLUSTRATION SHOWING THE APPLICATION OF METHVEN'S STANDARD SCREEN TO A LETHERY PHOTOMETER; the Candle Balance being on Rails ready for the prompt Use of Candles in lieu of the Screen.

not fully satisfactory under the severe test of 35-candle gas. I therefore made four others, the dimensions of the slots of which were calculated from the results obtained with the screen F. Of these No. 3 proved to approach nearest to 2-candle power, and was adopted for the crucial tests; the others, however, were very near to it in power, as a number of trials showed.

Table I. shows the amount of light which appeared to pass through the slit of F in candle power with gases varying by candle estimation from 12.4 to 15.05 candles. The extreme variation of the power of the gas is 21.3 per cent., while the extreme difference between the value of the screen's power is 5.4 per cent. only. My conviction, however, is that the light through the screens was practically constant, although the height of the slot above the burner was greater than that afterwards decided upon as correct. The indicated variations were, without doubt, due entirely to the candles. My reason for stating this is that I used the F screen in making a considerable number of experiments with paraffin lamps and with gas-burners, and I found such harmony and consistency in the results as satisfied me that the standard light was uniform in power, or, if at all affected, only by temperature and pressure in the same ratio as the contrasted flames.

Table II. exhibits the results of tests with No. 3 screen at the height above the burner finally selected. It will be seen that with a 5 cubic feet per hour flame of common coal gas of 14.02 candles power, the difference in the photometric readings between a 3-inch Argand flame from the same gas, and from gas of 35.37 candles power, was only 0.7 per cent. The second series is set out more fully, and shows that the candles indicated the power of the common gas to be as low as 13.24, and as high as 14.588, a difference of 1.348 candles, or 10.11 per cent., while the screen used with common and canal gas gives an extreme difference of only 0.83 per cent., and a mean difference of 0.3 per cent. only.

Table III. is derived from results set out in Table II., and is somewhat striking, as it shows how much the power of screens may appear to vary as the lowest or highest power of the gas, as indicated by candles, is taken as a dividend to be divided by the mean of the indications obtained with a screen standard, ranging as they do with common gas from 1.8388 to 2.0197, and with canal gas from 1.8325 to 2.0124, the difference in the mean value between common and canal gas being, of course, the same, or nearly so, as in Table II.; any difference being due to limitation of decimal figures.

It is well for me to say that all the screens yet produced have been hand-made, and the size of the slots finally settled by photometric observation. It is my intention to form the slots with a perfect die of the correct dimensions. Lest, however, it should be thought that there is any grave difficulty in their production, I caused two other screens to be made, and they were compared with a 5-foot Argand flame, the value of which had been ascertained by three pairs of candles, as shown in Table IV. The difference in indicated illuminating power with candles is 0.92 of a candle, which is equal to 5.9 per cent. The screen renderings range from 8.1 to 8.18, or a difference of only 0.61 per cent. The last is a very small percentage, when consideration is given to

the fact that the screens Nos. 5 and 6 were, with intention, somewhat hastily made. Here again we find the apparent powers of the screens changing as we calculate the illuminating value of the opposed gas-flame by the several candles employed; the mean in this instance for No. 3 being 1.958 with common gas, as against 1.96 in the previous example—a difference of 0.2 per cent. Other screens have since been made slightly larger, and as, I believe, of 2 candles power.

It is important to observe that in all the earlier trials, chimneys 1½-in. × 6-in. were employed with the standard; but as with these a satisfactory 3-inch flame could not be obtained when the rich canal gas was used, a 2-in. × 6-in. chimney was afterwards adopted, and with advantage.

The evidence which has been adduced is, I think, enough to convince you that Mr. Methven's statement is true; but it may be asked—If it be the case that portions of the flames of gases of varying qualities, burned properly from similar burners, are equal in illuminating power, is it not also true, as asserted by Mr. Sugg, and I believe for the first time publicly, that the quantity of light yielded by Argand flames of the same length, but from different qualities of gas, is also equal, if the conditions be the same and the burners and chimneys are identical in size and character? To this I frankly reply—Yes, or very nearly so, in my experience; but the difficulty I find is in accurately defining the length of the flame, for, with all the burners I have tried, each flame terminates, not in a horizontal ring, but in an irregularly defined figure, approximating to an oval, inclined at an angle, and ever changing in shape; while the flame tends to rotation round its vertical axis to the extent of nearly a quarter of a revolution. These effects are due to slight disturbance in the surrounding air, and to vibrations. It has only been by patient waiting that I have at times obtained flames truly 3 inches in length, and only when all around has been abnormally quiet. Then the results have been very close. In other instances, although trouble was not spared, the discrepancies have ranged up to as high as 8 per cent.

No such nicety of adjustment is needed with Mr. Methven's standard, 1-10th or even 1-8th of an inch in excess or in deficit in the length of the flame is of little or no consequence. Neither is it of vital importance that the top of the flame shall be absolutely regular. Not that I suggest that any proper condition or needful adjustment should be disregarded. The burner should be of the best, the chimney and the screen clean, the adjustment of height of flame made carefully, and then examined from time to time. All these attentions cost little trouble, while the determination of the real power of the opposed flame may be made in a minute or two. One thing is important, as it always is in photometry—viz., to burn off the "dead gas" in the fittings before testing. If the perfectly ridiculous and patience-trying obligation did not exist, of adjusting the gas to be tested to the 5 cubic feet rate, the flame length of Mr. Methven's standard could be adjusted, the disc placed in the position required on the photometer-bar—that is, at 7, 8, and so on, for 14, 16, and higher qualities of gas—the micrometer turned on until the opposing lights were equal, a few observations made, the rate of consumption taken as indicated by the meter, and the whole operation completed within five or six minutes.

I have been hoping year by year from 1857 to see such changes made, that the value of gas should be ascertained by the quantity required to produce a certain lighting effect, and not, as now, the light given by 5 cubic feet. Whether the proposed standard will ever become a legalized one remains to be seen. I have done a duty in again bringing it under your notice, and it will be well for you to consider whether it is not worthy of your adoption and trial in daily use, for the time being, as a secondary standard.

In the first portion of this paper I have dealt with certain facts and particulars with which you are familiar, and have done so for two reasons—first, to make the paper as complete as half an hour's time in the reading would permit; and, secondly, that it might serve as a sort of *aide-memoire* for the purposes of discussion.

[For Tables, see next page.]

Discussion.

Mr. W. SUGG said he had listened with great pleasure to this paper, and it was very pleasing to hear Mr. Hartley retract what he had said with regard to Mr. Methven's test; but it was only to be expected that he would do so. He (Mr. Sugg) wanted, however, to say a word in favour of the sperm lamp proposed by Mr. Keates and himself as a standard light. All parliamentary standards must refer to something independent of gas; and feeling this strongly, and feeling also that candles were so unreliable—for he had compared

TABLE I.

Screen F too High above Burner.

Illuminating Power of Gas by Candles.	Apparent Value of Screen.
13.18	1.922
13.16	1.853
12.40	1.856
15.05	1.892
14.25	1.822
14.63	1.872
14.73	1.896
14.49	1.851
14.78	1.852
14.73	1.901
Candles (direct comparison)	1.917

Extreme difference shown for value of screen by candles, 5.4 per cent.

Extreme difference in value of gases used as indicated by candles, 21.3 per cent.

TABLE II.

Screen No. 3 in proper Position.

First Series.

Illuminating power of common gas	14.02
" " " " " "	35.37
Screen with common gas	7.10
" " " " " "	7.09

Difference, 0.7 per cent.

Second Series.

Illuminating power of common gas.	
By 1st pair of candles	13.24
" 2nd " "	14.588
" 3rd " "	14.58
" 4th " "	14.062

Average, 14.117.

Illuminating power of cannell gas	35.37 candles.
Screen with common gas	7.20
" " " " " "	7.20
" " " " " "	7.26
" " " " " "	7.19
Mean common gas	7.20
" " " " " "	7.225

Extreme difference by candles, 1.348 candles, or 10.11 p. ct.

Extreme difference by screen . 0.83 per cent.

Mean " " 0.30 "

TABLE III.

Values of Screen No. 3 calculated on Illuminating Power as indicated by Four Pairs of Candles. (Table II.)

Candles.	Cannell.	Common.
1st pair	1.8325	1.8388
2nd " }	2.0124	2.0197
3rd " }		
4th "	1.946	1.954

Average . 1.950 . . . 1.958

TABLE IV.

Comparisons of Screens with Common Gas.

Illuminating power of gas.

1st pair of candles	15.48
2nd " "	15.64
3rd " "	16.40

Average, 15.84.

Extreme difference by candles, 5.9 per cent.

Readings with Screens.

No. 3.	No. 5.	No. 6.
8.1	8.13	8.18

Extreme difference, 0.61 per cent.

Values of Screens calculated on Illuminating Power indicated by Candles.

Candles.	No. 3.	No. 5.	No. 6.
1st pair	1.911	1.904	1.880
2nd "	1.939	1.923	1.900
3rd "	2.024	2.017	2.005

Average . 1.958 . . 1.948 . . 1.928

them on a former occasion to an india-rubber rule—Mr. Keates and himself proposed adopting a standard light from pure sperm itself, unmixed with any other matter. With the makers of sperm candles, the great difficulty was to get a pure sperm; and, secondly, to make a mixture of it with wax or some other substance, so as to obtain a candle which would be homogeneous. The same with regard to the cottons, and the way in which they were twisted. This also produced uncertainty. But by taking sperm oil itself, and by using it in a lamp with a burner like the Argand, so as to produce a light equal to the gas about to be tried, there was no multiplication of errors in the observation. He had shown that if two candles were taken to test 16-candle gas, the slightest error was multiplied by 8; but if a flame of 16-candle gas was used, and this was compared with a 2-inch flame of a spermaceti lamp, that would give exactly 16 candles. The sperm lamp, however, did not succeed well when tried by the Commissioners appointed to test the standards, because they said it took too long to get into burning order—something like 20 minutes; but the moment it was in burning order it would go on for two or three hours without any sensible variation. The thing then required was that it should take less than 20 minutes to get it in order. The Metropolitan Gas Referees prescribed that the gas should burn for a quarter of an hour or so before the tester commenced making his examination. Therefore, if they lit up the lamp at once, and let it get into proper burning order—the candles would take 10 minutes, so that there was only 10 minutes difference—it would be in burning order by the time they were ready to take the observation, and the light was then constant and reliable. With regard to Mr. Methven's test, the standard burner of the Gas Referees must be used, because if another burner was taken, such as that used by consumers, where the air arrangement was a little different, the same accurate result was not obtained as by using the Gas Referees burner. Otherwise, Mr. Methven's apparatus was, for ordinary purposes, where there was only a variation of, perhaps, one, two, or three candles, a very good standard.

Mr. R. O. PATERSON (Cheltenham) said he could not quite agree with the opinion Mr. Hartley had expressed as to the inapplicability of the test proposed by Mr. Vernon Harcourt. If a reliable and correct instrument or means of measuring light could be applied, he hardly thought the little trouble necessary to make the appliance perfect could be urged as an objection to it. Mr. Harcourt had shown on more than one occasion that it was extremely easy and simple to make the pentane gas. If it took ten minutes or quarter of an hour once a week to prepare the gas which then gave a reliable and accurate test, the time thus occupied could hardly be urged against the system. He believed that it was quite reliable, and Mr. Harcourt had such confidence in it that he would allow the utmost liberty to be taken with his apparatus. It was not necessary to have a gasholder in the laboratory; and there was apparently no difficulty in the preparation of the gas, other than the few minutes necessary to fill the gas-holder with air, and add to it the measured quantity of the pentane, which was immediately volatilized. Whether this standard was likely to come into use was another question. He must say that, looking at the instrument of Mr. Methven, he (Mr. Paterson) was more inclined to doubt its applicability to the estimation of the illuminating power of gas than he was the adoption of the pentane test. What Mr. Sugg said about the burners showed that at the height at which the slit was fixed there might be variable amounts of light, and consequently the standard was variable. He should like to know what candles were to be taken as fixing the standard, for he could give candles which would show a difference of 2½ candles with the same sample of gas. The tendency appeared to be to depreciate the candle and fix some other standard; but they must all be fixed originally by the candle, and therefore the question arose which candle should be accepted as the standard by which to measure the new standard.

Mr. C. E. JONES (Chesterfield) said if they were to give up the old candles, they should be very careful what standard for comparison they adopted. It had been shown that there were sources of error to a considerable magnitude by the standards proposed in lieu of the candle, and he rose rather to express some doubt as to the extreme variations in the much-abused candles, and to exhibit an amount of confidence in them far above that shown by Mr. Hartley or Mr. Sugg.

Mr. T. NEWBIGGING (Manchester) thought it was generally admitted that the defects of the test candle were principally associated with the wick, and that the sperm itself, if used as a lighting medium without a wick, would probably give a nearer approach to perfection in testing gas than anything

else. It appeared to him that it was scarcely fair to test their weights and measures by their own weights and measures. For instance, they had inspectors going about the country and seeing that the weights used in trade were of the proper standard; but it would scarcely do for a person to keep two sets of weights on his premises in order that the one might be tested by the other. This seemed to him a parallel case to testing gas by means of their own and the same identical gas, and there was no doubt, as Mr. Sugg had shown, that, owing to the variable qualities of flames of the same gas, it was difficult, if not impossible, to obtain a proportion of any flame which would give a satisfactory test of the quality of another. The same objection did not apply to the use of sperm, pure and simple; and if Mr. Methven or Mr. Hartley, or any other experimentalist, were to contrive a wickless lamp, by means of which they could test gas with a proportion of sperm light projected through a slit, instead of gaslight, they would have a standard that would be much less objectionable, and one that might be expected to answer every purpose.

Mr. J. SOMERVILLE, following up Mr. Newbigging's idea of weights, said for some time past they had had in use, at the South Metropolitan Gas-Works, these three sets of weights, which he might call weights of brass, of lead, and of copper, representing the sperm candles, the pentane, and Methven's slot; and they found, in testing the gas, that all these standards or weights agreed very nicely. The pentane was as near as possible equal to the candles, and Mr. Methven's slot 1 inch long and 9-32nds inch wide, taken out of the centre of the flame of the same gas, was exactly equivalent to the sperm candles burning 120 grains an hour, and to Mr. Harcourt's pentane. The great difficulty was in getting the candles into order for testing, and making them reliable. There was a great deal more trouble, especially in extremes of temperature in summer and winter, in preparing the pentane, because the temperature had an influence on the vapour of pentane, so that it had to be corrected for temperature, &c. With Mr. Methven's slot it was perfectly easy. One could see at a glance the exact illuminating power of any gas, and without any preparation—it was always ready. To his mind there was not any difference in the three weights or standards, and he only wished the Legislature would sanction the Methven slot as a standard by which to test gas.

Mr. R. MORTON (London) thought Mr. Newbigging's argument about the weights was really more sentimental than anything else. Whether this became a legal standard or not, to gas managers who were obliged to test their gas two or three times a day, and had not much time to do it, a standard which was brought into use in a moment was of much greater value than one which required even five minutes to put into operation, and this was much more reliable than candles. It was no breach of confidence for him to say that those gentlemen who were inquiring for the Board of Trade into the standards used in estimating the illuminating power of coal gas, were going into this matter pretty fully, and he believed, so far, they were very pleased with Mr. Methven's apparatus.

Mr. HARTLEY said it was almost refreshing now-a-days to hear a good word said for the sperm candle, as Mr. Jones had in his remarks. He (Mr. Hartley) had used them for many years, and they seemed to act better in his hands than in some people's, and if he had, in the experiments referred to in his paper, pursued his usual course, he should not have shown such great differences as were indicated in the tables exhibited. If he found that candles varied unduly, he did not accept the indicated results. He exercised his own discretion, just as the testers did in Paris, where they used the Carcel lamp, although they were supposed to be strictly following the rules laid down by Dumas. In his paper, however, he had felt it to be his duty to give the results he had obtained, in order to show how far candles might differ as compared with Mr. Methven's standard. Mr. Newbigging's argument had been already dealt with, and he did not see the slightest reason why they should not weigh a thing by a certain quantity of itself. In using this weight (so calling the screen) any one could satisfy himself that he had the right quality and quantity on both sides. It might be suggested that gas managers could make their gas of low quality, and so use the screen as to deceive the public or the testing inspector; but no such thing could be done if the inspector had the slightest judgment in him, for the simple reason that as the gas went down in power the blue of the flame would reach the screen. He could see to the sixtieth of an inch whether the screen was in its right position or not in relation to the blue part of the flame. Mr. Somerville had confirmed some of the statements he (Mr. Hartley) had made. He had learned that a favourable result had ensued from trials with the screen at the South Metropolitan Gas-Works, and the lecturer the previous

evening also spoke in favour of the screen standard. With regard to Mr. Paterson's observations, he must remark that he spoke very reluctantly against the pentane standard, because he had been so much associated with Mr. Vernon Harcourt, and so much esteemed and admired that gentleman, that he scarcely liked to say a word in antagonism to any project of his. He (Mr. Hartley) had been a worker with the pentane standard, and had made the instruments Mr. Harcourt had put up and worked with; but he (Mr. Hartley) had unwillingly come to the conclusion that Mr. Harcourt's standard was scarcely the right thing. Photometric apparatus of the simplest kind was costly. Small gas companies obtaining Provisional Orders from the Board of Trade were compelled to procure a photometric apparatus, and the pentane standard meant an addition of something like £40 to the ordinary cost. Again, it could only be used by those who perfectly understood all that belonged to gaseous volumes, and unless the pentane gas were carefully made, there might be errors, and its preparation involved calculations. Now, there were many of their friends who hardly had time or inclination for such a thing as this; and, further, they must have all joints and pipe-fittings sound to an unusual degree. To put another case, supposing a gas company were going in for an Act of Parliament, and an expert were suddenly called upon to investigate the quality of the gas for the purpose of giving evidence before a Parliamentary Committee. He could not put a 5-feet gasholder in his pocket, and take it down with him and set it up. He might also only have a limited time in which to make his investigation. Mr. Harcourt's standard involved the necessity of one, two, or more days of preparation in order to get things in readiness. It appeared to him, therefore, that that gentleman's test did not possess the universality and promptness of application which was required in a new standard. He thanked Mr. Sugg for the kindly way in which he had dealt with the subject. He had spoken of the sperm lamp of Mr. Keates, which he had used, and he (Mr. Hartley) was prepared to admit that Mr. Keates's lamp was an excellent one. He was only sorry he had not the opportunity of using it. Still the general objections to lamps remained unanswered—viz., that they required a great deal of trouble, whilst the screen standard required none. The lamp needed preparation beforehand, and to burn about twenty minutes before it was fit for using. This he had no objection to, and so far he was prepared to believe with Mr. Keates and Mr. Sugg that the lamp was decidedly better than candles. But if they could have something simpler, which could be more readily applied than a lamp, why should they not have it, although they were measuring the value of a thing by a portion of itself? Mr. Sugg had also made some observations as to the proportion of error which might arise with candles. He said that if candles were used any errors were multiplied. This was perfectly true, and if he had established as a fact that the lamp was practically constant, such errors were disposed of; but he could not grant absolutely that in the use of lamps there might not be errors as great in their import as belonged to candles themselves. However, he was content to accept Mr. Sugg's statement. Mr. Sugg also said that Mr. Methven's standard required a standard burner. He might compliment Mr. Sugg on the adoption of the standard burner. It was so adopted in order to secure the advantage of it and the opposed burner being of the same character. But when Mr. Sugg said the ordinary burner could not be used with the screen, he was only correct to a certain extent. Whatever position was established for a particular burner remained effective for that burner; and hence he might take one of Mr. Sugg's consumers burners, and by mere alteration of the position of the screen render that burner as effective for the purpose as the "London" Argand.

(X.)

THE CHEMISTRY OF SPENT LIME.

By Mr. W. FOSTER, M.A., F.C.S., &c.,

Professor of Chemistry at the Middlesex Hospital.

Some years ago Dr. Voelcker made an analysis of gas lime, the result of which was published in the *JOURNAL OF GAS LIGHTING*. The figures of the analysis are given by Mr. Newbigging in his "Gas Manager's Handbook." I am not aware of any other published analysis of gas lime or spent lime, and as the specimen on which Dr. Voelcker worked was one which had been freely exposed to air for a sufficient length of time to admit of its being safely used as a manure, its chemical characters were not those of the fresh gas lime.

Lime which has been converted by carbonic anhydride into calcium carbonate is perfectly inert as a purifying

material. A few weeks ago, when the subject of this short paper was brought under my notice, I was informed that Mr. Robert Harris, of the Bow Common works, was employing a simple process for "revivifying" the spent lime obtained in sulphur purification. This led me to communicate with Mr. Harris, who at once gave me full information respecting the plan he employs. He also furnished me with various specimens of lime for analysis.

The essential character of this paper is an account of the spent lime obtained by Mr. Harris's method of working. At first I was under the impression that the lime was used as recommended by the Gas Referees—that is, for the complete removal of carbonic acid before the crude coal gas is treated for "sulphur compounds" by means of special foul lime. In this I have been mistaken. The spent lime on which I have made my experiments is that produced by Mr. Harris in his treatment of sulphur compounds generally. Before considering the nature of the spent lime itself, it is important that I should give an account of the crude gas before it reaches the lime purifiers. Before passing through the lime, the crude coal gas has been washed and scrubbed with water and ammoniacal liquor. The latter used in this instance is in the condition in which it leaves the hydraulic main and condensers.

Mr. Harris has made determinations of the carbonic acid and sulphuretted hydrogen present in the gas after it has been washed and scrubbed with the liquids named. The numbers obtained were as follows:—

Carbonic acid	2.3 per cent.
Sulphuretted hydrogen	1.3

I believe these numbers approximately represent the average character of the crude coal gas with reference to these gaseous impurities. The impure coal gas then passes direct into the dry caustic lime, where it loses carbonic acid, sulphuretted hydrogen, and "sulphur compounds" other than sulphuretted hydrogen. The lime purifier is kept working until the quantity of sulphur compounds at the outlet of the purifier is nearly as great as at the inlet. The lime is now in a condition in which it is no longer serving a useful purpose in gas purification, and the purifier containing it is shut off from the gas stream. But although no longer useful in its present condition, there is still a large proportion of unaltered caustic lime present. A certain quantity of work has been done by the lime in removing impurities from the gas, whereby a given quantity of calcium compounds has been formed; but there still remains enough unaltered lime capable, under changed conditions, of discharging a second quantity of work equal in amount to that first performed. This is Mr. Harris's experience.

To get this second quantity of work out of his lime, Mr. Harris proceeds as follows:—The lime purifier shut off from the gas supply has atmospheric air driven through it, which in turn is made to traverse an oxide of iron purifier, so that any nuisance which might arise from sulphur impurities is avoided. The lime is then removed from the purifying vessel and spread on the dry floor of a shed. It is turned over twice by workmen with shovels, and then returned to the purifying vessel. The time occupied in exposing the lime is usually about a week. This exposure of the partially saturated lime to air destroys the hard and crystalline character of the fragments, which, no doubt, contain in their interior the portion of lime still in the condition of hydrate. Whether such a process can be called one of "revivification" is of little practical moment. The process, however, does not involve any chemical action, so far as I at present know, and in that particular entirely differs from the process of exposing oxide of iron to air. A portion of lime converted into carbonate remains as such, and acts as a diluting and inert component of the whole. The partially exhausted lime, after a second exposure to the purifiers, is found to be practically exhausted, and is removed as waste.

I have examined some of the fully spent lime produced in the above manner of working, as devised and practised by Mr. Harris—that is, dry caustic lime saturated up to a first limit with impurities, then exposed to air in the way I have described, and again saturated up to its final limit with impurities. A sample is on the table. It is in a dry pulverulent condition, having a greyish colour. Its chief constituents are—

Calcium carbonate.	Free sulphur.
" hyposulphite.	Naphthaline.
" sulphocyanate.	

Calcium carbonate is, of course, the most abundant component. Calcium hydrate is absent, so that the sample has done all that is possible under ordinary conditions. Sulphur is present in at least three forms, the total amount of the

element being by no means inconsiderable. As the result of several determinations which I will presently refer to, I find 8 per cent. When the spent lime is treated with water or spirit and filtered, a slightly coloured liquid is obtained. In each case when a few drops of ferric chloride solution are added, a deep red coloration characteristic of a sulphocyanate is produced. The aqueous solution bleaches free iodine or bromine. If warmed with a few drops of hydrochloric acid and allowed to stand a few minutes, the solution becomes turbid, owing to separated sulphur, whilst at the same time the odour of sulphurous acid is distinctly recognized. These indications point to the presence of hyposulphite. The original spent lime, treated with bisulphide of carbon, forms a clear brownish-yellow liquid. When this is decanted from the insoluble residue, and evaporated to dryness by the aid of a gentle heat, a quantity of free sulphur is obtained mixed with naphthaline. Special precautions have to be adopted in order to determine the total sulphur present, otherwise some of the element may escape as a gaseous compound, whilst a second portion, in the form of free sulphur, may escape oxidation. The simplest plan is to treat a weighed quantity of the spent lime, placed in a small flask, with an excess of fuming nitric acid (sp. gr. 1.5). It is well to place the flask in a large glass jar provided with a ground glass cover. The acid can then be poured quickly down a tube funnel on the lime, the funnel withdrawn, and the glass cover placed on the jar. The flask can be removed from the jar at the end of an hour or two, warmed, and in that way complete oxidation of the total sulphur to sulphuric acid is effected. The sulphur is then determined as barium sulphate in the usual manner.

A weighed quantity of the completely spent lime was treated with carbon bisulphide, and thoroughly exhausted by means of that liquid. The carbon bisulphide solution was then evaporated to dryness, and the free sulphur in the residue determined as above. The residual mass deprived of its free sulphur was then separately oxidized, and the combined sulphur determined. The combined sulphur is that existing in the spent lime as hyposulphite and sulphocyanate. The mean of several experiments gives—

Free sulphur	4.06 per cent.
Combined sulphur	4.02
Total sulphur	8.08 per cent.

Some experiments have been made on lime which is only partially converted into carbonate and sulphur-calcium compounds—that is, half-spent lime. The condition of my specimen is that in which it is returned to the purifier for second treatment. It contains sulphocyanate and hyposulphite, but the presence of free sulphur has not been experimentally proved. The total sulphur has been determined, and is 6.1 per cent. There is also a large quantity of calcium hydrate; and the chief object of my investigation of this part of the subject has been to devise a ready and efficient method of determining the amount of unaltered hydrate in specimens of partially spent lime, so that the engineer may have some means of calculating its purifying capacity when it is again returned to the purifier.

The sparingly soluble character of calcium hydrate prevents its separation, by means of water, from the other constituents of the spent lime. The process I have devised for my present inquiry consists in adding an excess of a solution of a copper salt to a weighed quantity of the lime. The calcium hydrate furnishes a precipitate of hydrate of copper, the excess of the copper salt remaining unaltered in the solution. Knowing how much copper salt was first added, and then determining how much remains behind in solution, the difference between the two represents the amount of copper thrown out of the solution as hydrate. The equivalent of this quantity of copper hydrate in terms of calcium hydrate is the amount of calcium hydrate in the quantity operated on. I have proceeded as follows:—A weighed quantity of spent lime (between 30 and 40 grains) was placed in a 100 cubic centimetre measuring flask, and standard cupric chloride solution added up to the measuring line. The whole was allowed to stand for a few hours with occasional agitation. A measured quantity (10 c.c.) of clear liquid was then withdrawn by means of a pipette, placed in a suitable cylindrical vessel, and excess of ammonia added. The blue liquid thus formed was then diluted to a convenient extent with distilled water. Ammonia and distilled water were next placed in a second similar cylindrical vessel, and some of the standard cupric chloride solution run in until the same depth of blue colour, as seen by looking down through the column on a white surface, was obtained. Ascertaining how much of this standard cupric chloride solution is equal to that present in the 10 c.c.

of liquid, it is at once obvious how much is equal to that in the whole 100 c.c. The amount of cupric chloride present in the original 100 c.c. being noted, and that now present being ascertained, the difference between the two quantities is the amount of cupric chloride removed as hydrate from the solution. Its equivalent of calcium hydrate can readily be calculated. Proceeding in this way, my sample furnishes 21 per cent. of unaltered calcium hydrate. Now, as calcium sulphocyanate, in particular, causes a precipitation of some copper, I bring the process forward merely as a rough method, and as the best which has yet occurred to me. With a little care it may render good service.

I now come to a consideration of the condition of the sulphur in the spent lime. The cause of the presence of the free sulphur is to me least intelligible. I have already stated that sulphur is present in *at least* three conditions, and it is most probable that a portion is present in a fourth condition—namely, as sulphite; but on this point I have no positive information. One may reasonably suppose that there are three calcium compounds containing sulphur produced in the lime purifier when crude coal gas, such as I have described, is passed into it. These are calcium sulphide (Ca S), calcium sulphocarbonate (Ca CS_3), and calcium sulphocyanate (Ca 2CNS). When calcium sulphide is exposed to atmospheric oxidation for a limited time in the presence of caustic lime, calcium sulphite and hyposulphite are produced. When calcium sulphocarbonate is similarly exposed, calcium carbonate and sulphuretted hydrogen are produced, especially if moisture is present. As caustic lime is an important constituent of partially spent lime, one would expect that this sulphuretted hydrogen would produce an additional quantity of calcium sulphide. It is also known that alkaline sulphocyanates undergo slow decomposition in the presence of moisture, yielding ammonia and a carbonate of the base; and one would expect a similar result with calcium sulphocyanate. But there is no evidence to show that the sulphur of an alkaline sulphocyanate separates in the free state. Therefore, so far as we know respecting the independent behaviour of each of these three calcium sulphur salts, we have no clue to the origin of the free sulphur in spent lime. It may be due to their mutual action, but this is by no means obvious. I am much more inclined to believe that I have only partially stated the facts, and that we have more to learn respecting the nature of the calcium-sulphur compounds produced in the lime purifier.

I may mention that I have examined a specimen of spent lime produced at the works of the South Metropolitan Gas Company. The crude coal gas in this instance had been treated with Hills's liquor, and was therefore in a different condition from that produced in Mr. Harris's method of working; that is, so far as sulphur and other impurities are concerned. The specimen on the table has a different physical character from that obtained at Bow Common. The only experiments I have made on it have been to determine its total sulphur. This I find to be 8.4 per cent. Such a result would scarcely be expected from an inspection of the specimen, especially after what is known respecting the amount of sulphur present in the grey pulverulent waste lime made at Bow Common.

In conclusion, I regret that I am unable to throw more light on this most intricate and least understood branch of the gas manager's art.

Discussion.

Mr. R. HARRIS (Bow Common) said that, as his name had been frequently mentioned in the paper, it might be desirable for him to give some information as to his mode of working. About 13 years ago he adopted the principle of removing the sulphur compounds other than sulphuretted hydrogen, commonly known as bisulphide of carbon, from gas by means of sulphide of calcium produced from pure caustic lime by the action of crude gas upon it. In changing the purifiers as used for this purpose, he found there was a considerable amount of nuisance, and to obviate this he adopted a system of drawing air through the material before the purifiers were discharged. This went on for some time, his lime account representing only 17 tons of coal per yard of lime. At length he noticed that the lime, after it had been ventilated by air and removed from the purifier, had much the same appearance as when put into position. He accordingly took steps to ascertain how far it had been used up, and from some rough experiments he found that about 40 per cent. had not been utilized. Feeling that this was a considerable waste, he endeavoured to see how far it could be prevented, and the first thing that occurred to him was that, instead of taking the lime out of the purifiers when it had been ventilated, the best thing would be to turn the gas through it again; but this was not very effectual. He then adopted the system

of taking the lime out after ventilation, turning it over, and putting it into the purifier a second time. He had continued this system for about four or five years, and the effect had been that he now purified the gas resulting from 27 to 30 tons of coal per yard of lime, and the lime when in operation the second time did nearly as much work as the first. He worked two purifiers, alternately using clean lime in one and once-used lime in the other. That which had been used twice went to the waste heap.

Mr. G. ANDERSON (London) asked at what rate the gas passed through the lime.

Mr. HARRIS said it varied in summer and winter, but the same thing took place continually. At the present moment they were passing a million cubic feet of gas per day through two purifiers in succession each about 26 feet square.

Mr. J. ELDRIDGE (Richmond) asked if there was any great nuisance in using the lime a second time.

Mr. HARRIS said practically they had no nuisance at all. The lime was perfectly innocuous when taken from the purifiers by both the first and the second time.

Mr. W. W. HUTCHINSON (Barnsley) said there was some information given at the last meeting of the Manchester District Institution of Gas Engineers which might throw light on the subject of the sulphur deposits. At Wigan there was in use a process of drawing a certain quantity of air through the lime purifiers in order to revivify the lime; and he was informed that they passed 10 million cubic feet of gas through one purifier, 12 feet square, without its being opened at all. He was not, however, informed as to the particular quantity of sulphur or bisulphide of carbon which existed in the gas, though it was interesting to know that there was no nuisance caused by it.

Mr. G. R. HISLOP (Paisley) said he had given this matter considerable attention for 6 or 7 years. The mode he adopted for the lime was simply to work it alternately with the oxide of iron, the foul gas entering the oxide first and then the lime, and alternately entering the lime first and secondly the oxide. In this way they fulfilled all the requirements and conditions laid down by Mr. R. H. Patterson in forming sulphide of calcium in order to remove the bisulphide of carbon in the gas. When oxide of iron was not employed along with lime, he preferred drawing the carbonic acid gases from the furnaces, of which they had any quantity, through a suitable condenser, and driving it up through the foul lime in the purifier before it was disturbed; otherwise, if it were broken up, the gas would not reach every atom of lime in the purifiers. But passing the carbonic acid gas through the lime undisturbed, it would follow the channels previously taken by the coal gas, and, therefore, reach every atom of lime, and discharge the whole of the sulphuretted hydrogen into oxide of iron contained in a separate tank or old purifier. The period when this was accomplished was ascertained in a very simple way by the acetate of lead test. When this test failed, the process was stopped and the lime taken out, which was found perfectly innocuous, and transferred to the calcining chambers. In connection with the first arrangement of working the lime and oxide alternately, he had restored the lime 150 times over, and if any gentleman saw it he would scarcely observe any difference in its appearance from the first day it was introduced into the purifier. The process was, therefore, reduced to the simplest possible form. It was worked in the ordinary method, avoiding any nuisance, and the objectionable substance was got rid of in a very profitable way. The cost was 7s. 6d. to 8s. per ton according to the locality and quality of the fuel employed. He was not quite sure as to the process suggested, of passing air through the lime, fearing the sulphur would be so far fixed, in other words that a chemical action would be set up and intense heat generated, and the sulphur fixed in the lime. In his way of treating it, the life of the lime was very much lengthened by the use of carbonic acid; it was maintained perfectly cool until the whole of the sulphur was discharged, and then nearly pure carbonate of lime was obtained.

Mr. CORBET WOODALL asked if any explanation could be given, beyond that already afforded by Mr. Foster, of the reason why the lime removed from the purifier and then exposed to the action of the atmosphere, if there were no chemical alteration in its constitution, should be operative for the removal of bisulphide of carbon upon which before it had no effect. He thought he must have misunderstood Mr. Foster, but he gathered that the lime as removed contained no calcium hydrate. He thought this must be a mistake, as he subsequently dealt with the quantity remaining in the purifier. He should like also to ask whether any attempt had been made to use the lime a third time, and, if so, what had been the effect.

Mr. ELDRIDGE said he gathered that Mr. Hislop was using lime and oxide alternately; but how would this answer with regard to taking out the bisulphide of carbon? It would be all right as far as restoring the lime was concerned; but how would it be with regard to the bisulphide of carbon, if they were compelled to keep down the sulphur to 20 grains per 100 feet of gas?

Mr. W. CARR (Halifax) said the paper opened up a large subject of inquiry, and after the explanation they had the previous evening of what had been made of the once despised coal tar—when they heard of so many different compounds being produced from it—they might hope that eventually something might be made of spent lime. It did seem quite possible that some day it might be used either as a valuable manure, or for other purposes. With reference to the lime from Mr. Harris's process, his idea was, as it was said that exposing it to the atmosphere did not produce any chemical action upon it, that it was pulverized, and made more accessible to the gas—that a quantity of hydrate of lime still remained, after it had been in the vessel some time, which had not been touched. This opened up a question that was pretty well discussed a few years ago, whether lime pulverized or in nodules was best for purifying. It was then asserted very forcibly, and not contradicted at the time, that the lime was better by being prepared in the shape of nodules. He did not know whether this was correct or not, and had never been able to test it for himself. He had to take it, like many other things, on credit. He knew it was much better to work in this way where there were small purifiers, because the gas passed more completely through it; but still it might be that a great quantity of lime was wasted by this process, and if it led to the investigation of that point alone the paper would be very useful.

Mr. FOSTER, in reply, said with reference to the amount of caustic lime in the partially spent lime, he determined this by means of the copper chloride reaction. The sample still contained 21 per cent., so that there was a great amount of work still to be got out of this particular specimen. The question of the free sulphur was the most interesting. He had gone into the details of the behaviour of each of the three compounds independently, and so far there was nothing to report which would explain the formation of free sulphur in the alkaline condition of the mixture. Many of those present were, no doubt, aware of the processes adopted for the recovery of sulphur from soda waste. There were processes of atmospheric oxidation, which brought the sulphur to a certain condition, a certain relative proportion of sulphur in a given condition, and a certain proportion in another—the two must stand in a certain ratio. Then, by the action of acids on the exposed soda liquor, free sulphur was thrown down. But there was nothing of this kind, so far as he could see, in the exposure of spent lime. It was exposed to the air and remained alkaline, and this was why he said there was something which was not intelligible, by the aid of their experience, as to the behaviour of each of the three compounds independently. Mr. Harris agreed with him that it was quite possible there might be other sulphur compounds beside bisulphide of carbon in coal gas. Mr. Harris found that he could take out a certain quantity of sulphur in the form of sulphur compounds by means of lime (the gas passing at a certain rate) with no effect on the other portion. He argued from this circumstance that the sulphur compounds were not all in the same condition, as they were not all so easily removed. One might oppose this theory by saying that the tension of the carbon bisulphide was considerably changed by an alteration of temperature, and this might modify the chemical affinity of the sulphide of calcium upon the sulphur compounds. There were many ways of looking at the question. Most probably there were carbon-sulphur compounds other than bisulphide of carbon present. Mr. Hislop would not like to expose the lime as Mr. Harris did without a power of fixing the sulphur; but the curious part of it was that the sulphur seemed to be largely eliminated in the form of free sulphur. He was furnished with a sample of gas-lime which had not been exposed to air; but, his time being limited, he had not been able as yet to touch it. Besides, it was very difficult to determine the actual condition of the sulphur in its very varied forms. One point he should like to know was the condition of the lime as it left the purifiers without atmospheric oxidation. This was the link missing in the evidence he had given. He had tried to afford an explanation of the effect brought about by exposure, from the particulars furnished by Mr. Harris. He did not regard it as due to chemical action at all, but to mechanical splitting up of the particles, so as to render the lime available for further treatment, though this might not

be the correct view of the matter. It seemed to be a possible explanation when there was something still missing. With reference to the question as to the amount of caustic lime remaining, there was 21 per cent.

The PRESIDENT said the paper was a very valuable contribution to the Transactions of the Association. It and the discussion which followed had suggested the possibility of their being able to revivify lime in much the same way, although not, of course, to anything like the same extent as they now revivified oxide of iron. Any process by which they could effect a reduction in the original weight of lime employed must be of great value, considering the almost intolerable nuisance occasioned, and the difficulty of getting rid of spent lime in many localities. Mr. Foster, therefore, deserved their best thanks for having brought this subject forward.

METROPOLIS WATER SUPPLY.

METROPOLITAN BOARD OF WORKS.

At the Meeting of the Board last Friday, the Parliamentary Committee presented the following report, which was agreed to:—

"The Board, on the 28th ult., referred it to your Committee, as well as to the Works and General Purposes Committee, to take such steps as might be necessary to enable the Board to assist in any inquiry concerning the Supply of Water to the Metropolis. The Board at the same time directed that certain Counsel should be retained, and these gentlemen are now appearing at the inquiry on behalf of the Board.

"It occurred to your Committee that the investigation might show the expediency of the Board taking some further action on behalf of the ratepayers beyond merely assisting in the inquiry. It might, for instance, seem expedient that the Board should make some application to Parliament on the subject next session, or take part in some measure which might be otherwise introduced. Unless, however, the Board's powers under the 144th section of the Metropolis Local Management Act were enlarged, it would be impossible for it legally to take such action. Your Committee felt that for the Board to take a useful part in this investigation and in any further proceedings which might be necessary, its power to do so ought to be clearly established. A letter was accordingly addressed by their direction to the Secretary of State for the Home Department, asking him to introduce a Bill into the House of Commons with a view to its becoming law during the present session, to extend the operation of the 144th section of the Act above mentioned, so as to enable the Board to make any application to Parliament which might be necessary with reference to the Water Supply of the Metropolis, or to appear upon any application which might be made to Parliament on the subject. To this letter a reply, dated June 19, has been received from the Home Office, to the effect that the Government will be glad to give all the facilities it can in the matter, and asking that a draft of the Bill which the Board proposes may be submitted to the Secretary of State.

"Before proceeding further in the matter, your Committee think it desirable to obtain the sanction of the Board to what is proposed. They accordingly recommend that the Solicitor be instructed to prepare a draft Bill to the effect above suggested, and that the draft Bill, when approved, be sent to the Home Office, with a request that the Secretary of State will himself introduce it into the House of Commons."

The following is Dr. Frankland's report on his analyses of the water supplied to London during May:—"Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies, and by the Tottenham Local Board of Health, was:—Colne Valley, 1.4; Kent, 1.5; Tottenham, 1.7; Grand Junction, 2.4; East London, 2.7; New River, 3.3; West Middlesex, 3.3; Chelsea, 3.7; Lambeth, 4.4; Southwark, 4.8. The Thames water delivered by the Grand Junction and Chelsea Companies was, for river water, of fairly good quality, but the West Middlesex Company's water was slightly turbid from inefficient filtration; whilst that distributed by the Southwark and Lambeth Companies, though obtained from the same source, was much more polluted by soluble organic matter. The Southwark Company's water was also slightly turbid from inefficient filtration. The Lea water, delivered by the New River and East London Companies, was efficiently filtered, and of about the same quality as the better samples of Thames Water. The deep-well water supplied by the Kent and Colne Valley Companies and by the Tottenham Local Board of Health was of its usual excellent quality for domestic purposes, and that sent out by the Colne Valley Company was suitable for all domestic purposes, having been softened before delivery."

Results of Analyses expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Matters.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen, as Nitrates and Nitrites.	Total combined Nitrogen.	Chlorine.	Total Hardness.
<i>Inner Circle.</i>								
Thames—								
Chelsea	25.00	.172	.044	0	.199	.243	1.5	19.1
West Middlesex	25.76	.153	.013	0	.194	.237	1.5	19.1
Southwark	25.76	.227	.054	0	.205	.269	1.5	19.4
Grand Junction	25.30	.102	.038	0	.182	.220	1.5	19.4
Lambeth	26.32	.215	.047	0	.201	.248	1.5	19.6
Lea—								
New River	24.31	.166	.028	0	.192	.220	1.6	19.4
East London	24.62	.121	.039	0	.126	.169	1.8	19.4
Deep wells—Kent	42.28	.076	.013	0	.382	.395	2.5	26.0
<i>Outer Circle.</i>								
Colne Valley	12.94	.066	.016	.003	.346	.365	1.5	4.9
Tottenham Local Board	40.20	.087	.018	.046	.025	.081	2.9	20.8
Corporation of Birmingham	21.96	.128	.030	.004	.264	.297	1.8	13.7
Corporation of Glasgow &c.	3.02	.115	.016	0	.006	.022	.61	.9

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
 † Analyzed by Dr. E. J. Mills, F.R.S., of Anderson's College, Glasgow.

Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

SOME NOTES FROM AMERICA.

(FROM OUR OWN CORRESPONDENT.)

Gas affairs in the Metropolis are in about the same position as at the time of my last letter (see *ante*, p. 801.) A Committee, appointed by the Municipal Gas Consumers Protective Association, waited on that Company last month, and presented their alleged grievance—viz., the high price of gas; or, more correctly, the raising of the price back to the old figure of 2 dols. 25 cents per 1000 feet. Having had a taste of the pleasure of getting gas at an inordinately low figure, while the several Gas Companies were engaged in cutting each other's throats, they are very unwilling to have to submit to paying the old price. The Committee were courteously received by the officers of the Company, but as their chief officer, the President, was away, the Company put them off with the understanding that their petition would receive attention, immediately upon the return of that gentleman. There the matter rests, and we here patiently await the sequel.

In the meanwhile, the death of a gentleman connected with the Municipal Company, and widely known as an inventor and a chemist, has occurred. I allude to the death of M. Cyprien Tessié du Motay, which occurred on Sunday, the 6th inst. This distinguished gentleman was born 65 years ago, of an old and aristocratic family. He began the study of chemistry in Germany, when he was about 25 years of age. He was the originator of a great many improvements in various manufacturing processes, which have been of great service to mankind, and have given to his name a world-wide reputation. He was, however, a public man as well as an inventor,—an ardent Liberal and a Radical Republican; the free expressing of his Liberal opinions, securing for him, under the Bonaparte dynasty, the sentence of death. His great scientific attainments then stood him in good stead, for not only was the sentence of death commuted to one of exile, but later he was allowed to return to Paris, where he continued his researches in chemistry. He then turned his attention to gas lighting, and took out several patents relating to that subject. Mr. Stern, of New York, bought of M. Du Motay his "water gas" patent. Latterly M. Du Motay had been filling the position of Consulting Chemist to the Municipal Gas Company of New York. His death, which occurred in New York City, was due to apoplexy. His remains will be sent to France for burial.

The inquest in the case of James Rolleter, an *employé* of the New York Gas Company, who was killed by an explosion at those works—which I noticed in my last letter—was concluded on the 20th ult. One witness, an *employé* of the Manhattan Gas Company of the same city, testified to seeing a man with a lighted match in his hand, on the stairs inside the purifying building just before the explosion; but it does not seem possible that any sane man would light a match in such a place. The jury returned the following verdict:—"The jury unanimously agree that the death of James Rolleter was caused by injuries resulting from an explosion at the New York Gas-Works, and that the testimony adduced indicates that the Company are at fault, inasmuch as the explosion would not have occurred had proper supervision, management, and caution been enforced by it in the conduct of operations within the building where he (the deceased) was working at the time of the accident." So, taking it for granted that the testimony was correct, the Company are blamed for the folly of one of their servants.

It does not seem that a great deal is being done in this country with the electric light; in fact, the subject seems about where it was a year ago. Some few factories have introduced the Brush machines in place of gas, thus cutting off a little of the revenue of the gas companies; but, as yet, this is a small matter, and I trust it will remain so. What the companies have lost by the electric light they have more than made up in extending the use of gas for other than lighting purposes. Here is a field for almost all gas companies, and, if they will only take a little trouble, they may occupy it, to the increase of their general prosperity. It is continually said that a factory can employ the electric light advantageously, because they can use their "surplus motive power" to drive the machines. One word in regard to the term "surplus motive power." What do manufacturers have such surplus power for? I take it that the object is never to run their boilers and engines to their full capacity, for it is poor economy to get out of any motor the last pound of power it is capable of exerting. If, then, the great part of this surplus power is used in generating the electric light, is it fair, when figuring the cost of the light in factories, to leave out altogether the cost of motive power? I think not. In some large factories, where they have a great abundance of power, that used by the generators of the electric light may be a small matter; but in other places it may be an important factor, and necessitate an increase of power. In either case, some allowance should be made for power to drive the generators when estimating the cost of the light produced by them. Apparently, Edison is doing nothing in his pet scheme of annihilating the gas companies; but, while on the surface it appears as if he has given his attention to other matters, on the other hand, there is a quiet, underground rumour that he is bringing his apparatus rapidly to perfection. Some people are bold enough to say that this time there is no doubt of it at all—that success is almost certain. We can, however, patiently await his pleasure. I have always contended, and will continue to hold to it, that such a great industry as gas lighting will not have so short a life as some insist, but that, as it is the light of the present, so it will continue to be not only the light, but the heating, and in some degree the motive power of the future.

A new stoking machine has been brought out in this country—the invention of Mr. Ross, of Cincinnati. In the absence of sectional drawings, I will not, at this time, enter into a detailed explanation of the machine, but will notice its chief novelty. This is in the charging machine, where the coal, instead of being carried into the retort by a scoop, and laid upon the floor of the retort, is thrown up or projected in by the direct action of steam. Coal of the usual size is received into a hopper, and thence passes into a conduit, adjusted to the level of the retort, and steam is admitted, through nozzles at the back of the coal, by sudden openings of the steam-valve. The coal is thus projected into the retort. The questions naturally arise whether the coal will not strike the end of the retort with sufficient force to injure it, as force enough is used to ensure its reaching the back of the retort; and, secondly, what effect will the admission of so much steam into the retort have upon the gas?—whether it may not be more difficult to keep up the heats. At present each charging and drawing machine is on a separate carriage, having thereon a boiler, supply-tank for water, steam-chest, &c., besides the regular apparatus. It would seem as if this expense might be obviated by having each apparatus connected by a flexible pipe with a permanent steam supply.

During last month two deaths occurred in different hotels in New York, through escapes of gas. In each case the cock of the gas-fixture was turned on full, and the occupant of the room dead.

P.S.—Since closing my letter, news of a meeting of the Municipal Gas Consumers Protective Association held last evening [June 8] has reached me. The Committee appointed to wait on the Company reported that they had been given to understand that the Company would not reduce

the price of gas. A motion asking all the consumers of the Municipal Company's gas to discontinue dealings with the Company was passed. They wish to have the price reduced from 2 dols. 25 cents. (9s.) to 1 dol. 50 cents (6s.)

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

All classes of round coal are now more or less a drug in this district, whilst prices throughout are so low—in some cases under the actual cost of getting—and there is so little prospect of the demand overtaking the means of production for some time to come, that colliery proprietors do not care to raise coal for stock, as is usually done at this season of the year. The consequence is, that short time is being enforced at nearly all the Lancashire collieries, a very large number of them not running more than five or six days a fortnight.

As yet there have been very few gas coal contracts settled; but it is probable that a considerable number will be concluded during July. Very low tenders continue to be sent in, gas coal, I believe, being delivered into Manchester at 7s. 6d. per ton, whilst there are plenty of sellers of good screened Wigan gas coal at the pit at 5s. 9d. to 6s. per ton. Tenders for long periods are also offered freely, and those firms who are not prepared to contract for something like three years have very little chance.

In other classes of coal the tendency of prices is downwards. House coals are now very bad to sell, and the Manchester firms are making reductions of 10d. and 1s. 8d. per ton in their delivery rates to private consumers. In pit prices there is no announced alteration, but generally there is a weaker tone, concessions being made to secure business. Best Wigan Arley at the pit does not, for quantities, fetch more than 7s. 6d. to 8s.; whilst common sorts and Pemberton four-feet can be bought under 6s. up to 6s. 6d. per ton. Common classes of round coal for steam and forge purposes are being offered at extremely low figures, ranging in many cases as low as 4s. 6d. per ton at the pit. Engine classes of fuel continue in fair demand, and although there is no actual scarcity of supplies at present, there is less being produced, and in some cases an attempt is made to obtain higher prices; from 3s. 9d. to 4s. 3d. per ton being about the average quotations for good burgy at the pit, and 8s. 8d. to 8s. 9d. for good slack.

The shipping trade continues very dull, and Lancashire steam coal delivered at Liverpool or Garston can be bought at 6s. per ton.

The limited demand for coke is causing many of the ovens to be put out, but prices nominally are without change, although there is an easier tone in the market.

There is a slightly better feeling in the iron trade, and although consumers are purchasing very sparingly, there is more disposition to buy; whilst some considerable sales of outside brands for forward delivery have recently been made to middle-men in this district. Lancashire makers of pig iron have been doing a little more business, but a good deal of iron is still going into store, with quotations nominally remaining at 47s. 6d. per ton, less 2½ for delivery into the Manchester district, although less would be taken if offers were made. In some quarters a few more inquiries are reported for finished iron; but makers, as a rule, are pressing for business at very low figures, and Lancashire bars delivered into Manchester can be bought at from £6 to £6 10s. per ton, if not under.

THE SOUTH STAFFORDSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

In one or two cases local pits of which the output has been mostly consumed by the blast furnace have lately been idle, or at least have been employed only one or two days in the week. This is an inevitable consequence of the decline of the pig-making business. As the lowest ebb has not yet been reached, judging by the continuation of the operations of blowing out, the smelting coal trade is in a very bad state. The deep pits, however, are much better off, and the demand for thick coal is fairly good, though scarcely so great as it was a month ago. Prices for best qualities are firm, but of inferior kinds they are in an unsettled state, and are anything but uniform. Gas coals, engine coals, and slack, are, on the whole, in fair request. In the Tipton district the competition is very keen with the small colliery proprietors.

The iron trade has shown but little alteration; there was, however, during the past week, a better call for all kinds of finished iron at the usual weekly markets, and most classes of pigs were firmer than they have been for a few weeks past. The only increased rates noted were for special brands of merchant iron, but unmarked bars are not so freely offered, and though some parcels changed hands at prices below £6 10s., several lots were placed at 6 15s. Best marked bars are offered at £8, though it is considered that probably £8 10s. will be the rate fixed for them at the approaching quarterly meeting. Sheets (common singles) are to be had at £7 15s.; but girder plates are scarce at £9 10s. All-mine is quoted at £4, which is a little over last week's prices. Part-mine stands at £2 15s. to £3, and cinder pigs at about £2. It was considered probable that the reduction of 10 per cent. in furnace-men's wages, which came into operation a week ago, would cause some slight reduction further than was shown in the previous week's markets; but there is now, on the other hand, a somewhat firmer tone. The inconvenience sustained by the iron trade in the matter of weights as now used in accordance with the Weights and Measures Act of 1878, has been the subject of much controversy, and one of the local members asked the President of the Board of Trade in the House, on the 21st, to cause a standard weight of 112 lbs. to be denominated, but was unsuccessful in his efforts.

THE YORKSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The tenders for further contracts for the supply of gas coal to Yorkshire gas companies continue to be placed, several having been decided since my last notice. It may be said that directors never had more quotations, nor was there ever more anxiety with respect to the placing of the contracts so far as coalowners are concerned. One of the companies received tenders from both the Barnsley thick-seam pits and those working the Silkstone bed. Prices are, if anything, lower than they were last year, some firms quoting Silkstones as low as the Barnsley bed.

During the past week great attention was paid to the decision of the Directors of the Railway Companies interested in the conveyance of coal to London, who were appealed to, but have declined to reduce the rates, which are now 8s. 3d. per ton, including City dues. It is understood that the Great Northern would have conceded something, but other interested Companies could not see their way clear to meet the coalowners. Some of the coal merchants in London went so far as to only ask for some concessions to relieve them during the present exceptional state of trade, but even this request was not granted. The demand for house coal is very quiet, not only as regards the Metropolis, but also the other markets with which the collieries are connected.

Steam coal is in good request for shipment, and large quantities continue to be forwarded to Hull and Grimsby, which has the effect of keeping the exports well up. The West Riding coalowners are doing a fair business with Goolé, which port is within easy reach of the coal-field. The

pits in this district are, however, working but short time, and miners are complaining of earning low wages.

The coke trade, taken as a whole, holds well up, but the output is in excess of the demand, owing to the building of so large a number of new ovens. There is a large traffic over the Manchester, Sheffield, and Lincolnshire line for North Lincolnshire, but the trade in that district is on the decline, one of the firms having already damped down one of their furnaces; whilst the tonnage of pig iron from the furnaces is not nearly so large as it was a couple of months since.

The iron trade is not so cheering as it was a short time ago. The blast furnaces are kept in full work, but the foundries are only slack. The same may be said with regard to engineering branches, fitters, and machinists.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The gas coal trade of the county of Durham has been quiet over the past fortnight, having been of the usual summer character. It is very much limited to shipments to meet the ordinary contracts. Very little business has been done in gas coals in the open market, and no new trade has been taken in for later on in the year. A large amount of uncertainty surrounds the prospects of the general coal trade at this, the commencement of the second half of 1880. The steam and house coal businesses are undoubtedly dull. The coalowners in the first-mentioned trade have not been able to uphold their prices, which are about 6d. per ton lower than they were a month ago. Firms in the iron and chemical trades are unable to determine what will be the requirements of the next six months, as a very great amount of uncertainty surrounds the prospects of these trades over the period mentioned. The manufacturers are very slow to make contracts for small coals. Coke, in sympathy with the stronger tone in the pig iron trade, is a little dearer, the value being 11s. 6d. per ton, delivered free on board ship in the Tees.

The shipping trade, especially coasting, shows no improvement. Freight rates are low. There is no appearance of an advance in rates. Very little business is transacted in the way of freighting steamers or sailing vessels to load gas coals at present.

As the iron trade has a tendency towards improved prices, orders are coming into the foundries on the Tees and Tyne for gas and water pipes. The fall in pipes over the last half year has not been so rapid as pig iron; but as they are not affected by speculative movements, the rise is not so great, and prices do not advance to the same extent. There is, however, an opportunity at present to buy at a reasonable rate, and companies are tempted to secure supplies. The lead trade is better. Spanish ordinary lead is sold in the wholesale market on the Tyne at £15 17s. 6d. per ton, which is an advance of fully £1 per ton upon the prices which were current in the early part of June. The price of copper is also stronger. Indeed, metals of all descriptions show a slightly upward tendency. The shipments of the best sorts of fire-clay goods to the Continent are well sustained. Second-class kinds have somewhat fallen away in value.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The Directors of the Hawick Gaslight Company have just issued a most satisfactory report, which is to be considered at the annual general meeting of the Shareholders on the 2nd prox. Referring to the previous year's balance-sheet, which showed that the profits earned during that year were upwards of £400 short of the amount required for paying the guaranteed dividend of 10 per cent., they go on to say that, notwithstanding the reduction of 5d. per 1000 feet in the price of gas (amounting to upwards of £450), the profits made during the past year are more than sufficient to pay the guaranteed dividend. That such a favourable result has been attained is, they say, in a great measure due to the success of the experiments which were mentioned in last year's report as being carried out by the Manager (Mr. J. Smith). In order to have the means of accurately determining the illuminating power and the purity of the gas, and of testing the value of coals previous to making contracts, a new laboratory, furnished with the most improved instruments, has been fitted up, and has been in operation for some time. The illuminating power of the gas supplied to the consumers during the past year was maintained at 29 to 30 candles. Contracts for coals for the ensuing year have been made on favourable terms. New street-mains of fully a mile in length have been laid during the past year; the consumers have become more numerous, and the increase in the amount of gas sold was nearly a million cubic feet. Loss by condensation or leakage was moderate, and for each ton of coal delivered at the works 9030 feet of gas were sold. From May 26, 1879, till May 26, 1880, the gas sold amounted to nearly 23 million cubic feet, almost the whole of which was sold at 3s. 9d. per 1000 feet. The attention of the Shareholders is drawn in the report to the balance of £956 still remaining over, after the payment of the yearly dividend is provided for; and as the mode in which such balances are to be applied is regulated by the Company's contract of co-partnership, the Directors recommend that the price of gas for the ensuing year be fixed at 3s. 6½d. per 1000 cubic feet. That price will be subject, I believe, to a discount of 7½ per cent. to the large consumers, thereby making the net price to them 3s. 3½d. per 1000 feet. Should the proposed price of 3s. 6½d. be agreed to at the annual meeting of the Shareholders, there is every probability that the question of "The Cheapest Gas in Scotland," which was discussed with such persistence and animation last summer and autumn, will be renewed. To be able to sell 29-candle gas at that price will certainly be regarded on many hands as a great achievement. Before the discussion is resumed, I may remind those persons who are likely to take part in it that the Company make a charge of 2s. 6d. per annum in the shape of meter-rents. Gas managers in Scotland scarcely need to be reminded that Hawick lies at a considerable distance from any mineral field where gas coal is worked.

The monthly meeting of the Perth Gas Commissioners was held on Monday, the 14th inst., Lord Provost Richardson in the chair. An abstract of the revenue and expenditure of the Commission for the year ending the 30th of April last was submitted. The revenue amounted to £13,124 13s. 2d., and the expenditure to £12,091 2s. 9d., and the sum of £1061 1s. 11½d. was set aside for the sinking-fund, and to meet contingencies. The expenditure for the current year was estimated at £12,497 10s., the sinking fund and contingencies at £710 3s. 4d., and the revenue at £13,207 13s. 4d. In moving the adoption of the balance-sheet and Auditor's report, along with the estimates for the current year, Bailie Mackenzie said that the year ending the 30th of April had been a very prosperous one for the Gas Commission. They had been able not only to pay off all the working expenses, but, besides laying aside £100, as had been estimated, towards the contingency and depreciation fund, they had been able to apportion £230 additional to meet the expenses of a new exhauster. The cost of this new exhauster was to be paid out of last year's revenue, and still there was £200 to add to the contingency and depreciation fund. The increased consumption of gas during the year had amounted to 2,744,630 cubic feet, or 2½ millions

increase over that of the year 1879. The actual increase in the consumption of gas since 1874, which was the first whole year the Commission had the works in their hands, was over 50 per cent. Having explained the method in which the finances of the Commission were conducted, Bailie Mackenzie concluded by moving the adoption of the balance-sheet and estimates, as also that the price be 4s. 2d. per 1000 cubic feet, with the usual meter charges for the city, and 5s. for Scone; and that the 5 per cent. discount be given to large consumers as usual. The motion was duly seconded and unanimously adopted. Including renewals and extensions, the piping laid during the past year amounted to about 2 miles, and the leakage is now reduced to 8·9 per cent.

At the annual general meeting of the Selkirk Gaslight Company, which was held a few days ago, a report was submitted which, along with the statement of the income and expenditure, showed that the affairs of the Company were in a prosperous state. A dividend of 10 per cent., free of income-tax, was declared, and it was agreed to reduce the price of gas for the ensuing year from 5s. to 4s. 7d. per 1000 cubic feet. The make of gas for the year was 14,340,900 feet, as indicated at the station-meter, and the unaccounted-for gas had been reduced to 10 per cent. Owing to dull trade in the town there was a decrease on the consumers meters of 563,000 cubic feet over the year.

During the year ending the 15th of June there was an increase in the amount of gas manufactured at the Forfar Corporation Gas-Works of 1,330,000 cubic feet over that manufactured in the preceding year; and for the year just commenced contracts have been closed for 2000 tons of coal at an average price of 18s. 11½d. per ton, whereas the average price last year was 20s. 5d. per ton, the reduction giving for the current year a saving of something like £150 on the cost of the coals required.

The annual general meeting of the Dunfermline Gaslight Company was held last Wednesday—Mr. David Russell, Chairman of the Company, presiding. Mr. Mackenzie (the Manager) read the report of the Directors, which stated that the quantity of gas sold during the past year considerably exceeded that of any preceding year, that the loss by leakage had been very much reduced, and that the illuminating power and purity of the gas were well maintained. A reduction in price to consumers—equal to 4 per cent.—had been in operation during the year, and the results of the whole year's working were in many respects satisfactory. Contracts for coal for the coming season were being made, and the Directors had every reason to expect that they would be concluded on favourable terms. The works and whole apparatus were in good order, and in the most efficient state of repair. On the recommendation of the Directors, a dividend of 29s. 9d. per share, being at the rate of 8½ per cent. per annum, was declared, and the report was unanimously adopted. In the course of the proceedings, the Manager reported that since the supply of gas had been extended to Townhill, the consumption there had gone on increasing, and he likewise stated that the greatest satisfaction prevailed in the village at the existing state of matters. Bailie Walker and Messrs. John Davie and Thomas Alexander, jun., were appointed Directors in the room of those who retired. A cordial vote of thanks was passed by the meeting to the Chairman and Directors for their attention to the Company's interests during the year, and a similar compliment was paid to the Manager. The question of further reducing the price of gas in Dunfermline will not be settled until the price is known in other eight towns, some in the East and others in the West of Scotland—the average price paid in those eight towns being that which the Dunfermline Gas Company will charge for the ensuing year.

On Monday of last week the Shareholders of the Muirkirk Gaslight Company held their annual meeting—the Chairman of the Company, Mr. C. Howatson, presiding. The usual dividend of 10 per cent. for the year ending the 21st ult. was declared, and it was agreed to continue the price of gas at 5s. per 1000 feet. With a view of providing for an extension of the works, it was resolved to increase the capital of the Company by the creation of 1000 new shares of £1 each.

On Wednesday last there were offered for sale in Glasgow 100 shares of the Coatbridge Gas Company's new stock, of which 80 were sold at £11 per share, and the remaining 20 at £11 5s. per share. They are £8 shares, fully called up.

By the activity which has marked the action of the Dundee Water Commissioners, the Newport water supply, which was cut off by the fall of the Tay Bridge on the 28th of December last, is about to be replaced from the Wormit stream, situated about two miles west of Newport. The reservoir on the Wormit Hill and a large portion of the main which served for the Lintrathen supply have been found quite serviceable for the temporary scheme. It is expected the water system will again be in complete operation by the 1st of July.

On Thursday last, at a meeting of the Finance Committee of the Dundee Water Commission, the estimate of the expenditure and revenue for the year from May 15, 1880, to May 15, 1881, was submitted. The total expenditure was given at £38,252 13s. 7d. The revenue was estimated at £38,516 13s. 4d., showing a margin of £263 19s. 9d. It is proposed to continue the assessment for domestic purposes at the former rate of 1s. 4d. per £1. The revenue is made up in the following manner:—Domestic rate, £18,666 13s. 4d.; public rate, 1d. per £1—£2750; and special rates, £17,850. For bad debts £750 is entered. The estimates will be submitted at the annual meeting of the Commission to be held on Thursday of the present week.

Edinburgh water annuities advanced in price last week from £152 to £153 per share.

Last week's Glasgow pig iron market was very irregular, and a large business was done. The price of warrants advanced almost to 50s. per ton on Wednesday, and at the close on Friday buyers were offering 48s. 4½d. cash.

The coal market is exceedingly depressed, and strikes, both actual and threatened, on account of very low wages, are giving much anxiety to the coalmasters.

REDUCTION IN THE PRICE OF GAS AT ST. HELEN'S.—It is stated that the Gas Committee of the St. Helen's Corporation at their last meeting came to the conclusion to reduce the price of gas from 3s. 9d. to 3s. 6d. per 1000 cubic feet. It will be remembered that when the disposal of the gas profits was lately before the Town Council, something like an assurance was given by the Chairman of the Committee that if the Council would consent to allow about £1200 of the profits to be carried to the borough fund, the interests of the gas consumers would receive the immediate attention of the Committee, and that a reduction in the price of gas might reasonably be expected. The Committee, it now appears, have lost no time in carrying out the promise then made, and the reduction of 3d. per 1000 feet will be gratifying news, especially to large consumers of gas.

present time. The amounts which appear in the consumers ledgers are carried forward as revenue. Coal has been supplied to the defendant by the Company. There is a ledger account of that.

Mr. BESLEY: When did you begin supplying coal to Mr. Brickwell?

Mr. WEBSTER: That will appear by the books. Let the books themselves be produced.

Witness: They are not here, but I can produce them.

Examination continued: I was present at the meeting of the 10th of April last. Mr. Brickwell was in the chair. A question was put as to gas being used by Mr. Brickwell without payment. I am not certain whether the words "and without meter" were used. The question was written on a piece of paper by Mr. Bellingham, and passed to the Chairman, who answered it in the affirmative. I have not yet posted up the minutes of this meeting. I have been so pressed that I have not had time. The question was asked aloud, as well as being written and handed up. I have not the piece of paper here. As far as my memory serves me, the question was put in this way: "Is it true that Mr. Brickwell has a supply of gas to his house, and is using it without payment?" I do not know that the words "and without meter" were also used. After the meeting two meters were sent to Mr. Brickwell's house. They were sent on the 10th of May. I do not know what light meters they are. The state of the meters has not yet been taken. It will be taken on quarter-day.

Cross-examination by Mr. WEBSTER: Mr. Bellingham, Mr. Surr, and Mr. Munns are present in court. I entered the Company's service on the 26th of May, 1851, and up to 1856 my ordinary duties were those of a clerk in a gas-works, attending to the sale of the residuals, &c. This went on up to the time I was appointed Secretary. Mr. Brickwell was supplied with gas by contract for some time. He commenced burning by meter on the 8th of September, 1847, and discontinued on the 25th of June, 1849. He commenced burning gas by contract on the 25th of September, 1849, and ceased at Christmas, 1861. That was for his house at the corner of Lordship Lane, Tottenham. He remained in this house till October, 1861, and went to reside at Mountford House in October, 1862. The contract price was £1 7s. 3d. per quarter for the two winter quarters, and 10s. 6d. per quarter for the two summer quarters, making £3 15s. 6d. for the year, and this sum was paid each year, as appears by the books.

Mr. BESLEY: My friend is imposing upon me a book which I have never seen, and which refers to a previous time. All I ask is that if the witness is going to prove payment, he should prove from his own knowledge that he took the money. If there was any payment to a collector, it must be proved by the collector.

Cross-examination continued: The book is in the handwriting of Mr. Brickwell and myself. The price of gas at that time was 7s. per 1000 feet. The contract price was based upon the previous consumption by meter. It appears from the book that by meter he paid 11s. 3d. for one quarter and 13s. 3d. for the Christmas quarter. The entries on the other side of the book were made before my time. They are in the handwriting of a man named Davey. I do not know whether he is dead or alive. It was Davey's duty to enter up the payments for gas; and the entries would be made in the ordinary course of business. I have not the ledgers here after the year 1851, but I know that Mr. Brickwell paid for gas until 1861.

Mr. BESLEY: You were only taking the gas to the surgery, and not to the house.

Witness: The house and the surgery accounts are distinct up to 1848.

Cross-examination continued: The gas consumers ledger would be submitted to the Auditors in the ordinary course of business, and properly speaking the receipts from Mr. Brickwell should have gone in as part of the gas receipts. After I joined the Company I knew there was great difficulty in floating it, and Mr. Brickwell took an active part in the management of the Company. He induced people to subscribe for shares. He was Managing Director of the Company for some time; and I have heard it stated that he went on to the gas works at a time they were in difficulties. I know that he has become surety for the Company. I know as a fact, and it is reported on the minutes, that the thanks of the other members were given to Mr. Brickwell during the years 1852, 1853, 1854, 1855, and 1856.

Mr. WEBSTER then read the following resolution passed at the meeting of April 17, 1852—"Resolved, that the thanks of the Board of Directors be presented to Mr. Brickwell for his indefatigable exertions on behalf of the Company's interests during his superintendence of its affairs, and that he be directed to act as Treasurer in future, and to countersign the drafts on the bankers."

Cross-examination continued: During the early years of the Company, from 1851 to 1857, Mr. Brickwell gave up a great portion of his time to its affairs. He acted as Managing Director, and had charge of the whole of the Company's affairs.

Mr. WEBSTER: In your opinion, but for Mr. Brickwell's exertions the Company would not have been kept alive?

Mr. BESLEY objected to the question. He understood that the right of cross-examination was limited to two points—relevancy, and to test the credit of the witness. As the witness was undoubtedly on the best of terms with the defendant, the question of credit did not arise; but upon the point of relevancy, if his friend examined as to the amount of defendant's exertion, he (Mr. Besley) should have to examine as to the amount of remuneration; and therefore he submitted it was not relevant. Any facts which would enable his friend to establish such a wide proposition as that Mr. Brickwell was the whole Company, and therefore entitled to steal its property, he was entitled to have; but to get the opinion of a witness was most objectionable.

Mr. WEBSTER said he must once for all respectfully protest against the Counsel for the prosecution introducing such expressions as "Mr. Brickwell stealing gas." He knew that such observations would not influence the mind of the Bench, and therefore he would not refer to the subject again. The magistrates were aware that Mr. Randall had been put into the box before Mr. Bellingham, and it appeared that a statement had been made by Mr. Bellingham to Mr. Brickwell in the hearing of the witness. Before inquiring as to the bargain made between the Company and Mr. Brickwell, it was necessary to point out what were the services rendered by Mr. Brickwell, and therefore he was asking the Secretary as to what was the result of Mr. Brickwell's exertions. He should submit that the question was relevant to the inquiry, but if the Bench thought it desirable, he would postpone this part of the examination till later on.

Mr. BESLEY said unless he, as an advocate, were able to present the case as one of stealing gas, what would be the object of the summons. The idea of scolding him because he said it was "stealing gas," when the summons said so, was simply ridiculous.

Mr. WEBSTER said he should point out presently that the Bench could deal with the matter. He did not agree with what his friend had said about the law.

The CHAIRMAN said the Bench felt that the question was not exactly relevant to the inquiry.

Mr. WEBSTER said he was quite content to bow to the decision of the magistrates, and would therefore pass on to another point.

Cross-examination continued: Mr. Brickwell worked very hard for the Company during the years I have mentioned. I remember Mr. Brickwell

going to reside at Mountford House. There was a surgery connected with it. The surgery was taken by Dr. Jackson, and occupied by him until he left. Mr. Lichfield Green occupied a house close by. It is a fact that from Michaelmas, 1862, to Midsummer, 1863, Mr. Brickwell and Mr. Smallfield paid for a joint lamp in the forecourt of the two houses, and this lamp was taken over by the parish in the year 1874. The charge for the lamp was £2 10s. per half year. The pressure of gas would not be properly registered by a pressure-gauge if the gas had to pass through a meter, as a meter offers resistance to the gas. I do not remember Mr. Brickwell, on going into his new house in the year 1862, applying for a supply of gas. The application would have been to Mr. Bartley, who died in 1874. A pressure-gauge was fixed at Mr. Brickwell's house as soon as he took possession—in 1862 or 1863.

Mr. WEBSTER: I must not ask what you have heard subsequently; but I may ask you this: Did you not know from Mr. Bartley, or other officials of the Company, that Mr. Brickwell had applied to have a gas supply to his new house by contract, as before?

Mr. BESLEY objected to the witness being asked whether communications had been made to him. If the application had been regularly made the communication would be in writing, and ought to be produced. The investigation would be interminable if they were to enter upon such a wide field as that which Mr. Webster invited them to go over.

Mr. WEBSTER said he was not surprised that his friend should try to shut out evidence. What was the case before the Bench? The defendant was charged with fraudulently taking and applying to his own purpose the property of a body corporate; secondly, with fraudulently keeping certain entries out of a book; and, lastly, with feloniously stealing gas. Assuming, for the purpose of argument, that there was no minute of the Company, but that he could prove from the mouth of the witness that the Directors agreed and asked Mr. Brickwell, in consideration of his past services, to accept a supply of gas, no minute would be required—it would be quite within the powers of the Directors. Any bargain of this kind made between the Directors and Mr. Brickwell which was not sought to be inquired into until after the expiration of 20 years, could be proved by showing that it came to the knowledge of the officers of the Company at the time.

Mr. BESLEY said this very point came before the Central Criminal Court in the case of *The Queen v. Swindlehurst and Baxter Langley*, where it was proved to be within the knowledge of the Directors and others that the defendants had purchased property for £20,000 and resold it to the Company for £30,000. It was not competent for his friend to ask the witness: "Did you know about this?" that being a matter for the trial. Unless there was some substantial documentary evidence, vague statements of this sort ought not to be made.

Mr. HOWARD: If it is a matter for defence at the trial, how can he get it without going into it now?

Mr. BESLEY said he did not object to its being proved in the regular way, but he did object to the witness being asked whether, in conversation, not in the presence of the complainant or the defendant, with some person now dead, he heard anything about a contract.

The CHAIRMAN said there must have been two parties to the arrangement; and the witness might be asked whether he heard of it from either party—the Board or Mr. Brickwell.

Mr. WEBSTER (to witness): Did you hear from Mr. Brickwell, prior to the meeting of the 10th of April, that there was any arrangement between him and the Board as to a free supply of gas?

Witness: I did; he told me.

When did you first hear from Mr. Brickwell that he was to have a free supply of gas?—About the year 1863.

Can you recollect whether anybody was present when he told you that he was to have a free supply of gas?—The other Directors were present; it was mentioned at the Board meeting.

Cross-examination continued: The Directors present were Mr. Brickwell, Mr. Malcolm, Mr. Croll, Mr. Samuel, and Mr. Black. There is no minute with reference to the subject. I have searched and cannot find one. After the meeting in 1863, the matter was referred to from time to time. There is a pressure-gauge at Mr. Brickwell's house; and the officers of the Company have access to it at any time. Four or five of the Company's servants knew that gas was being supplied to Mr. Brickwell's house. Mr. Bartley, Mr. Caine, Mr. Page, and Mr. Broadberry knew it. There is no account against Mr. Brickwell in any of the books of the Company, except for the meters which have lately been put up. I do not know of any authority to the officers of the Company, except what passed at the Board meeting, to charge Mr. Brickwell or to leave an account against him. Mr. Brickwell never to my knowledge gave any directions to the officials of the Company as to leaving out his account or dealing with it in any way.

Mr. WEBSTER: Is it not the fact, whether it is rightful or wrongful, that what has been done since this time was done in accordance with the arrangement in 1863?

Witness: It is.

Mr. BESLEY said the question had been answered before he could object; but he must object to its appearing upon the deposition. They could not have the opinion of the witness, but simply his knowledge.

Mr. WEBSTER said one of the charges against his client was that he had concurred in making a fraudulent omission from the books, and, therefore, they ought not to shut out the fact that the Secretary had acted throughout in accordance with the decision of the Board, and without the intervention of the defendant. There might be a right to sue to recover the value of the gas consumed; but at present they were dealing with a criminal offence.

Mr. BESLEY said he should not object if the question were put in a proper way—that the Secretary knew the gas was being consumed and did not inform the Shareholders; but his friend had been going on bit by bit trying to show there was no case; and, therefore, when he went beyond a certain line he (Mr. Besley) had a right to object. It was not fair to ask a witness what his opinion was in consequence of some conversation.

Mr. WEBSTER was quite ready to admit that there was "no case." He was not asking the opinion of the witness, but as to the course of business.

The objection having been overruled, the cross-examination proceeded: Mr. Black, the late Chairman of the Company, had a free supply of gas, and Mr. Malcolm, the Vice-Chairman of the Company has had a free supply of gas from the 4th of October, 1875. There is no minute with regard to either of these cases. In April, 1862, I applied to the Directors for a free supply of gas.

Mr. BESLEY objected to this statement as irrelevant.

Mr. WEBSTER said he wished to show what the Directors, whether rightly or wrongly, had done in the way of remunerating their officers; and he ventured to submit that if it were shown that other persons who had acted under the same circumstances were not charged with fraud, it would have some bearing upon the matter.

Cross-examination continued: There is no minute of the Board with reference to a supply of gas to myself. I had a meter in my house; and afterwards I had a pressure-gauge fixed. The meter went out of action, and it was taken away and not replaced. The prosecutor, Mr. Bellingham, called upon me on the 2nd of last April. He became a Shareholder in the

Company in the year 1873. Ever since the year 1870 the Company have paid maximum dividends, and Mr. Bellingham bought his shares when the Company were paying maximum dividends. Mr. Bellingham came to me with a string of questions on paper. He allowed me to take a copy of the questions, but I have not the copy with me now. He asked me a number of questions with regard to coal, loans, and the books. He asked me if the Directors and officers were supplied with gas; if so, whether they paid for it, and the names of the persons. I told him that Mr. Brickwell and Mr. Malcolm had a free supply. He did not say anything at the time about the Directors having had "a long innings."

Mr. BESLEY said that Mr. Bellingham would be put into the box.

Cross-examination continued: At the meeting of the 10th of April, when Mr. Brickwell was asked whether he had a free supply of gas, or had gas without paying for it, he said, "I have had no notice of this question, but I will answer it at once." He gave the meeting a very full statement of the services he had rendered to the Company, and he mentioned the fact that he had had to supply coal in order to keep the works going. He also stated that he had had to pledge his credit to the wholesale houses for the public lamps.

By Mr. DOE: There are five Directors, but two do not live in the neighbourhood.

Cross-examination continued: Mr. Brickwell stated at the meeting that he had allowed the Directors to put gas into his private house, and that nothing would induce them to let him pay for it; that the Company knew the matter had been arranged at the Board; and that he believed there was a minute upon the subject. Several Shareholders at the meeting expressed themselves satisfied with the explanation given by Mr. Brickwell, and a vote of thanks was passed to the Directors. The Directors have a dinner after the meeting. They had one on this occasion, and Mr. Bellingham was present. Mr. Brickwell has never interfered, in any manner, with me as to the way in which I enter up the books. I have made the entries from time to time in the usual course of business.

The re-examination of the witness was deferred.

SATURDAY, JUNE 26.

Mr. Randall recalled, and re-examined by Mr. BESLEY.

The consumers ledger from 1847 to 1851 contains entries in Mr. Brickwell's writing. Some of the entries relate to the surgery connected with the private house in Lordship Lane. The house in Lordship Lane contains 10 rooms. Between December, 1847, and June, 1849, the charge, as per meter, for the surgery amounted to £3 3s. 9d., and for the house to £1 19s., representing together 12,000 cubic feet of gas.

By the CHAIRMAN: I have searched the minute-books of the Directors, but in no one instance is there any allusion made to a contract with any one.

Re-examination continued: The next ledger commences at Michaelmas, 1859, that is immediately after the incorporation of the Company. In this ledger I find Mr. Brickwell's name. It is scored through in ink, and Mr. J. G. Jackson's name inserted. There is also a memorandum of a contract for £1 ls. for one half year, and £2 15s. for the other half year. The payment by contract ends at Michaelmas, 1861. That is about the date Mr. Brickwell ceased to occupy the house in Lordship Lane. The only record in the books of the Company of the change from contract payment to payment by meter is the record of the meter being fixed. I find an entry showing that the meter started at zero at Michaelmas, 1861. From Christmas, 1861, to Christmas, 1868, gas was consumed by meter in the Lordship Lane house. The previous occupier of Mountford House was not supplied with gas, but he paid half the cost of the outside lamp. Mr. Brickwell, with Mr. Smallfield, afterwards paid for this lamp, but I do not find any entry of this in the ledger. The house occupied by Mr. Smallfield is of the same size as Mr. Brickwell's house. There is an entry of the private supply to Mr. Smallfield from 1858 to 1868. He had a 10-light meter from some time in 1867, and paid about £17 a year for gas in that year.

Mr. WEBSTER submitted that they had nothing to do with what some one else had paid for gas.

Mr. BESLEY thought it material, as proving what was paid for gas in respect of a house of the same size.

Mr. WEBSTER said they did not know whether the same quantity of gas was burnt.

Re-examination continued: I should think during the last 20 years we have not laid pipes into a house without a written requisition. When a person requires gas to be laid on we open an account with him in the ledger. We require a separate requisition for a meter. I cannot produce any written requisition for putting the pipes or a meter into Mountford House. I recollect the fact of the gas being laid on. The work was done by the Company's servants. We have nothing to do with the interior fittings, our duty of carrying gas into a house ends at the meter. I do not know who put in the inside pipes. Mr. Black is too ill to attend as a witness. The free supply to that gentleman ceased in 1851, when he left Tottenham. Mr. Malcolm became a Director on the 1st of September, 1855. He was then living out of the district. I cannot say when he came into the district; but a meter was fixed at his house on the 4th of October, 1875. He was appointed Deputy-Chairman on the 11th of November, 1876. No account was opened in the ledger for Mr. Malcolm from October, 1875, to November, 1876; but the state of the meter would be taken.

The CHAIRMAN: If money was received on accounts which did not appear in the ledger, where was the record of the money having been received?

Witness: It would come into the cash-book, from the cash-book it would go to the journal, and then into the ledger.

Mr. WEBSTER said he could easily clear up this point. The amount would appear in the collector's book, and it would then go through the ledger. The names of customers altered, and although the money was received from the house it would not appear under the proper name. There was no entry in the ledger of the payment of £2 10s. by Messrs. Brickwell and Smallfield for the outside lamp, but in the collector's book the entry appeared.

Mr. BESLEY: Are there any accounts received by the collectors which do not go through the ledgers?

Witness: No.

The CHAIRMAN thought the point had been satisfactorily explained.

Re-examination continued: The Company have paid maximum dividends since 1870.

Mr. WEBSTER said he had a tabular statement showing the dividends paid by the Company from 1862 to the present time, and it appeared that maximum dividends had really been paid since 1863.

Re-examination continued: Before 1863 temporary loans had been made to the Company by the Directors. Interest was paid upon the loans. The remuneration of the Directors was increased in 1866.

Mr. BESLEY: Have you taken out the amount paid to Mr. Brickwell as remuneration?

Mr. WEBSTER thought this was going a little too far, though he should not object, if the remuneration from the very commencement of the Company was taken.

The CHAIRMAN said he presumed the Directors were paid for what they did.

Re-examination continued: In 1875 three out of the five Directors resided within the district. Mr. Gripper became a Director in 1874. He had not a free supply of gas, as he consumed it for trade purposes. It was understood at the meeting of Directors held on the 17th of January, 1863, that Mr. Brickwell, for special services, should have a free supply of gas. No limit was fixed as to how long the supply should continue. I am aware of the statutory obligation to put before the shareholders at general meetings all questions as to the remuneration of directors; but I did not call the attention of the Directors to this fact. I made no note in the agenda book of the discussion upon the subject. I did not take a vote from the Board to omit the matter from the minute-book.

Mr. HOWARD: Was it put to the meeting and carried as a resolution?

Witness: It was unanimously agreed to by the Directors.

Was it merely talked of, or was it put to the meeting?—It was not put as a definite resolution; it was talked of.

Re-examination continued: At the meeting on the 10th of April last Mr. Gripper said that up to the previous evening he had no knowledge of the matter.

[A passage from the shorthand notes of the proceedings at the meeting was read in support of this statement; but it also appeared that Mr. Gripper had expressed himself satisfied with the explanation, and that he considered Mr. Brickwell had been the "heart and soul" of the concern.]

The CHAIRMAN said the fact of Mr. Gripper using gas for trade purposes seemed to be put forward as a reason why he paid for it; therefore he should like to know whether Mr. Gripper paid for the gas for his private house.

Witness said he paid for both. He had a 30-light meter for the brewery and a 10-light meter for the house.

Re-examination continued: There was no adjustment of the Directors fees, by which those living out of the district were to get some commensurate benefit to a free supply of gas. The Directors were paid according to their attendance.

The CHAIRMAN thought the question as to how the Directors should divide their fees was a matter entirely for themselves.

Mr. BESLEY (to witness): Do you know of any single Shareholder in this Company who before the meeting knew of the free supply of gas?

Mr. WEBSTER objected to the question.

Mr. HOWARD: It never was mentioned at any meeting of Shareholders to your knowledge?

Witness: Not prior to the meeting of the 10th of April.

[The re-examination being concluded, Mr. Webster asked to be allowed to put a few questions through the Bench; and this was allowed.]

By Mr. WEBSTER: The amounts received by the collector are added up and carried forward. The collector's books are signed by the Auditors. I am not aware of any amount received by a collector which had not passed into the till or the coffers of the Company. The Directors used to arrange for the supply of gas by contract. At one time many persons were supplied by contract, but since 1859 the meter system has been adopted. If a consumer who was supplied by contract left the neighbourhood, the contract was not renewed. We have only one contract now in existence. Dr. Liddle, one of the Directors, stated at the meeting on the 10th of April that he was perfectly satisfied with Mr. Brickwell's statement. Mr. Surr proposed that a committee should be appointed to inquire into this matter, but the motion was not put because previous notice had not been given. By section 27 of the Company's Act of Parliament ten Shareholders have power to convene an extraordinary meeting, but no step has been taken in this direction. The Act only provides for one meeting being held every year, but the Directors hold half-yearly meetings. The meeting of the 10th of April was one of these informal meetings. The Act also provides that the question of the remuneration of the Directors shall be submitted to a meeting, but there is no criminal liability if any other course is adopted.

By Mr. BESLEY: The meeting of the 10th of April was an ordinary half-yearly meeting, but the Act only applies to an annual meeting. Half-yearly meetings have been held for the last seven or eight years. I have not the requisition from Mr. Brickwell for the meter which was put in on the 10th of April.

Mr. HOWARD: How was it Mr. Black had a free supply of gas?

Witness: He had helped to float the Company; he had found large sums of money for it.

When did his free supply commence?—In 1848.

Louisa Robbins, examined by Mr. BESLEY: I live at Mountford House, The Green, Tottenham; and have been in the service of Mr. Brickwell as cook for nearly two years. During that time we have had a cooking-stove, which is supplied with gas. There is one burner in each of the three bed-rooms. I do not know how many burners there are in the dining and drawing rooms, but there is one in each kitchen and one in the passage. I have not counted the number of burners there are in the house. Occasionally two burners are alight, but generally only one.

By Mr. WEBSTER: There is one servant besides myself in the house.

By Mr. BESLEY: Mr. James Brickwell also resides in the house.

Rev. Hugh Hercus, examined by Mr. BESLEY: I hold 85 original shares in the Company, and am one of the Auditors, having succeeded Mr. Laing in the year 1862. I was never told that any of the Directors had a free supply of gas, and until the meeting of the 10th of April last I was not aware that Mr. Brickwell consumed gas which did not pass through a meter.

By Mr. WEBSTER: I knew that Mr. Brickwell was supplied with gas. Mr. Randall, the Secretary, Mr. Broadberry, the Manager, and Mr. Ilsley, the Collector, are Shareholders in the Company.

Mr. Alexander Nicol, examined by Mr. BESLEY: I am the holder of 22 original shares in the Company, and have been an Auditor since my father's death in 1874. In the performance of my duties I attend at the offices of the Company about once a quarter, to examine the books and vouchers. Until the half-yearly meeting on the 10th of April last I had not the slightest knowledge that Mr. Brickwell received gas without payment.

Mr. Walter Low, examined by Mr. BESLEY: I am the holder of 103 original and 26 ordinary shares in the Company. I attended the half-yearly meeting on the 10th of April last, but up to that time I was not aware Mr. Brickwell was receiving gas without payment and without meter.

Mr. HOWARD: How long have you been a Shareholder?

Witness: About 20 years.

Examination continued: In addressing the Shareholders at the meeting, I stated that the Company had been in a most flourishing condition for 10 or 15 years, that the Directors had been handsomely paid for their services, and I thought that for a paltry £10 or £15 they had laid themselves open to the censure of the Proprietors by allowing two of their number to receive gas without paying for it. To the best of my recollection, I did not propose a vote of thanks to the Chairman at the conclusion of the meeting, as appears in the shorthand writer's notes. I believe a gentleman on my right proposed the vote of thanks.

Mr. WEBSTER: Cannot you recollect whether you proposed the vote of thanks?

Witness: I cannot swear that I did not.
Did you hear Alderman Finnis second the motion?—Yes.
Did you hear a single soul oppose the motion?—I cannot say I did.
By Mr. WEBSTER: I have not taken any steps to call a special meeting to consider this matter, but I know that steps have been taken by Mr. Bellingham. I have not been applied to to concur in calling a meeting.
By Mr. BESLEY: To the best of my belief, on the vote of thanks, "to the contrary" was not put. I certainly did not put the vote to the meeting.

Mr. Robert James Laing, examined by Mr. BESLEY: I hold 110 original and 40 ordinary shares in the Company. I did not attend the meeting on the 10th of April, and was not aware, until I saw it stated in the papers, that gas was supplied free and without meter to Mr. Brickwell. For 25 years I held the office of Engineer and Manager in the Independent Gas Company. Mr. Brickwell was a Director of the Company. We supplied the districts of Shoreditch, St. Luke's, and Hoxton, and at one time the Vice-Chairman resided in the district. I have never sanctioned the supply of gas free.

Mr. BESLEY: Did you ever hear of such a thing?
Mr. WEBSTER objected to the question.
Cross-examined by Mr. WEBSTER: Mr. Brickwell was Chairman of the Independent Gas Company. He is a Director of The Gaslight and Coke Company and of the Lea Bridge Gas Company, and no doubt has had large experience in gas-works. I am not aware of another case where a director of a company receives a free supply of gas.
By Mr. BESLEY: I do not know of any such case. I am constantly in the habit of meeting directors of gas companies.

Mr. Joseph Surr, examined by Mr. BESLEY: I am the holder of 500 original shares in the Company, and have been a Shareholder since June 30, 1879. I have attended the meetings held since that date. I first became aware that gas was being consumed by Mr. Brickwell without meter, and without payment, on Friday, the 9th of April, and next day I attended the meeting and addressed the Proprietors. After the meeting Mr. Bellingham and I went to Messrs. Munns and Longden, the Solicitors conducting the present prosecution.

Mr. WEBSTER: At whose request did you take shares in the Company—was it a mere speculation?

Witness: I bought them at the Auction Mart.
Did you know anything of the Company before you bought your shares?
—I made inquiries first.

You knew of the Directors filling up a vacancy on Mr. Black becoming unwell?—I did not hear—

Answer the question. You know of it now?—I knew of it from the report sent to the Shareholders prior to that meeting.

You are aware, are you not, that this is strictly within their powers?—I believe it is.

Mr. Doe: Does that want confirmation by the Shareholders?
Mr. WEBSTER said the gentleman appointed would stand in the position of the Director whose place he had taken, and would seek re-election upon retiring by rotation. (To witness:) You said at the meeting that Mr. Bellingham would have been the choice of the Shareholders?

Witness: I believe he would.
Do you know that Mr. Bellingham wished to be a Director?—I know that he wished it.

Were you very anxious to be a Director?—Not at present.
In the future?—Yes; I prefer to wait.

You wanted to get Mr. Bellingham in first; by so doing you thought you would get in the thin edge of the wedge?—I thought Mr. Bellingham to be an able, honest, and conscientious man.

Did you and Mr. Bellingham on the 9th of April agree as to the matters upon which you could complain of the Directors?—We agreed to bring the matter forward the next day.

Did you agree to complain of the coals not being bought by tender?—No.

That you swear?—That I swear. The question arose at the meeting. Did you discuss the question of insurance of the Company's property as a matter to be complained of?—Not till the meeting.

Of amounts owing for coals?—I do not remember.

Do you remember anything you discussed on the 9th of April, except the free supply of gas?—That was all which was discussed, to the best of my recollection; the other matters may have been mentioned incidentally.

You heard Mr. Bellingham complain at the meeting of the matters to which I have just referred?—I did.

Were you with Mr. Bellingham up to the end of the meeting?—I was.

Did you hear Mr. Bellingham say: "One thing I am resolved upon, I will be a Director of the Tottenham Gas Company"?—I do not remember hearing him say so.

Will you swear he did not say so within your hearing?—I do not remember hearing it; that is all I can say.

Give me the date when you went to Messrs. Munns and Longden?—The 12th of May.

I have a letter of the 21st of May from Mr. Munns, in which he states: "We have been consulted by Mr. Bellingham and Mr. Surr, two of the largest Shareholders. We venture to suggest the propriety of your seeing us upon the subject immediately." Did you instruct Mr. Munns to tell Mr. Brickwell that if he would resign at once no further notice should be taken of the matter?—That was mentioned in conversation.

Mr. BESLEY said any communication made by letter might be put in, but they ought not to go into a fishing inquiry as to what took place in Mr. Munns's office.

Mr. WEBSTER said there having been a direct communication to his client, he was entitled to prove it.

Mr. BESLEY said he should not object if the questions were confined solely to this matter.

Mr. WEBSTER agreed to do so.

Do you not know that Mr. Munns, at the interview with Mr. Brickwell, said to him: "If you will resign no further proceedings will be taken"?—As I was not there, I do not know.

But did you not hear from Mr. Munns that he had so stated?—Mr. Munns told me so. I wanted to save Mr. Brickwell from the disgrace of exposure.

The MAGISTRATES CLERK: You had better simply answer the questions put to you.

Mr. WEBSTER: Was not this suggestion by Mr. Munns made with your authority and consent?—Doubtless it was.

And with the authority and consent of Mr. Bellingham?—Yes.

Was it not arranged that a similar interview should take place between Mr. Malcolm and Mr. Munns?—Yes.

[A letter from Mr. Munns to Mr. Malcolm was read to the Court, inviting Mr. Malcolm to retire.]

Have you not stated that in the event of those two gentlemen retiring you and Mr. Bellingham would submit yourselves as Directors of the Company?—Certainly I have.

What is your profession?—I am a retired silk merchant.

And an auditor of a public company?—Of several.

You are aware, are you not, that ten shareholders, holding one-twentieth part of the capital, can call an extraordinary meeting of a company?—Yes.
You and Mr. Bellingham do hold one-twentieth of the capital?—I should think we do.

You are aware, I suppose, with your large experience, that an extraordinary meeting can remove the whole of the directors if they like?—I believe they can.

The CHAIRMAN: But not without there has been some default on the part of the directors.

Mr. WEBSTER: Yes, Sir, the directors are simply the servants of the shareholders.

The CHAIRMAN said he thought the directors could not be removed unless there had been dereliction of duty.

Mr. WEBSTER replied that it had been done in the Woolwich Subway Company.

Cross-examination continued: I have not taken any steps to call a meeting of Shareholders to consider this matter. I did not know Mr. Brickwell before I joined the Company. I had ascertained that he was a Director of The Gaslight and Coke Company. I believe he has had many years experience in gas-works. I heard every word Mr. Brickwell said at the meeting of the 10th of April as to what had been his connection with the Company prior to its incorporation.

Re-examined by Mr. BESLEY: I heard him state that directors generally had their gas free; but I have never known of such a case. I have never known an instance of an extraordinary meeting making a change in the direction of a company without there having been a preliminary committee of investigation. Directors have considerable authority over shareholders. I have acted under the advice of Mr. Munns, and have placed myself entirely in his hands. I knew Mr. Bellingham's father, but I cannot say that I was an intimate acquaintance of the son.

Mr. Wm. Bellingham, examined by Mr. BESLEY: I hold 501 original and 148 ordinary shares in the Company. I became a Shareholder in October, 1879, and have usually attended the half-yearly meetings. Prior to the meeting of the 10th of April last no statement was made to my knowledge that the defendant was receiving gas without meter and without payment. I first ascertained that fact from the Secretary on the 2nd of April. I discovered it by accident. I had no information upon the subject before I asked a general question. The vote of thanks was not put "on the contrary." After the meeting I consulted with Messrs. Munns and Longden.

Mr. BESLEY: Do you desire to be a Director of this Company?

Witness: Undoubtedly.

Are you influenced in any way by that desire in what you are doing?

Mr. WEBSTER submitted that this question was one which ought not to be asked.

Mr. BESLEY contended that in order to prevent its being said that some unworthy motive influenced Mr. Bellingham in instituting the present proceedings, he had a right to ask whether the proceedings had been brought with any desire on his part to become a Director of the Company.

The MAGISTRATES CLERK thought it was not part of the issue before the Court.

Mr. BESLEY said he would not pursue the matter further.

Cross-examined by Mr. WEBSTER: I heard the questions put to Mr. Surr as to what took place at Mr. Munns. If asked the same questions I should give the same answers.

Mr. WEBSTER: Did you not say to one of the Shareholders after the meeting of the 10th of April, "One thing I am resolved upon, I will be a Director of the Tottenham Gas Company?"

Witness: I am not aware that I said anything of the kind. I have always had a desire to be a Director.

What did you say to that gentleman about being a Director of the Tottenham Gas Company?—I said that it would come in due course.

Did you say it was your wish?—I might have expressed myself so.

On the 2nd of April you went down with a string of questions to the Secretary?—I did.

You made the answers to some of those questions the foundation of your complaint against the Directors at the meeting?—I did.

What made you ask the Secretary whether any of the Directors had their gas free?—Knowing that three of the Directors lived in the district, it was a natural question to ask.

In fact, you expected that some of them did?—I could not tell.

Answer my question, please.—I did not know.

Did you not expect that some of them did?—I surmised that some of them did.

Did this surmise arise from your previous experience of other gas companies, or from your own inner consciousness?—From neither.

What gave rise to the surmise?—I cannot give any explanation.

Mr. BESLEY said that this was his case.

Mr. WEBSTER, after stating that he did not propose to call any evidence, proceeded to address the Bench on behalf of the defendant. He said that but for the fact that he was standing in a Criminal Court, he should not have any anxiety whatever about the case; but when entrusted to defend the character and reputation of a gentleman in Mr. Brickwell's position against a charge brought from motives which appeared in the present case, it was natural he was anxious to make a few remarks. He had to complain that Mr. Besley on one point had ventured, though he hoped erroneously, to mislead the Bench as to its duty. He had spoken of the inquiry as a preliminary inquiry, and said that the Bench need not deal with the matter. Mr. Besley had read a passage from "Archbold's Criminal Pleading" in support of his statement; but he (Mr. Webster) thought, when that gentleman came to consider it, he would be obliged to admit that it had no reference to the duties of the magistrates in any way, but was merely a general direction with regard to the law of larceny. It was stated in Archbold that in all cases of larceny, whether the defendant took the goods *bona fide* or otherwise, or with an intent to return them to the owner, or fraudulently, were questions to be decided by a jury. That was simply a direction as to what was to be the province of a jury as distinguished from a judge at the trial, and if Mr. Besley asked the Bench to take the passage and read it as being a direction to them not to consider the ingredients of the offence before committing a gentleman for trial upon such a charge as the present one was, he (Mr. Webster) should say there was nothing in common between them, and that his friend was not strictly performing his duty as a barrister. He should not have thought fit to notice the point had not his friend read the passage, and invited the magistrates to send the case to a jury. Now the Act of Parliament under which they were proceeding, the 11 & 12 Vict., cap. 42, sec. 25, provided that when all the evidence offered upon the part of the prosecution against the accused party should have been heard, if the Justice or Justices of the Peace then present should be of opinion that it was not sufficient to put such accused party upon his trial for any indictable offence, such Justice or Justices should forthwith order the accused party, if in custody, to be discharged as to the information then under inquiry; but if, in the opinion of such Justice or Justices, the evidence was sufficient to put the accused party upon his trial for an indictable

offence, or if the evidence raised a strong presumption of guilt, he was to be committed to prison or let out upon bail. That being the Act, he (Mr. Webster) would call attention to the law as laid down by Justice Bailey in the case of *Cox v. Coleridge* (1st Barnwell and Cresswell): "A magistrate is clearly bound, in the exercise of a sound discretion, not to commit any one unless a *prima facie* case is made out against him by witnesses entitled to a reasonable degree of credit." At page 919 of Oke's "Synopsis" occurred the passage: "I think a magistrate is clearly bound, in the exercise of his discretion, not to commit unless a *prima facie* case is made out against the defendant, by witnesses entitled to a reasonable degree of credit. He should consider whether or not the evidence makes out a strong, probable, or even a conflicting case of guilt." He would ask the Bench to notice those words: "There must be a strong, probable, or conflicting case of guilt." It might possibly be that he (Mr. Webster) had not much experience in criminal matters, but he did tremble and hesitate when appearing for a man upon a question of guilt as distinguished from civil wrong or remedy. If the magistrates could put their hand upon a piece of evidence and say it was evidence of a guilty mind, then by all means let them send Mr. Brickwell for trial, and allow a character which had, for a life, longer than, perhaps, any one's in court, be unblemished to be cleared. It was further stated in Mr. Oke's book that, if from the slender nature of the evidence, or the unworthiness of the witnesses, the magistrates felt that the case was not sustained, and that if the accused were sent for trial he must be acquitted, they must discharge the accused. He should ask them to say that there was not even slender evidence, and that the testimony of the gentlemen who suggested a felony was unworthy in this sense, that no honourable man would be a party to such a prosecution. If the prosecution had an honest case of felony or stealing, they could prefer an indictment, and no injury would be done them if the magistrates said they were not satisfied of the guilt. There was no question of being bound over under the Vexatious Indictments Act. Mr. Bellingham and Mr. Surr, if actuated by a high spirit of honour, were entitled to prefer an indictment at the Assizes; but he did ask the Bench, before lending the sanction of its judicial position to committal upon such evidence, to consider whether they should put such a stain upon the character of Mr. Brickwell. Now as to the nature of the offence. Mr. Besley stated that he was dealing with the case as that of a costermonger who had stolen a bunch of greens, and he cited the case of *The Queen v. Frith*, which was the case of a man who had surreptitiously put a pipe on the wrong side of the gas-meter, and stolen gas unknown to the officials of the Company, and the case of *The Queen v. Sanderson*, which was the case of a man who had surreptitiously, and without the knowledge of any living soul, gone and secretly obtained gas; and he said that those authorities supported his proposition. It was all very well for any one to adopt a high tone, and ask for a committal; but he (Mr. Webster) asked the Bench to apply an equal and a just law to the offence. He would take a case most against himself. Suppose a baker's servant, standing in his master's shop, with no authority to give away his master's goods, gave a loaf of bread to a person who had done him a service; that man, although he might be sued for the value of the loaf, could not be accused of stealing. He challenged his friend to produce a single authority to show that the man who gave the loaf was guilty of the offence of stealing, though it was very easy for Counsel for the prosecution to say: "I put the facts before you; I ask you to infer a felonious criminal intent, and to send the case for trial upon that ground." With regard to the first charge, the Act referred to any director who fraudulently took or applied for his own use the property of the company, and therefore the magistrates must be satisfied that Mr. Brickwell had done so fraudulently; in other words, that he had done so with a fraudulent mind, intending to take the gas unauthorized, with a criminal intent and without intending to account to the Shareholders. The next charge was that, with intent to defraud, he fraudulently omitted, or concurred in omitting, some entry in a book of account. When Mr. Besley stated that his clients deserved the thanks of the public for what they had done, he evidently forgot they were charging a gentleman with omitting entries. The Secretary of the Company, who had been called as a witness on the part of the prosecution, admitted that from first to last Mr. Brickwell had never interfered directly or indirectly with one single book of the Company, or even given a direction as to what should be put in or what should be left out. Next, if any person, being a member of a partnership, should steal or embezzle the goods of the partnership, he could be indicted for a felony; and Mr. Brickwell was summoned for feloniously stealing gas. The books of reference indicated what was the rule as to fraudulent taking. Archbold laid it down that the taking or carrying away must be felonious, that the goods must be taken *animo furandi*, the word "felonious" being made to mean that there was colour of right to excuse the act. Therefore the Bench must be satisfied that the evidence proved that Mr. Brickwell took the gas not under the colour of right before they could convict. It was said that the Directors who gave the free supply had no authority to do it; but the want of authority was no evidence of a criminal or felonious intention. The question was not whether there was a civil remedy, or whether an action could be brought against the Directors for negligence, but whether Mr. Brickwell had acted fraudulently and feloniously in what he had done. The prosecutors knew perfectly well the circumstances under which the gas had been taken, because Mr. Brickwell explained the matter at the meeting. Mr. Bellingham and Mr. Surr heard that explanation; they knew that several gentlemen were aware of the matter; and yet the case had been opened by their Counsel as though Mr. Brickwell had taken the gas he had used like Frith or Sanderson, by putting a pipe surreptitiously on the wrong side of the meter. If the Shareholders had sustained any wrong, they might bring an action for negligence against the Directors who authorized the free supply, or an action against Mr. Brickwell to recover the value of the gas consumed. Using the words of an eminent judge, he did caution the magistrates against allowing these persons, for their own private motives, to use criminal proceedings for the purpose of extorting an advantage to themselves. Up to this time there had not been a single stain upon Mr. Brickwell's character; he had occupied a prominent position in the gas world, and having brought integrity, industry, and talent to bear upon his work, he had received as a reward that which no one suggested was any great loss to the Company. For 20 years the thing had been treated as a matter of course, and they were not dealing with the complaint of some one who alleged loss, but with the complaint of two men who had laid their heads together to get themselves put upon the Board of the Company. Although he admitted that this could not alter the character of the offence, if it were an offence, he did submit that there was strong evidence to show that there had been no felonious intent, and that the prosecution had been undertaken with the idea of frightening Mr. Brickwell into resigning his seat.

The CHAIRMAN said it was the opinion of the Bench that the last summons was the only one upon which Mr. Webster need comment.

Mr. WEBSTER, while thanking the Bench for this intimation, said he must point out that the three summonses were identically the same. The law, as laid down by Baron Parke in *The Queen v. Holloway*, was that "the taking should be not only wrongful and fraudulent, but without any colour of right." The history of the matter was shortly this, as appeared

by the shorthand notes of the meeting of the 10th of April, that from 1848 to 1856 Mr. Brickwell had devoted some of the best years of his life to the interests of the Company, and that the difficulty of floating the Company was so great that not a single person in the neighbourhood could be induced to take shares. After many times refusing, he consented to join the Board, though little dreaming at the time the burden he was taking upon himself. The Imperial Company had attempted to supply the neighbourhood, but, through engineering difficulties, had failed; and Mr. Brickwell, at great sacrifice to his practice, and after much perseverance, induced some of his friends, upon the promise of a dividend, to subscribe about half the requisite capital. Having to devote nearly the whole of his time to the Company, his practice was greatly neglected; but had it not been for his exertions the Company would have failed. He had to meet the bills of the Company, to find money "to keep the ship afloat," to pay the wages, and even to send coal out of his own cellar in order that the works might not be stopped. The Shareholders might say he was a fool for doing so, or that no doubt he had been well paid for it; but he had never received a penny for these services, for the coal he had sent out of his cellar when the Company could not get a ton elsewhere, or for pledging his credit to the wholesale houses. The gentleman connected with the Company at that time thanked him; they said they did not know how to recompense his services, but from first to last he had never received one farthing. The present prosecutors, having lately joined the Company and had the benefit of Mr. Brickwell's exertions, were the men who now turned round and said, "Because you—foolishly if you like, without authority if you like, illegally if you like—consented to the other Directors giving you a free supply of gas, you are to be branded as a criminal, and take your trial at the Old Bailey." One trembled to think what vindictiveness might do, what pain and grief might be caused, when people, for their own wicked ends, put the criminal law in force to attain their object. Mr. Brickwell stated that he allowed the Directors to put gas into his private house, and that nothing would induce them to let him pay for it; he accepted the offer, little knowing that what was then done would be charged against him hereafter. He said he had known scores of other Directors do the same, that he would not have done it unless it had almost been forced upon him. He did not admit it was right, but that it was the only thing at the time which the Directors could think of as an acknowledgment of his services. At the meeting in April, Mr. Cartwright, Mr. Gripper, and Dr. Liddle expressed themselves satisfied with the explanation given by Mr. Brickwell; but none of these gentlemen had been called as witnesses. It was proved that at one time Mr. Brickwell paid for his gas by contract; then he changed his residence, and upon applying for a supply of gas the Directors asked him to accept a free supply, which he did; and Mr. Randall had proved that it was known to all the officials of the Company and to the workmen who altered the pipes and attended to the pressure-gauge at the house. If the two gentlemen who wished to become Directors really thought a felony had been committed, which he was sure they did not, they had been compounding it by their offers through their Solicitor. Mr. Bellingham went to the Secretary with a string of questions, and somehow or other it occurred to him that a natural question to ask would be, "Do any of our Directors have a free supply of gas?" and, being told that they did, he went to the meeting and said, "The question is whether these gentlemen have done their duty as they should to secure a permanent dividend." Thereupon Mr. Surr proposed that a committee of investigation should be appointed, but the resolution was not put in consequence of the meeting being an informal one. Now, under the 27th section of the Company's Act they had the power to summon an extraordinary meeting. These gentlemen, holding one-twentieth of the capital of the Company, had only to transfer some of their shares to eight other persons, and they could have called the meeting. If they thought there had been a felonious intention, would they not have called a meeting and had the Directors turned out? Why had they not ventured to do so? Because they were the only two men who had such an object in view. In order to get upon the Board they came to Mr. Brickwell in his old age, and, holding a pistol at his head, said, "Resign your seat." What could one think of the evidence of these men, when they asked the Bench, from the mere facts, to infer a fraudulent intent, without the slightest evidence of there being any such fraudulent intent? Where were the Shareholders who said there had been a fraudulent taking of gas? The Shareholders had sustained no wrong, because they had been paid their maximum dividends. It was shocking to find, after Mr. Brickwell had brought the Company to its present state of prosperity, such a disgraceful charge made against him. He (Mr. Webster) would not address the Bench further upon the matter. The case depended upon evidence, and not upon the observations of Counsel; but if he had been addressing a jury upon mere facts, he should have little doubt of his argument being successful, and he had but little doubt about it now. He would ask the magistrates to judge these persons conduct as they would have their own judged, and to say that there was not the slightest evidence of any fraudulent intent; that there was not the slightest evidence of strong, probable, or even a conflicting case of guilt; and that there was no evidence of any guilt whatever. If the prosecutors thought there was, they could prefer an indictment without any trouble; but he did ask the Bench to pause before putting upon Mr. Brickwell's name the brand of a criminal offence.

Upon the conclusion of Mr. Webster's address, the magistrates retired, and returning into court after an absence of three-quarters of an hour,

The CHAIRMAN said: As you may suppose, the Bench have had some consultation on this subject. We have examined into it very closely, and have come to the conclusion that, under all the circumstances, it will be only the right thing to remit this case to a jury to settle. I am bound also to say that the Bench are not free from doubts on the subject.

The case was then formally adjourned until Monday, July 5, for the purpose of reading over and signing the depositions, Mr. Brickwell's own recognizance being taken for his reappearance.

CROYDON COUNTY COURT.—TUESDAY, JUNE 8.

(Before Mr. VERNON LUSHINGTON, Judge.)

DISPUTED ACCURACY OF A GAS-METER.

The Carshalton Gas Company sued a gentleman named *Richard White*, residing at South Beddington, for payment of an account for gas supplied by meter. The case was originally set down for hearing on the 3rd of May, but was adjourned to the 24th ult., costs to abide the event, and on that day it was further adjourned, upon the defendant undertaking to pay £12 into court. The money had not even then been paid, and the case was further adjourned till this morning. The Company claimed £17 17s. 4d., which was resisted by the defendant, on the ground that the disparity in the consumption of gas was so great when compared with the quantity consumed in the corresponding period of the previous year, under precisely similar circumstances, as to warrant the assumption that the meter was defective, and that the index recorded a consumption in favour of the Company, but greatly against the consumer.

The Company's Inspector was called to prove taking records of the quan-

tity of gas consumed, and the Secretary having proved the number of the meter,

Mr. Detheridge, the Official Meter Examiner, was called, and stated that he had carefully examined the meter which had been supplied to the defendant, and found that its actual registering was 1.98 per cent. in favour of the consumer. He thoroughly tested the index dial as far as practicable, and found nothing the matter with it.

Mr. DENNIS cross-examined with the object of showing that the index might have registered a much larger consumption than actually occurred, but witness said it was impossible under the circumstances, as the meter was in perfect order.

Mr. LUSHINGTON gave judgment for the full amount claimed, with costs. Payment in 14 days.

LAMBETH POLICE COURT—SATURDAY, JUNE 12.

(Before Mr. ELLISON.)

OPPONENTS OF THE CONSTANT SUPPLY SYSTEM.

Matilda Flight, of Bond Court House, Walbrook, was summoned at the instance of the Lambeth Water-Works Company for neglecting to comply with the regulations under the Company's Acts to provide stand-pipes or covered cisterns with proper fittings, in the place of butts, to houses of which she was owner, in Hope Street, Villa Street, Walworth.

Luther Clements, of Seymour House, Peckham Rye, was also summoned for a similar offence with regard to houses of which he was owner in Gurney Street, New Kent Road.

Mr. BESLEY appeared to prosecute, and stated that the Company had for some time been using every exertion to carry out the constant supply system, as required by the Board of Trade, and £3000 or £4000 had been expended in this most important work. Mrs. Flight was summoned with regard to some 54 houses in which she had failed to carry out the regulations. The Company had been most considerate in the matter, and did not cut off the supply of water, which they had power to do, and for a long time refrained from taking the present proceedings. Some time back a case was before this Court of a similar character, and the defendant in that instance was ordered to pay a fine of £5. Since the day the summonses had been taken out Mrs. Flight had signed an agreement to complete the required work in 21 days. If this was done the Company had no desire to press for judgment, but they were anxious that it should be known all through the district which they supplied that these highly necessary regulations must be carried out. At present some 12,500 houses had been dealt with as required, but there remained about 3000 houses, the owners of which had failed to comply with the notices served upon them.

Mr. H. J. Catmur, an inspector of the Company, was called, and proved the case. He added, however, that since these proceedings had been instituted Mrs. Flight had put the work in hand, and about a dozen houses had been done.

Mr. ELLISON, at the desire of Mr. Besley, directed an adjournment for three weeks, and added that if the work was not done the heavy penalties under the Act would be imposed.

In the second case, the son of the defendant appeared, and declared he was not responsible. It was, however, clearly shown that he had acted as the agent of his father.

Mr. BESLEY said he had been given to understand that the property was to be sold, and therefore he asked for an order.

Mr. ELLISON said it was highly important that such matters required by the statute should be carried out, and that owners of property should be aware that they were bound to do so, or render themselves liable to very heavy penalties. He ordered the defendant to pay a fine of 5s., and £8 5s. costs.

BANBURY POLICE COURT.—MONDAY, JUNE 14.

(Before the MAYOR and a Bench of Magistrates.)

DISCOUNTS FOR THE PROMPT PAYMENT OF GAS ACCOUNTS.

Mr. John Mawle, an ironmonger, of High Street, Banbury, was summoned for the non-payment of 14s. 11d. due for gas supplied to him by the Banbury Gas Company.

Mr. J. Gough, who appeared for the Company, said the facts of the case were very simple. The price charged by the Company for gas supplied, within one mile of the Town Hall, was 4s. 6d. per 1000 feet; but, in order to obtain prompt payment, the Directors of the Company had given notice that for payment within a specified time of the end of each quarter a certain discount would be allowed, and on the Christmas account sent to defendant was the following notice:—"A discount of 6d. per 1000 feet will be allowed on the present quarter's account if paid to the collector on delivery, or at his office, No. 2, Market Place, or the gas-works, on or before the 13th of February next; but no discount will be allowed after that date." The amount then due from defendant was £6 14s. 5d., and he would have been entitled to discount provided the account had been paid on or before the 13th of February, but this was not done. He, however, sent a cheque on the 18th of February for £5 19s. 6d., being the amount due, less the discount. This was received five days after the time fixed by the Company, and they said he was not entitled to the discount, but was indebted to them in the difference between £5 19s. 6d. and £6 14s. 5d.—namely, 14s. 11d. Defendant had stated that he would not pay till he was compelled; and the next quarter he paid his account in time, and received the discount; but the sum of 14s. 11d. still remained owing.

James Russell, formerly a meter inspector in the employ of the Company, deposed to having, on the 6th of January last, inspected defendant's meter, the index of which registered 29,900 feet as having been consumed during the previous quarter.

Walter Bateman, the Company's collector, stated that it was his duty to deliver the accounts to the consumers. On the 31st of January he took defendant's account to his place of business, and handed it to one of the assistants in the shop. On the 22nd of April he delivered the Lady-day account, which had since been paid.

Mr. W. R. Cooper, Manager and Secretary of the Company, stated that the Directors being anxious to sell gas to the public at a reasonable price, adopted the discount system. According to the inspector's report the sum of £6 14s. 5d. was due by defendant. Witness received a letter from him dated the 17th of February, in which was enclosed a cheque for the gas account. Defendant stated that he had had no application for payment, that he did not wish to lose the discount, and that he had always paid the collector when he called. Witness received this letter on the 18th of February, with a cheque for £5 19s. 6d., leaving a balance due of 14s. 11d. Defendant would have been entitled to receive that sum as discount if he had paid his account on or before the 13th of February. Witness made out the account for the quarter ending the 31st of March, which amounted to £6 2s. 11d., and this had been paid, with the exception of the 14s. 11d., which was included. On the 7th of May he received a cheque for £5 8s. from defendant, who wrote a letter stating that if the Company had any further claim on him, and could prove it, he should be quite willing to pay it, but not otherwise. He had since declined to pay.

In answer to defendant, witness said the accounts were due at the end of each quarter, and if they were not paid within a few days the Company could, if they thought proper, take steps to recover the amount.

The Defendant said his contention was that this was a demand for 14s. 11d. made in consequence of a circumstance over which he had no control. He did not have the gas account till three or four days only before it became due, and under these circumstances he considered the Company should not claim the 14s. 11d. He contended that the Directors could not charge two prices for their gas, nor did he think they had power to make conditions regarding its supply which, to a certain portion of the public, he believed would be an injustice. It seemed exceedingly hard on poor people, for instance, that they would not get this 6d. per 1000 feet reduction if they had not the money to pay in time. He looked upon the discount simply as a trade discount, as a facility for getting in the money; but he thought it was unjust and unreasonable to attach conditions to payment.

The CLERK: The terms of the reduction are mentioned on the account, and the Company have special power to recover their debts.

The MAYOR: We have the conditions before us, and I think this is all we have to do with. (To defendant:) We are bound to decide against you.

An order was then made for the amount to be paid, together with 7s. 6d. costs.

Miscellaneous News.

CHELSEA WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held at the Office, Commercial Road, Pimlico, on the 24th inst.—JOHN DEEDES, Esq., the Governor, in the chair.

The SECRETARY (Mr. Albert Gill) read the advertisement convening the meeting, and the following report of the Directors and statement of accounts were taken as read:—

The Directors regret to announce the death in February last of the late Deputy-Governor, who, for many years, had been a member of the Board. They elected, on the 4th of March last, John Stone Wigg, Esq., as Director to fill the vacancy, under the powers conferred by the Act 8 Vict., cap. 16, sec. 89.

Sir William Henry Wyatt has been elected as Deputy-Governor of the Company.

The audited accounts of the Company for the half year up to the 31st of March, 1880, are presented to the Proprietors herewith.

The revenue for that period amounted to £49,554 7s. 11d., and shows, when compared with the revenue of the same period of last year, an increase of £1419 7s. 3d.

The charges for maintenance and management for the same period were £16,438 1s. 2d., and show, on similar comparison, a reduction of £1801 19s. 8d.

The capital account for the half year shows a further outlay of £1737 16s. 4d., incurred chiefly for extensions of iron pipes in the new districts, 2290 yards having been laid during the half year.

The total quantity of water pumped into the district during the half year was 1480 million gallons, being 80 millions in excess of the quantity pumped in the corresponding period of 1879.

The Engineers report that the reservoirs at Molesey are acting most satisfactorily; that the contract for putting the second pair of engines into sound repair is completed; and that the mains, buildings, and machinery are in good order.

It has been deemed advisable, in the interests of the Company, to oppose the scheme recently revived by the Lower Thames Valley Main Sewerage Board, for the formation of a sewage farm at Molesey. A protracted inquiry in support of the scheme has been held by the Inspector appointed by the Local Government Board, but the decision of the Board has not as yet been made known.

The Proprietors are doubtless aware that the Metropolis Water-Works Purchase Bill, proposed by the late Government, has not been taken up by the present Parliament, and that a Select Committee of the House of Commons has been appointed to inquire into the expediency of acquiring, on behalf of the inhabitants of London, the undertakings of the several Metropolitan Water Companies; to examine into the provisional agreements made with them for the acquisition of the Companies' undertakings, and to inquire and report as to their rating powers. It will be the duty of the Directors, in common with the Directors of the other Metropolitan Water Companies, to protect, to the utmost of their ability, the rights vested in them as Proprietors.

The Directors have the satisfaction to congratulate the Proprietors on the excellence and order of the works, on the absence of complaint on the part of the consumers as regards the quality and quantity of the water supplied to them, and on the progressive improvement of the Company's income. They recommend that a dividend at the rate of 6½ per cent. per annum be now declared.

The Directors retiring by rotation are Mr. John Deedes, Mr. William Henry Child, and Mr. John Stone Wigg, who respectively offer themselves for re-election. Mr. Borlase Hill Adams, one of the Auditors, also retires by rotation, and offers himself for re-election.

DR.—REVENUE ACCOUNT, FOR THE HALF YEAR ENDED MARCH 31, 1880.

Maintenance.	
To Maintenance and repair of impounding and service reservoirs, filtering-beds, works, and pipes, or for obtaining and storing of water, including the cost of materials and labour	£662 13 4
Maintenance and repair of mains, pipes, fittings, meters, and works connected with the distribution of water, including the cost of materials, labour, and renewals	2,580 5 3
Pumping and engine charges, including cost of coals, wages, &c.	3,532 19 3
Filtration, including the cost of materials and labour	388 5 7
Salaries of Engineer, Inspector, Superintendent, and Clerks, and wages of Turncocks	2,102 12 5
Thames Conservancy	1,000 0 0
Rates and taxes, exclusive of income-tax	2,395 14 9
	£12,662 10 7
Management.	
Allowance to Directors	£625 0 0
Allowance to Company's Auditors	41 0 5
Salaries of Secretary, Accountant, and Office Clerks	1,103 1 3
Superannuation of servants of the Company	462 8 8
Commission to Collectors	1,005 14 3
Stationery, printing, and general establishment charges	274 10 4
Law and parliamentary expenses	204 11 8
Official Auditor and Water Examiner	59 4 0
	3,775 10 7
Dividend and interest account for transfer of profits	30,918 6 9
Balance carried to next account, to provide for losses	2,200 0 0
	£49,554 7 11

CR.—REVENUE ACCOUNT.

By Balance brought from former account	£2,000 0 0
Less sums written off as losses—viz.:	
Empty houses	£1,772 5 10
Bad debts	105 4 7
	1,877 10 5
	£122 9 7
Water-rates accrued to date of this account	49,140 17 1
	£49,263 6 8
Rent of houses and lands accrued to date and owing to the Company	260 15 3
Fees received for registration of stock transfers, &c.	30 5 0
	£49,554 7 11

The GOVERNOR moved—"That the report of the Directors be received and adopted, and entered on the minutes." After expressing the regret of the Directors at the death of the late Deputy-Governor of the Company, with whom they had been long associated, he drew attention to the report, and said that the revenue during the half year had been £49,554, and showed, when compared with the same period of last year, an increase of

£1419. There had, he said, been a gradual increase for some time, arising principally from a better class of houses being substituted for those which had been removed, either by the railway or by time. This had been especially the case in the years 1878, 1879, and the present year, and would account for the increase he had mentioned of £1419 upon the revenue. The charges for maintenance and management were also quite satisfactory, inasmuch as in the same period they were £16,438, showing a reduction of £1800 as compared with the corresponding period of 1879. This arose from the fact of the working expenses having been looked into a good deal more than they had hitherto been. They were now brought down to 33 per cent., having been last year 38 per cent., and they had been as high as 40 per cent. He trusted that this diminution might be considered a step in the right direction. The total quantity of water pumped into the district during the half year was 1480 million gallons, being 80 millions in excess of the quantity pumped in the corresponding period of 1879. The gross quantity was very much less than in consecutive years, upon a return that had been made since 1872, in accordance with the wishes of the Parliamentary Committee now sitting on the London Water Supply. The quantity was much less than that pumped in 1872, although there had been a very considerable increase in trade, and the smaller amount pumped the Directors attributed to the successful working of the staff of waste inspectors. There was one paragraph—the eighth—in the report to which he desired to draw the Shareholders attention. It was thought very advisable that the sewerage scheme there referred to should be very narrowly watched, and care taken that the interests of the Company were not interfered with. As far as rumour went, the report of the Local Government Board's Inspector had not very much encouraged the scheme; but this document had not yet been made public. He next alluded to the powers and duties of the Select Committee of the House of Commons, that was now sitting on the subject of taking over the undertakings of the Metropolis Water Companies. The Committee, he said, commenced their inquiry on the 15th inst., and met on Tuesdays and Fridays, and the only witness who had as yet been examined was the gentleman with whom the agreements with the Water Companies were made—namely, Mr. E. J. Smith, who acted for Sir Richard Cross on the part of the late Government. Agreements were made, as the Shareholders were probably aware, between Mr. Smith and the different Companies. These were followed by a Bill, which came to an end with the dissolution of Parliament; and the present Committee were examining and considering how far those agreements could be made the basis of any future legislation on the subject of the Water Supply of the Metropolis. Probably the inquiry would take some time, and at present the Directors could not do more than advert to the fact of its existence. He was happy to say that the report concluded with a reference to the excellent condition of the works. He saw that testimony of a similar character was given by Mr. Smith in the course of his examination before the Select Committee, and he felt no doubt that it was well deserved.

Sir WILLIAM HENRY WYATT seconded the motion, and it was carried unanimously, as was the following:—"That the accounts as laid before the meeting be received and entered on the minutes."

The GOVERNOR next moved, and Sir W. H. WYATT seconded, resolutions (which were passed) to set aside out of the profits sufficient to pay the preference dividends, and declaring a dividend for the half year at the rate of 6½ per cent. per annum on the ordinary capital stock.

The retiring Directors, Messrs. William Henry Child, John Stone Wigg, and John Deedes were re-elected, as was also the retiring Auditor, Mr. Borlase Hill Adams.

The GOVERNOR having acknowledged the re-election of his colleagues and himself, a vote of thanks was passed to him and to the Directors for their services, and the proceedings terminated.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

The Annual Meeting of this Company was held at the London Offices, 60, Gracechurch Street, on Tuesday last—J. B. PADDON, Esq., in the chair.

The SECRETARY (Mr. F. A. Duffield) read the notice convening the meeting, and the following report was presented:—

The accounts of the Company for the year ending March 31 last are herewith presented to you. The result of the Company's working closely resembles that of the preceding year.

After providing for payment of the usual dividends of 7 per cent. on the first preference shares, and 7½ per cent. on the second preference shares, the Directors recommend you to declare a dividend of 3 per cent. free of income-tax on the ordinary shares, and to carry the balance of £863 3s. to the reserve-fund.

Mr. Samuel Andrews retires by rotation from his office of Director. He is eligible for re-election, and offers himself accordingly.

The Auditors, Mr. James Le Geyt Daniel and Mr. Alfred Hersee, retire in due course, and, being eligible, offer themselves for re-election.

Profit and Loss, for Twelve Months ending March 31, 1880.				Cr.	
Coals	£7,023	17	4	Gas	£20,895 16 0
Gas-making (salaries and wages)	2,435	5	8	Coke	3,181 15 0
Charges on street lights	1,350	18	0	Tar	130 19 10
Maintenance	993	3	2	Fittings and meters	87 2 0
Purifying materials	86	5	7	Interest and discount	4 3 4
Rents	41	17	9	Transfer fees	7 15 0
General trade charges	733	1	1		
Depreciation of stock	400	0	0		
Bad debts and allowances	239	18	2		
Tax on meters	242	8	16		
Treasurer's commission at stations and audit fee at Malta	297	4	3		
Inspection of stations	103	0	7		
London expenses	932	11	8		
Law expenses	136	6	2		
Exchange	457	2	0		
Income-tax	22	8	6		
Balance to interest and dividend account	8,784	2	5		
	£24,307	11	2		£24,307 11 2

The CHAIRMAN, in moving the adoption of the report, said that no incident, favourable or otherwise, in the past year, had been noteworthy enough to be specially referred to in the report. From an outside point of view, the year seemed like the preceding one, so far as the accounts were concerned, and the outcome was practically the same. The governing circumstance of the last twelve months was the commercial depression; but the year had not been one of inaction, so far as the Directors were concerned. During the past twelve months a good deal of useful work had been done, and, although there was little to show for it as yet, he thought it would have a very important bearing on the future of the Company. The Shareholders would probably remember that at the last meeting reference was made to an inspection that had taken place of the works, and to a report which the Board had received on that inspection; also that the Directors proposed to take action thereon. In the course of the proceedings taken by the Directors they found it necessary to invite their General Manager at Malta, whom they had never seen before, to come over and confer with them, and subsequently the Secretary was deputed to visit the several stations. The result had been im-

portant to the Company. In the first place, in carrying out the alterations which the Board desired to make, they were enabled to avoid a good deal of confusion which would otherwise have taken place in the system of business at their various offices. They were also able to avoid giving offence to the Local Authorities, and several improvements were effected which before then were held to be impracticable. The Directors had made a considerable change in the system of book-keeping, and had brought it more in accordance with the English system—or rather that common to similar undertakings in England—and a reduction had been made in the number of officials. Moreover, the Directors had gained a very great deal of knowledge which they did not before possess as to the details of the Company's business. The property of the Company at the various stations had been very well preserved, and the Directors had more evidence on this subject than they had ever had before, and the general condition of the works was such as to reflect great credit on those in charge of them. There had been one drawback—an increased loss of gas by leakage. Instructions had, of course, been sent out to the persons in authority, and they had been requested to take remedial measures, which were in full progress, and the Directors hoped these would be successful. The amount of gas lost had been 13 per cent. Some years ago such a loss would not have been considered large, even for English undertakings; but the Directors felt that it was larger than it ought to be, that they could not afford it, and that it must be reduced. Notwithstanding the similarity between the accounts of this year and those of the preceding year, there were some items which exhibited a difference, and he would just call attention to them by way of explanation. There was a slight increase in the second preference capital, and there was also a slight increase in the amount of debentures. Both these increases were the results of certain preparations which the Directors made to deal with a number of debentures at their maturity. They desired that these debentures should either be paid off, or renewed at 5 per cent., and he was very glad to say that they had succeeded in doing this; but to put themselves in a proper position they had to collect as much money as they could, and the remainder of it appeared in this form. With regard to the small increase in the debentures, this need not be considered a permanent increase, for in all probability when the next batch of debentures became due, the Directors would succeed in effecting a further reduction. As the Shareholders were aware, year by year the Board had been bringing this item down, and they still believed that it was to the interest of the Company that the amount should be still further reduced. On the other side of the account the Shareholders would find there had also been a small increase of the capital expended—£237. This amount had gone entirely for new mains and services, and extensions of a similar kind, which the Directors thought would turn out moderately remunerative; but, as he had very often explained before, these were matters on which they were not free agents. The terms of the concession required the Company to make extensions from time to time, and of course they were always glad if these works turned out profitable. Going from this to the revenue account, the first item was that of coal. More money had been spent on coal, and this was chiefly the result of increased freights and some rather expensive transshipments from the large stations at Malta to smaller ones. This was perfectly unavoidable. The item of depreciation of stock appeared for the first time in the accounts; and, considering the very large amount of stocks which the Company were obliged to keep, it was desirable that some provision should be made to meet inevitable depreciation. As to the amount which stood in the accounts as stocks, a good deal was due to coal, and depreciation did not apply to it, but the Company had a great many gas-fittings and other things which did not increase in value as time went by, and it was proper that some depreciation should be allowed for. Hence the establishment of the item referred to, which the Directors hoped to increase from time to time instead of carrying the amount to the reserve-fund. As to bad debts and allowances, this item was exceptionally large. The Directors had not charged so much for a long time; but it arose through the overhauling of accounts which had taken place at Malta. Several accounts were so much in arrear, and had so many doubtful circumstances about them, that, while it was hoped something would be got out of them, the Directors thought they were better out of the books than in them. The next item was that of the tax on meters. This was also exceptional. Although it was said to be a tax on meters, it applied, perhaps, to some other things; but the Italian Government levied a tax on meters, and the item was chiefly composed of this tax. As to its amount, its collection, and general incidence, there were a good many arrears in connection with it which had been paid up, and the amount was considered too large to be dealt with in the way the tax was usually dealt with—viz., taken to debit of meters and fittings. It therefore stood by itself in the present accounts, but probably it would not be seen again. On the other side, the account showed a small increase of rental, and also an improvement in the sales of residuals. The item of fittings and meters was very small as compared with last year; but last year there was a considerable extension of public lamps at one of the Sicilian stations, which was very profitable, and increased the amount last year, whereas this year there had been very little of such work to do. He would like to say a few words as to the increased dividend recommended by the Board. If the amount of the increased dividend had been carried to the Company's reserve-fund, it would have been a sound financial proceeding; but the Directors felt that the holders of ordinary shares had claims which were entitled to the fullest consideration. They desired to meet those claims; and taking into consideration the way in which the money had been earned, and the fact that they did not exhaust all the profits of the Company, but still carried something to the reserve-fund, the Board thought it only right to recommend the increase of dividend; and they did so with some confidence that it would be maintained in the future.

Mr. J. ROMANES seconded the motion.

Mr. R. H. JONES said that to a great extent the Chairman had anticipated the items he had intended to refer to in the accounts. It was satisfactory to find that the increase as to capital was not of a permanent character, but would probably be reduced next year. It was reassuring to be told this, because there was scarcely any warrant for an increase of capital this year, seeing that last year so much was put aside to the reserve-fund. He considered the explanation of the Chairman was very satisfactory, and that the Shareholders might look forward next year to a considerable reduction not only in the loans on debenture, but also in the interest paid thereon. In his opinion, however, the additional cost of coal had scarcely been sufficiently explained, because one who was conversant with such matters thought there ought to be a reduction rather than an increase in this item, and if one compared the profit and loss account this year with that of last year, this striking fact came out—last year the coal stood at £6600, and the gas revenue was £20,680; ergo, there was a profit of £14,080. This year the gross profit—the difference in the cost of the coal and the gas revenue—was £13,872; in other words, there was over £200 deficiency this year as compared with last. This the Chairman had partly explained by the extra cost of transit, and also by the increased leakage, but the Shareholders were not informed of what the leakage was in the previous year. With respect to the dividend, he might say that although he was an ordinary shareholder, he should have

preferred to have the dividend as before, and to have brought the accounts into a rather more healthy state than they were now. One could not, however, find fault. On the contrary, he thought that the Shareholders must slightly congratulate themselves upon the present balance-sheet. The profits were just the same as last year, but there had not been expended this year anything like the amount spent last year on the maintenance of plant—by some £1300 or £1400. It was true £400 had been written off for depreciation, but this was really going to be paid away in the shape of increased dividend. On the whole, he could not find fault with the accounts, and really referred to the items he had mentioned in friendly criticism.

Mr. STOKES asked if there had been any improvement at the different stations. With respect to coal, it was an exceptional time. He supposed the difficulty the Company had to contend with was freight. Coal was remarkably cheap now, and he thought that money spent in this way would answer their purpose, if they could put it into the stations advantageously. It was very gratifying to find that they had a little increase of dividend, and that the Directors were taking means to look thoroughly into everything, writing off everything that was not perfectly straightforward. At the same time, a suggestion might be made as to the bad debts, and that was as to the advisability of putting them into the hands of a solicitor, and paying some commission on those recovered, in addition to the ordinary fee.

Mr. C. C. SMITH asked whether the consumption of gas at Malta was going on satisfactorily.

The CHAIRMAN, in reply, said that the extra cost of coal was made up partly by leakage, to which he had referred, and partly by the extra cost of freights. He might state that it was not that the freights during the past year had been dear or high; it was because they were put in comparison with a year when they were abnormally low. Still the fact remained that they were not getting them at as low a rate as before, and this told on the price of coal. The increased rental they brought to bear would also account for the increase in the price of coal, and if those three causes did not exhaust the difference, it must be put down to the working not being quite so good as in the previous year. The question was raised as to the purchase of coal and the propriety of availing themselves of the present time. It did not, however, follow that because coal was cheap they must necessarily fill up all their stores and keep a large quantity on hand. It was the practice of gas companies to have contracts, and the Directors not long ago made a contract which would carry them on for at least 18 months from then. With regard to the leakage of last year, the loss was 11·18 per cent., as against 13·05 per cent. now. A question was put as to the progress that was being made at the various stations. Instead of dealing with them as a whole, it would perhaps have been wise, in accordance with custom, to deal with them separately. With regard to their progress, at the two principal stations, Malta and Calcare, the badness of trade had resulted in an actual decrease of rental. Still the Directors were inclined to regard this as temporary, and as arising directly through the state of things in the island. The decrease had not been large, but they never liked to report a decrease—they liked to see an increase, however small it might be. At Corfu there had been an increase of rental, and things were looking very well there, and they were very pleased indeed with their future prospects in connection with that station. He was also glad to say that at their two Sicilian stations, Marsala and Trapani, there had been a very satisfactory increase of rental. It was an increase of rental from these three small stations that had enabled the Directors to cover their deficiency at their two principal stations, and actually show something to the good. With regard to the bad debts, such a matter was constantly in the minds of the Directors. It was a subject of a portion of their report, and they were dealing with them, and removing them altogether from the ordinary collection, had also been advocated. However, everything out there moved slowly. The Directors had felt that up to the present time they had done all that possibly could be done, and it was with this conviction that they thought it better to at once deal with the books as they had done, and to take out those debts which there did not seem any reasonable probability of getting in, or at any rate in a reasonable time.

The motion was then put, and carried unanimously.

On the motion of the CHAIRMAN, seconded by Mr. S. ANDREWS, the preference dividends were declared; and the CHAIRMAN next moved, and Major W. S. STUART, R.E., seconded, the payment of the dividend recommended on the ordinary shares.

The retiring Director and Auditors were then re-elected, and a vote of thanks was passed to the Chairman and Directors for their attention to the interests of the Company.

The CHAIRMAN having briefly acknowledged the compliment,

Mr. STOKES moved, and Mr. DANIELL seconded, a vote of thanks to the Secretary.

The CHAIRMAN in supporting the resolution, said it was not too much to say that they owed a great deal to the vigilance of their Secretary.

The motion was carried unanimously.

The SECRETARY having briefly replied, the proceedings terminated.

OPENING OF THE LLANDUDNO NEW WATER-WORKS.—On the occasion of the opening of the new harbour works at Holyhead by the Prince of Wales on Thursday, the 17th inst., His Royal Highness consented, on leaving Holyhead for Trentham, the seat of the Duke of Sutherland, to stop at Llandudno for the purpose of formally opening the new water-works. It will be remembered that the original water supply, derived principally from deep wells and springs, having become inadequate to meet the wants of the population, an application was made to Parliament in the year 1876, by the Improvement Commissioners, for power to obtain an additional supply. This new supply is drawn from two lakes having respectively an elevation of 1756 feet and 2100 feet above the level of Llandudno. These lakes are situated on the west side of the River Conway, at a distance of 15 miles from the town, and the water obtained from them has been pronounced to be equal in purity to the water of Loch Katrine. It is estimated that the lakes are capable of yielding a supply equal to 25 gallons per head per diem for a population of 30,000. On the arrival of the train at Llandudno Junction, His Royal Highness was received by Mr. W. Bulkeley Hughes, M.P., Chairman of the Llandudno Improvement Commissioners, and Alderman Wood, Deputy-Mayor of Conway, who escorted him to a field near the station, where addresses were presented from the Conway Corporation and the Llandudno Improvement Commissioners, and the ceremony of turning on the water took place. A silver epergne bearing the following inscription:—"Presented to His Royal Highness the Prince of Wales by the Commissioners and Inhabitants of the town of Llandudno, on the occasion of the opening of the new water-works. William Bulkeley Hughes, Chairman; June 17th, 1880,"—was then presented to the Prince as a memorial of the part he had taken in the opening. The Engineer in charge of the scheme (Mr. T. T. Marks, C.E.) had the honour of being introduced to His Royal Highness previous to the ceremony.

WEST OF SCOTLAND GAS MANAGERS ASSOCIATION.

(Continued from p. 926.)

The following is the report of the Committee upon

HISLOP'S PROCESS FOR THE REVIVIFICATION OF FOUL LIME.

At the last annual meeting of the West of Scotland Association of Gas Managers, held at Coatbridge on the 25th of April, 1879, it was agreed that the matter of lime revivification by Mr. G. R. Hislop be the subject of investigation by the Committee, and that they should report to an after meeting. About last autumn the matter was under discussion, when it was resolved that it lie over till the general meeting of the Association for their report. In accordance with this resolution the Committee visited the Paisley Gas-Works on the 14th of April, 1880, when the following gentlemen were present:—Mr. W. Smith, Helensburgh; Mr. J. M'Gilchrist, Dumbarton; Mr. D. Jeffrey, Kirkintilloch; Mr. J. Renfrew, Langbank; Mr. R. S. Carlow, Port Glasgow; Mr. S. Stewart, Greenock; Mr. S. Dalziel, Kilmarnock; Mr. J. Johnston, Hamilton; Mr. R. Mitchell, Coatbridge.

The Committee made a preliminary inspection of the plant, which consisted of one bench of six furnaces, each consisting of four calcining chambers and fire-box. Two of these furnaces and eight calcining chambers were in operation. The Committee were at the works at six o'clock in the morning, when a start was made with the experiment, and were there till six o'clock in the evening, when the experiment was completed. Under-noted the results of the experiment are carefully tabulated:—

Note of Experiments and Results obtained in the Revivification of Spent Gas Lime by G. R. Hislop's Process, April 14, 1880.

Spent lime charged at 6 a.m.	9 3 5	= 1097 lbs.
Deduct for water in part of charge taken out	10	"
		1087 lbs.
Quick lime drawn	5 1 20	608 " = 55·93 per cent.
Impurities and water discharged	479	" = 44·07 "
		100·00 per cent.

Centesimal Results.

Caustic lime	50·11 per cent.
Fixed impurities (silica-sulphate of lime, &c.)	5·82 "
Impurities removed (including 10·2 per cent. water)	44·07 "
	100·00 per cent.
Average produce of quick lime per shift	23·18 cwts.
Wages of man, 12 hours, to produce the above	4s. 3·00d.
Coke used in two furnaces, 6½ cwt. at 3d.	1 7·50
Dross, coal, do. 2½ do. 3d.	0 7·50
	6 6·00

Statement as to Cost per Ton of Quick Lime.

Cost of wages per ton of quick lime—one man producing 23·18 cwt. per shift, at 4s. 3d.	3 8·00
Cost of fuel per ton, 9 cwt. at 3d. being required to recover 23·18 cwt. per shift	1 11·29
Interest on original cost of erection of one double set of chambers (one man's work), £70, at 10 per cent. per annum, 140s., and allowing 1000 tons to be produced without renewals, and allowing 339 working days per annum, = 339 × 23·18 = 7858 ÷ 20 = 392·9 tons per annum. Then 1000 ÷ 392·9 = 2·55 years at 140s. = 357·50	4 3·84
Cost of renewals at £70 per 1000 tons	6 3·41

Cost of royalty (say) at 6s. 6d. per million cubic feet of gas made, one ton to purify 400,000 cubic feet	2 7·20
Net cost per ton of quick lime, including cost of preparing for the purifiers	8 10·61

The above calculation as to cost of renewal of chamber is based upon data given by Mr. Hislop, and does not include ordinary wear and tear of tools, nor interest on cost of house, stalk, &c., in which the process is conducted. Making allowance for other contingencies, this may be taken at 7·39d. per ton, making a total cost of 9s. 6d. per ton of reburnt lime; but as this cost includes the preparation of the lime for the purifiers, and making a deduction of 1s. 6d. as the value of such labour, gives 8s. as the net cost per ton of quicklime.

The Committee, in placing their report before the members of this Association, would have done so with greater satisfaction had they had an opportunity of testing the lime reburnt in the purification of gas against an equal quantity of fresh lime. Owing to the want of time at the disposal of the members of the Committee, this part of the experiment had to be abandoned, and they have simply to refer the members of the Association to the accompanying analysis prepared by Dr. Wallace:—

	Seventieth Restoration.	Hundredth Restoration.	Original Lime, Pure.	Spent Lime, First Foul
Hydrate of lime	65·64	69·73	77·82	—
Carbonate of lime	5·07	5·43	7·16	46·98
Sulphate of lime	7·00	6·70	0·98	8·53
Sulphide of calcium, &c.	—	—	—	18·91
Magnesia	0·62	0·59	0·60	0·42
Oxide of iron	1·63	1·96	0·32	0·70
Alumina	2·65	3·04	0·64	1·60
Silica	7·93	7·57	2·70	2·95
Water	8·68	4·93	9·78	19·91
	99·22	99·95	100·00	100·00

Taking into consideration that it cost the Paisley Corporation 20s. 6½d. per ton for Irish lime, it is evident that a great saving can be effected by the adoption of this process at Paisley.

The Committee have every confidence in recommending this process to gas engineers and managers generally, as in many large towns where lime is used, and which are situated at a distance from the centre of supply, considerable saving could be effected on the carriage of the material alone.

The Committee would be glad if the results above stated could induce some of the leading engineers to take the matter up and give the process a fair trial, and to have the finding of their experiments confirmed.

The PRESIDENT said the cost for purification was only 0·48d. per 1000 feet of gas purified, including material and labour.

Mr. M'GILCHRIST said that the Committee were greatly indebted to Mr. Hislop for his kindness and attention during their visit. The cost of revivifying spent lime did not seem to much exceed 9s. per ton, including preparation for the purifiers; and he had no doubt that 9s. per ton was very much cheaper than purifying with fresh lime, either Scotch or Irish. But the difficulty he had was in no way removed, that lime revivified was equal to

fresh lime. To have this point properly investigated in a practical way would be of considerable assistance in arriving at a conclusion as to the utility of the discovery. He was satisfied, however, that at Paisley the Corporation had effected a great saving by the adoption of the process.

Mr. STEWART said he had tested the process with 400 tons, and found that the lime purified gas nearly equal to fresh lime. The difficulty he had was in not knowing when the lime was thoroughly burned. It was possible to charge the chambers in such a way as, through the carelessness of the men, to produce a lime not thoroughly burned throughout its bulk, and thus need more of it being used to purify, ton for ton, than fresh caustic lime. The reason why he gave up the process was, that as he used an oven in the retort-bench fitted with the chambers, when drawing a charge of the lime the fine particles were carried into the main flue and about the house, to the annoyance of the stokers. The only way in which he would now work the process would be to have the chambers in a separate house, and this he believed was what Mr. Hislop had done. This chamber with a chimney stalk, was altogether apart from the retort-bench; and he had no doubt Mr. Hislop had been led to make this change for the reason referred to. This was one of those things that managers ought to make a trial of. The necessary apparatus could be fitted up in a simple way. He had no doubt Mr. Hislop would fit up a simple arrangement for those who desired to try the process for themselves, and a report based on such trials would be a valuable addition to gas-works statistics. Of course, with the experience Mr. Hislop's men had had, they were perfectly up to the work, and he had no need to watch and arrange for every difficulty. With him there was no doubt that the process was a very great success. In practical working, away from Mr. Hislop and his men, difficulties might arise; but the process was worthy of a trial.

On the motion of Mr. STEWART, the further consideration of the report was deferred till next meeting, which will be held in Port Glasgow.

Mr. NELSON then proposed a vote of thanks to the President, who had, he said, spared no efforts to make the last and the present meeting a success.

The PRESIDENT acknowledged the compliment.

On the motion of Mr. STEWART, a vote of thanks was accorded to the Secretary (Mr. Dalziel).

Mr. DALZIEL replied, and the proceedings terminated.

SALE OF SHARES IN THE BRIGHTON AND HOVE GAS COMPANY.—On Thursday, the 17th inst. Messrs. Wilkinson and Son offered for sale 30 original fully-paid £20 shares in the above-named Company. They were

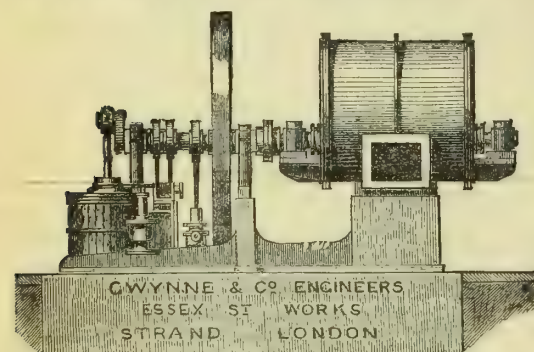
put up in six lots, and disposed of as follows:—Lot 1, £35 2s. 6d. per share; lots 2 to 5, £35 per share; and lot 6, £35 10s. per share. The total amount realized by the sale was £1053 2s. 6d., being a premium of £453 2s. 6d. on the nominal value of the shares.

THE LIVERPOOL CORPORATION (VYRNWY) WATER SCHEME.—At a recent meeting of the Shrewsbury Town Council, a draft agreement, in reference to the Vyrnwy scheme, between the Liverpool Corporation and the various opponents of the Bill now before Parliament, embodying it, was read. By it £25,000 will be paid as compensation to the Great Western Railway Company, the Severn Navigation Company, and two Canal Companies. The Liverpool Corporation will pay the opponents of the Bill all their costs. They will give 10 million gallons per day compensation water in regular and constant supply, and other water for flushing the river at intervals. In case of default £25 for every million gallons deficient is to be paid, the money to go to the improvement of the Severn Navigation. The Corporation will also undertake to provide all gauges and self-registering apparatus necessary for recording the quantity of water supplied, and will provide a house for an inspector to be appointed by the Severn Navigation Commissioners. The draft agreement, which was generally approved of, was referred to a Committee for final adoption.—At the last meeting of the Board of Conservators of the Severn Fishery District, a resolution was also adopted accepting the terms offered by the Corporation, and it was unanimously agreed to withdraw all opposition to the Bill in Parliament.

THE PURCHASE OF THE COLCHESTER WATER-WORKS BY THE CORPORATION.—A special meeting of the Colchester Town Council was held on Wednesday to further consider the purchase of the water-works by the Corporation. The matter has for some time been in abeyance, owing to difficulties upon which it was thought necessary to take counsel's opinion. Mr. Philbrick, Q.C., and Mr. Miller, Q.C., who had been consulted, recommended the Council to complete the purchase, and this recommendation the Water Supply Committee endorsed. The amount of the purchase-money is £88,000. The Committee's report was adopted, and a resolution was passed declaring that the Corporation would complete the purchase as soon as practicable, and authorizing the Committee to take all necessary steps for raising the loan. It was stated that a writ had been issued by the solicitors to the vendors, requiring specific performance of the contract entered into, and also asking for certain costs which the late Town Clerk had advised the Council not to pay. It was decided to enter an appearance in answer to this writ, but it was distinctly stated that this was for the purpose of preventing and not promoting litigation.

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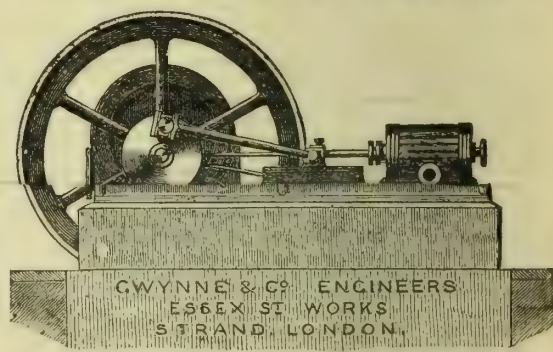
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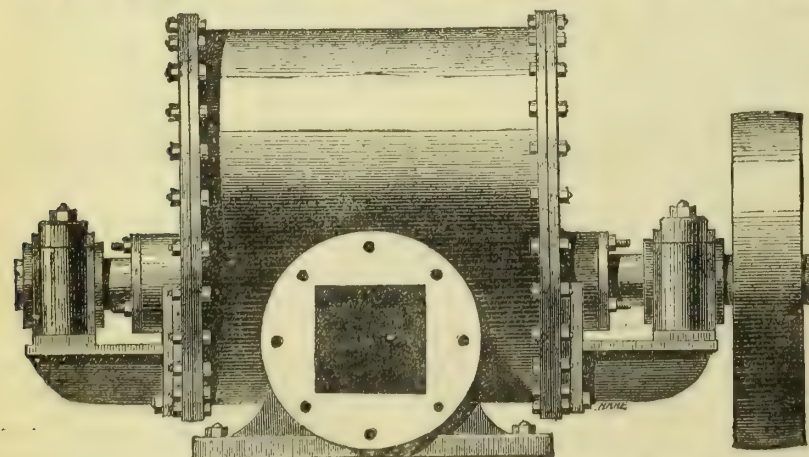


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